MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute, Affiliated to RGPV, Bhopal (M.P.) India)

NAAC Accredited with A++ Grade

Department of Electronics Engineering

Online
Board of Studies Meeting
of
Electronics Engineering
29-11-23

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Agenda of the BoS Meeting

(BoS Meeting Scheduled during 29th Nov 2023)

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
Microprocessor & Interfacing	2140413	2023	29.11.2023	15%	12	46	annexure19
Digital Communication	2140411	2023	29.11.2023	15%	12	44	annexure26

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
Mobile Communication & 5G Networks	140619	Improve technical skill (5G and mobile networks)	07	25	annexure20
Embedded Systems	900116	Enhanced technical proficiency	09	32	annexure21
VLSI Design	140616	Hardware and circuit design skill	07	26	annexure22
Artificial Intelligence & Machine Learning	140617	Improve machine and deep learning skills	07	27	annexure23
Cyber security	2140415	Enhanced security concerns	12	47	annexure24

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
Photonic Integrated Circuits	140856	Design, fabrication, and application aspects of photonic materials	03	13	annexure25
Mobile Communication & 5G Networks	140619	Improve technical skill (5G and mobile networks)	06	25	annexure20

Feedback on curriculum received from stakeholders: Analysis& ATR*

Stakeholder	**Student**	**Faculty**	**Alumni**	**Employer**
No. of responses	121	21	24	45
Link of Analysis	https://shorturl.at/hmsBN	http://surl.li/nyyds	http://surl.li/nyymi	http://surl.li/nyynq
ATR Link	https://shorturl.at/hmsBN	http://surl.li/nyyds	http://surl.li/nyymi	http://surl.li/nyynq
Link showing Excel sheet of Google Form details of stakeholders	Through IMS	Through Moodle	http://surl.li/iavop	

* **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 column for each point**

2. The BoS minutes along with the cover/summary page (under point number 1, above) must be uploaded on the departmental web page and **link for the same must be shared with the office of the Dean Academics.**

3. The following must be uploaded on the departmental web page and link for the same must be shared with the office of the Dean Academics.

- The Stakeholder feedback collected & analyzed to find the index out of five
- Action Taken Report on each feedback
- Google form showing responses from alumni, employer, student, faculty etc.

4. Minutes should have footer with department name, page number, and month of meeting.

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Minutes of the online Board of studies meeting on 29-11-2023

Following members have attended the online meeting:

1.	Dr. Vandana Vikas Thakare	Chairperson, Professor and Head
2.	Dr. Jyoti Singhai	External Member, Professor, ECE Dept., 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. Yasho Vijay Singh Yadav	Alumni, External member, Scientist, CSIR
6.	Dr. P. K. Singhal	Professor
7.	Dr. Laxmi Shrivastava	Professor
8.	Dr. R. P. Narwaria	Assistant Professor
9.	Dr. Karuna Markam	Assistant Professor
10.	Prof. Madhav Singh	Assistant Professor
11.	Ms. Pooja Sahoo	Assistant Professor
12.	Prof. D. K. Parsediya	Assistant Professor
13.	Dr. Vikas Mahor	Assistant Professor
14.	Dr. Rahul Dubey	Assistant Professor
15.	Dr. Hemant Choubey	Assistant Professor
16.	Dr. Deepak Batham	Assistant Professor
17.	Dr. Varun Sharma	Assistant Professor
18.	Dr. Shubhi Kansal	Assistant Professor
19.	Dr. Sushmita Chaudhari	Assistant Professor
20.	Dr. R Jenkin Suji	Assistant Professor
21.	Prof. Prateek Bhadauria	Assistant Professor
22.	Prof. Rachit Jain	Assistant Professor
23.	Dr. Pawan Dubey	Assistant Professor
24.	Dr. Tej Singh	Assistant Professor
25.	Dr. Vikram	Assistant Professor
26.	Dr. Vibha Tiwari	Assistant Professor
27.	Dr. Priyanka Garg	Assistant Professor
28.	Dr. Nookala Venu	Assistant Professor
29.	Mr. Manoj Kumar	Assistant Professor

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:

<table>
<tr><th colspan="2">BoS Agenda Items</th></tr>
<tr><td>Item 1</td><td>To confirm the minutes of previous BoS meeting held in the month of May-June 2023.

The minutes of previous BOS held on 31st May 2023 has been finalized.</td></tr>
<tr><td>Item 2</td><td>The examination committees constituted vide Dean Academics Notice no 1332 dated 20/4/2021 need to be reconstituted this year.

As per dean academic notice no DA/MP/23/69 dated 01/11/2023 /Examination committee is reconstituted. Annexure I</td></tr>
<tr><td>Item 3</td><td>To propose the scheme structure of VIII Semester with the provision of ONE DE & ONE OC course to be offered in online mode with credit transfer for the batch admitted in academic year 2020-21. (The total credits from I-VIII semester should not be less than 160 for this batch).

Scheme Structure of B.Tech VIII Semester with provision of one Departmental Electives and One Open Category courses has been discussed and finalized. Annexure II</td></tr>
<tr><td>Item 4</td><td>To propose the list of courses which the students can opt from SWAYAM/NPTEL/ other MOOC Platforms/ Institution (MITS) MOOC, to be offered in online mode under Departmental Elective (DE) category courses (DE-5) and open category (OC3) for credit transfer in the VIII Semester under the flexible curriculum (Batch admitted in academic year 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 (DE-5) and open category (OC-3) for credit transfer in the B.Tech. VIII Semester under the flexible curriculum has been discussed and finalized. Annexure III</td></tr>
<tr><td>Item 5</td><td>To propose the list of “Additional Courses” which can be opted for getting an
(i) Honours (for students of the host department)
(ii) Minor Specialization (for students of other departments)
[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. VIII semester students (for the batch admitted in 2020-21)] and for B.Tech. VI semester (for the batch admitted in 2021-22)]

The list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in online mode under Honors and Minors category has been discussed and finalized. Annexure IV
<table>
<tr><th>Semester</th><th>Hons/ Minor</th><th>Domain</th><th>Subject Name</th></tr>
<tr><td rowspan="2">VI</td><td rowspan="2">Honors</td><td>Communication and Signal Processing</td><td>1. An Introduction to Information Theory
2. Communication Networks</td></tr>
<tr><td>VLSI Design</td><td>1. Analog IC design
2. Integrated Circuits, MOSFETs, OP-Amps and their Applications</td></tr>
</table>
</td></tr>
</table>

			Nano-Technology	**1. Surface Engineering of Nanomaterials** **2. A brief introduction of Micro - Sensors**
		Minors	**Control & Sensor Technology**	**1. Microprocessors and Microcontrollers** **2. Network Analysis**
			Communication and Signal Processing	**1. Communication Networks** **2. Fundamentals Of MIMO Wireless Communication**
	VIII	**Honors**	**Communication and Signal Processing**	**1. An Introduction to Information Theory** **2. Computer Vision and Image Processing- Fundamentals and Applications**
			VLSI Design	**1. Microwave Integrated Circuits** **2. Integrated Circuits, MOSFET, OP-Amps and their Applications**
		Minors	**Control & Sensor Technology**	**1. Control And Instrumentation** **2. Optical Fiber Sensors**
			Communication and Signal Processing	**1. Signal Processing Techniques and its Applications** **2. Computer Vision and Image Processing- Fundamentals and Applications**

Item 6

To review and finalize the **scheme structure of B.Tech VI Semester under** the flexible curriculum **(Batch admitted in 2021-22)**

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

Item 7

To review & finalize the syllabi for all Departmental Core Courses (DC) and Mandatory Course (MC) of B. Tech VI 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. VI Semester (for batch admitted in 2021-22) under the flexible curriculum along with their COs has been discussed and finalized. Annexure VI

S. No	Category	Subject Code	Subject Name
1	DC	140619	Mobile Communication & 5G Networks
2		140616	VLSI Design

Item 8

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batches admitted in 2021-22) **in online mode under Departmental Elective (DE-1) Course** with credit transfer, in the VI Semester.

<table>
<tr><td></td><td>The list of courses from SWAYAM/NPTEL/MOOC Platforms, to be offered (for batches admitted in 2021-22) in online mode under Departmental Elective (DE-1) Course for credit transfer in the VI Semester has been discussed and finalized. Annexure VII</td></tr>
<tr><td>Item 9</td><td>To review and finalize the courses & syllabi to be offered (for batch admitted in 2021-22) under the Open Category (OC) Courses (in traditional mode) for VI semester students of other departments along with their COs.

The list of courses & syllabi to be offered (for batch admitted in 2021-22) under the Open Category (OC) Courses (in traditional mode) for VI semester students of other departments along with their Cos has been discussed and finalized. Annexure VIII
<table>
<tr><th>S. No</th><th>Category</th><th>Subject Code</th><th>Subject Name</th></tr>
<tr><td>1</td><td>OC-1</td><td>900116</td><td>Embedded Systems</td></tr>
<tr><td>2</td><td>OC-1</td><td>900117</td><td>Intelligent Control</td></tr>
</table></td></tr>
<tr><td>Item 10</td><td>To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.VI semester (for batch admitted in 2021-22).

Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.VI semester (for batch admitted in 2021-22) has been discussed and finalized. Annexure IX
<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>140616</td><td>VLSI Design</td></tr>
<tr><td>2</td><td>DC</td><td>140617</td><td>Artificial Intelligence & Machine Learning</td></tr>
<tr><td>3</td><td>DLC</td><td>140518</td><td>Minor Project-II</td></tr>
</table></td></tr>
<tr><td>Item 11</td><td>To review and finalize the suggestive list of projects which can be offered under the ‘Skill based mini-project’ category in various laboratory components based courses to be offered in B.Tech. VI Semester (for the batch admitted in 2021-22).

The suggestive list of projects which can be offered under the ‘Skill based mini-project’ category in various laboratory components based courses to be offered in B.Tech. VI Semester (for the batch admitted in 2021-22) has been discussed and finalized. Annexure X
<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>140616</td><td>VLSI Design</td></tr>
<tr><td>2</td><td>DC</td><td>140617</td><td>Artificial Intelligence & Machine Learning</td></tr>
</table></td></tr>
<tr><td>Item 12</td><td>To review and finalize the scheme and syllabi of B. Tech. IV Semester (for batch admitted in 2022-23) under the flexible curriculum along with their COs.

The scheme structure and syllabi of B.Tech. IV Semester (for batch admitted in 2022-23) under the flexible curriculum has been discussed and finalized. Annexure XI</td></tr>
</table>

Item 13

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch IV semester **(for batch admitted in 2022-23)**

The Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch IV semester (for batch admitted in 2022-23) has been discussed and finalized. Annexure XII

S. No	Category	Subject Code	Subject Name
1	DC	2140411	Digital Communication
2	DC	2140413	Microprocessor and Interfacing
3	DLC	2140414	Software Lab

Item 14

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

The suggestive list of projects which can be offered under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B. Tech IV Semester *(for the batch admitted in 2022-23)* has been discussed and finalized. Annexure XIII

S. No	Category	Subject Code	Subject Name
1	DC	2140411	Digital Communication
2	DC	2140413	Microprocessor and Interfacing
3	DLC	2140414	Software Lab

Item 15

To review and finalize the scheme and syllabi of B. Tech. II Semester (**for batch admitted in 2023-24**) under the flexible curriculum along with their COs.

The scheme and syllabi of B. Tech. II Semester (for batch admitted in 2023-24) under the flexible curriculum along with their Cos has been discussed and finalized. Annexure XIV

Item 16

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch II semester **(for batch admitted in 2023-24)**

The Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch II semester (for batch admitted in 2023-24) has been discussed and finalized. Annexure XV

S. No	Category	Subject Code	Subject Name
1	DC	3140221	Digital Circuits &Systems
2	DC	3140222	Electronics Circuits
3	DC	3140224	Python Programming

Item 17

To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B. Tech IV Semester ***(for the batch admitted in 2023-24)***.

The suggestive list of projects which can be offered under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B. Tech IV Semester *(for the batch admitted in 2023-24)* has been discussed and finalized. Annexure XVI

S. No	Category	Subject Code	Subject Name
1	DC	3140221	Digital Circuits &Systems
2	DC	3140222	Electronics Circuits
3	DC	3140224	Python Programming

Item 18

To review the CO attainments, identify gaps and suggest corrective measures for the improvement in the CO attainment levels for the courses taught in Jan-June 2023 Session.

The review of the CO attainments, gaps and corrective measures for the improvement in the CO attainment for the courses taught in July-December 2023 has been finalized as per the discussion with BOS members.

Item 19

To review the PO attainment, CO-PO mapping matrix and action to be taken to improve PO attainment level.

The PO attainment of 2019-2023 batch, CO-PO mapping matrix with attainments and gap analysis has been discussed and finalized.

Item 20

To review curricula feedback from various stakeholders, its analysis and impact.

Curricula feedback from various stack holders includes students, faculty, employer and alumni has been discussed and action taken report has been finalized.

Item 21	To discuss and recommend the scheme structure & 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. Annexure XVII**
Item 22	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. Annexure XVIII**
Item 23	Any other matter. **NA**

Dr. R.B Pachori

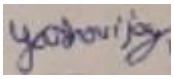
Professor, IIT Indore
(External member)

Dr. Ashutosh Datar

Professor, SATI, Vidisha
(External member)

Dr. Jyoti Singhai

Professor,MANIT, Bhopal
(External member)



Mr. Yasho Vijay Singh Yadav

Scientist, CSIR
(Alumni Member)

Dr. P. K. Singhal

Dr. Laxmi Shrivastava

Dr. R. P. Narwaria

Dr. Karuna Markam

Prof Madhav Singh

Prof Pooja Sahoo

Prof D K Parsedia

Dr. Vikas Mahor

Dr. Rahul Dubey

Dr. Hemant Choubey

Dr. Deepak Batham

Dr. Varun Sharma

Dr. Shubhi Kansal	**Dr. Pawan Dubey**	**Dr. Tej Singh**
Dr. Vikram	**Dr. Vibha Tiwari**	**Dr. Priyanka Garg**
Dr. NookalaVenu	**Dr. Sushmita Chaudhari**	**Dr. R. Jenkin Suji**
Prof. Prateek Bhadauria	**Mr. Manoj Kumar**	**Prof. Rachit Jain**

Dr. Vandana Vikas Thakare
Head of the Department

Annexure I

Item 2

The examination committees constituted vide Dean Academics Notice no 1332 dated 20/4/2021 need to be reconstituted this year.

As per dean academic notice no DA/MP/23/69 dated 01/11/2023 /Examination committee is reconstituted as follows

1. Dr. Vandana Vikas Thakare
2. Dr. P. K. Singhal
3. Dr. Laxmi Shrivastava
4. Prof. Madhav Singh
5. Dr. Shishir Dixit (Electrical Engineering)

Annexure II

Item 3

To propose the scheme structure of **VIII Semester** with the provision of **ONE DE & ONE OC course** to be offered in **online mode** with credit transfer for the batch admitted in academic year 2020-21. (**The total credits from I-VIII semester should not be less than 160 for this batch**).

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B.Tech Electronics Engineering

Scheme of Examination B.Tech. VIII Semester

[For batches admitted in Academic Session 2020-21]

S.N.	Subject Code	Category	Subject Name & Title	Maximum Marks Allotted					MOOCS		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.	Term Work / Lab Work & Sessional	Assignment	Exams		L	T	P				
1.	**1408XX**	**DE**	**Departmental Elective-5***	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	1.5 Hrs
2.	**9006XX**	**OC**	**Open Course -4**	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	1.5 Hrs
3.	**140804**	**DLC**	**Internship/Project**	-	-	-	250	150	-	-	400	-	-	18	9	Offline	SO	-
4.	**140805**		**Professional Development#**	-	-	-	50	-	-	-	50	-	-	4	2	Offline	SO	-
			Total	**-**	**-**	**-**	**300**	**150**	**50**	**150**	**650**	**06**	**-**	**22**	**17**			**-**
Additional Courses for obtaining Honours or minor Specialization by desirous students			**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**															

***All of these courses will run through SWAYAM/NPTEL/ MOOC**

 # Evaluation will be based on participation/laurels brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG program (participation in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events and technical events)

List of DEs and OCs:

Department Electives-1 (DE-5) (1408XX)	Fundamental of Power Electronics (140854)	Biomedical Signal Processing (140855)	Photonic Integrated Circuit (140856)

Open Course-4 (OC-4)	Linear Dynamical Systems (900601)	Sensors and Actuators (900602)

Honors	**Communication & Signal Processing (Track)**	An Introduction to Information Theory (H140805)	Computer Vision and Image Processing- Fundamentals and Applications (H140806)
	VLSI Design (Track)	Microwave Integrated Circuits (H140807)	Integrated Circuits, MOSFETs, OP-Amps and their Applications (H140808)
Minors	**Communication & Signal Processing (Track)**	Signal Processing Techniques and its Applications (M140802)	Computer Vision and Image Processing- Fundamentals and Applications (M140804)
	Control & Sensor Technology (Track)	Control System Design (M140805)	Optical Fiber Sensors (M140806)

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Mode of Teaching					Mode of Examination				Total Credits
Theory				Lab	Theory			Lab	
Offline	Online	Blended		Offline	PP	AO	MCQ	SO	
		Offline	Online						
-	6	-	-	11	-	-	6	11	17
-	35.29%	-	-	64.71%	-	-	35.29%	64.71%	100%

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Annexure III

Item 4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/ other MOOC Platforms/ Institution (MITS) MOOC, to be offered in online mode under Departmental Elective (DE) category courses (DE-5) and open category (OC-3) for credit transfer in the VIII Semester under the flexible curriculum (Batch admitted in academic year 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-5	**140856**	Photonic integrated circuit	12	22/01/2024	12/4/2024	Dr. Hemant Choubey
2		**140854**	Fundamental of Power Electronics	12	22/01/2024	12/4/2024	Dr. Varun Sharma
3		**140855**	Biomedical Signal Processing	12	22/01/2024	12/4/2024	Dr. Shubhi Kansal
4	OC-3	**900601**	Linear Dynamical Systems	8	22/01/2024	15/03/2024	Dr. Deepak Batham
5		**900602**	Sensors and Actuators	12	22/01/2024	12/4/2024	Dr. Sushmita Chaudhari

Annexure IV

Item 5

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

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

[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. VIII semester students (for the batch admitted in 2020-21)] and for B.Tech. VI semester (for the batch admitted in 2021-22)]

Semester	Hons/ Minor	Domain	Subject Name
VI	Honors	Communication and Signal Processing	1. Principles of Signals and Systems 2. Communication Networks
		VLSI Design	1. Analog IC design 2. Integrated Circuits, MOSFETs, OP-Amps and their Applications
		Nano-Technology	1. Surface Engineering of Nanomaterials 2. Physics of Nanoscale Devices
	Minors	Control & Sensor Technology	1. Microprocessors and Microcontrollers 2. Network Analysis
		Communication and Signal Processing	1. Communication Networks 2. Fundamentals Of MIMO Wireless Communication
VIII	Honors	Communication and Signal Processing	1. An Introduction to Information Theory 2. Computer Vision and Image Processing-Fundamentals and Applications
		VLSI Design	1. Microwave Integrated Circuits 2. Integrated Circuits, MOSFETs, OP-Amps and their Applications
	Minors	Control & Sensor Technology	1. Control And Instrumentation 2. Optical Fiber Sensors
		Communication and Signal Processing	1. Signal Processing Techniques and its Applications 2. Computer Vision and Image Processing-Fundamentals and Applications

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 (VI Semester)						
Honors	VI	Principles of Signals and Systems	12	22/01/2024	12/4/2024	Dr. Rahul Dubey
	VI	Communication Networks	12	22/01/2024	12/4/2024	Prof. Madhav Singh

	VI	Analog IC design	12	22/01/2024	12/4/2024	Prof. Pooja Sahoo
	VI	Integrated Circuits, Mosfets, OP-Amps and their Applications	12	22/01/2024	12/4/2024	Dr. Deepak Batham
	VI	Surface Engineering of Nanomaterials	8	22/01/2024	15/03/2024	Dr. Sushmita Chaudhari
	VI	Physics of Nanoscale Devices	12	22/01/2024	12/4/2024	Dr. Varun Sharma
Minors	VI	Microprocessors & Microcontrollers	12	22/01/2024	12/4/2024	Dr. Vandana V. Thakare
	VI	Network Analysis	12	22/01/2024	12/4/2024	Dr. R. P. Narwaria
	VI	Communication Networks	12	22/01/2024	12/4/2024	Prof. Madhav Singh
	VI	Fundamentals Of MIMO Wireless Communication	8	22/01/2024	15/03/2024	Prof. Pooja Sahoo
Electronics Engineering (VIII Semester)						
Honors	VIII	An Introduction to Information Theory	12	22/01/2024	15/03/2024	Prof. Pooja Sahoo
	VIII	Computer Vision and Image Processing- Fundamentals and Applications	12	22/01/2024	12/4/2024	Dr. Shubhi Kansal
	VIII	Microwave Integrated Circuits	8	22/01/2024	15/03/2024	Prof. D. K. Parsediya
	VIII	Integrated Circuits, MOSFETs, OP-Amps and their Applications	12	22/01/2024	12/4/2024	Dr. Deepak Batham
Minors	VIII	Control System Design	12	22/01/2024	12/4/2024	Dr. R. P. Narwaria
	VIII	Optical Fiber Sensors	12	22/01/2024	12/4/2024	Dr. Karuma Markam

	VIII	Signal Processing Techniques and its Applications	12	12	22/01/2024	Prof. D. K. Parsediya
	VIII	Computer Vision and Image Processing- Fundamentals and Applications	12	22/01/2024	12/4/2024	Dr. Shubhi Kansal

Annexure V

Item 6

To review and finalize the **scheme structure of B.Tech VI Semester under** the flexible curriculum **(Batch admitted in 2021-22)**

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Department of Electronics Engineering

Scheme of Evaluation

B. Tech. VI Semester (Electronics Engineering) *(for batch admitted in academic session 2021-22)*

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			MOOCs									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam.	Continuous Evaluation		Assignment	Exam		L	T	P				
				End Sem. Exam.	$^{\$}$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab work & Sessional	Skill Based Mini Project										
1.	140619	DC	Mobile Communication & 5G Networks	50	10	20	20	-	-	-	-	-	100	4	-	-	4	Blended	PP	2 Hrs
2.	140616	DC	VLSI Design	50	10	20	20	60	20	20	-	-	200	3	-	2	4	Blended	PP	2 Hrs
3.	1406**	DE	Departmental Elective* (DE-1)	-	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	1.5 Hrs
4.	900***	OC	Open Category (OC-1)**	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended	PP	2 Hrs
5.	140617	MC	Artificial Intelligence & Machine Learning	50	10	20	20	60	20	20	-	-	200	3	-	2	4	Blended	MCQ	1.5 Hrs
6.	140618	DLC	Minor Project-II	-	-	-	-	60	40	-	-	-	100	-	-	4	2	Offline	SO	-
7.	200XXX	CLC	Novel Engaging Course (Informal Learning)	-	-	-	-	50	-	-	-	-	50	-	-	2	1	Blended	SO	-
Total				**200**	**40**	**80**	**80**	**230**	**80**	**40**	**25**	**75**	**850**	**16**	**-**	**10**	**21**	**-**	**-**	
8.		MAC	Intellectual Property Rights (IPR)	50	10	20	20	-	-	-	-	-	100	2	-	-	GRADE	Online	**MCQ**	**1.5 Hrs**
Summer Internship-III (On Job Training) for Four weeks duration: Evaluation in VII Semester																				
Additional Course for Honours or Minor Specialization				**Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization**																

$proficiency in course/subject-includes the weightage towards ability/skill/competence/knowledge level/ expertise attained etc. in that particular course/subject. *This course run through SWAYAM/NPTEL/ MOOC platform

*DE-1 (SWAYAM/NPTEL/ MOOC platform)		**Open Category (OC-1)(For students of other branches)	
140665	Electromagnetic Waves in Guided and Wireless Media	**900116**	Embedded Systems
140662	Digital IC Design	**900117**	Intelligent Control
140663	Fuzzy sets, logic and System & Applications		

Honsors	**Communication & Signal Processing (Track)**	Principles of Signals and Systems (H140606)	Communication Networks (H140607)
	VLSI Design (Track)	Analog IC design (H140608)	Integrated Circuits, MOSFETs, OP-Amps and their Applications (H140609)
	Nano Technology (Track)	Surface Engineering Of Nano-materials (H140610)	Physics of Nanoscale Devices (H140611)
Minors	**Communication & Signal Processing (Track)**	Communication Networks (M140604)	Fundamentals Of MIMO Wireless Communication (M140605)
	Control & Sensor Technology (Track)	Microprocessors and Microcontrollers (M140606)	Network Analysis (M140607)

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Mode of Teaching					Mode of Examination				Total Credits
Theory				Lab	Theory			Lab	
Offline	Online	Blended		Offline	PP	AO	MCQ	SO	
		Offline	Online						
-	3	9	4	5	11	-	7	3	21
-	14.28%	42.85%	19.04%	23.81%	52.38%	-	33.33%	14.28%	100%

Annexure VI

Item 7

To review & finalize the syllabi for all Departmental Core Courses (DC) and Mandatory Course (MC) of B. Tech VI Semester (for batch admitted in 2021-22) under the flexible curriculum along with their COs.

S. No	Category	Subject Code	Subject Name
1	DC	140619	Mobile Communication & 5G Networks
2		140616	VLSI Design
3	MC	140617	Artificial Intelligence & Machine Learning

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140619	DC	Mobile Communication & 5G Networks	50	10	20	20				100	4	-	-	4

Mobile Communication & 5G Networks (140619)

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

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

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

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

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

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

Text Books:

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

Reference Books:

1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.

2. T.S. Rappaport ,"Wireless Communications: Principles and Practice", second edition, Prentice Hall publication, 2002.

Course Outcomes:

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

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

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficie ncy in Subject course	Mid Sem Marks	Quiz/ Assign ment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140616	DC	VLSI Design	50	10	20	20	60	20	20	200	3	-	2	4

VLSI Design (140616)

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

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

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

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

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

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

Text Books

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

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
2. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.
3. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
4. John P.Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005.

Course Outcomes:

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

CO1. Analyze operating modes of CMOS transistors

CO2. Compute static characteristic parameters of CMOS inverters.

CO3. Evaluate the propagation delay and power dissipation of CMOS inverter.

CO4. Design CMOS logic circuit and layout.

CO5. Compare semiconductor memories.

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B.Tech. VI Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini proj		L	T	P	
140617	DC	Artificial Intelligence & Machine Learnin	50	10	20	20				100	4	-	-	4

Artificial Intelligence & Machine Learning (140617)

Course Objectives: To provide the fundamental knowledge of Artificial Intelligence, Neural Network and Machine Learning, to present the basic representation and reasoning paradigms used in AI & ML, to understand the working of techniques used in AI & ML.

Unit – I Introducing Artificial Intelligence: Definition, Goals of AI, Task of AI, Computation, Psychology and Cognitive Science. Perception, Understanding, and Action. Artificial intelligence vs machine learning vs deep learning and other related fields. Applications of Artificial intelligence and Machine Learning in the real world.

Unit – II Problem, Problem Space and Search: Production System, Blind Search: BFS & DFS, Heuristic Search, Hill Climbing, Best First Search

Introduction to Neural Networks: History, Biological Neuron, Artificial Neural Network, Neural Network Architectures, Classification, & Clustering

Unit – III Introduction to Machine Learning: Traditional Programming vs Machine learning. Key Elements of Machine Learning: Representation, process (Data Collection, Data Preparation, Model selection, Model Training, Model Evaluation and Prediction), Evaluation and Optimization. Types of Learning: Supervised, Unsupervised and reinforcement learning. Regression vs classification problems.

Unit – IV: Supervised Machine Learning: Linear regression:implementation, applications & performance parameters. Decision tree classifier, terminology, classification vs regression trees, tree creation with Gini index and information gain, IDE3 algorithms, applications and performance parameters. Random forest classifier. Case study on regression and classification for solving real world problems.

Unit – V: Unsupervised Machine Learning: Introduction, types: Partitioning, density based, DBSCAN, distribution model-based, hierarchical, Agglomerative and Divisive, Common Distance measures, K-means clustering algorithm. Case study on clustering for solving real world problems.

Text Books/Reference Books:

1. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. Introduction to Machine Learning using Python: Sarah Guido
6. Machine Learning in Action: Peter Harrington

Course Outcomes:

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

CO1. Explain basic concepts of Artificial Intelligence & Machine Learning.

CO2. **Describe** the techniques for search and processing.

CO3. Compare AI, ANN & Machine Learning techniques.

CO4. Apply AI and ML techniques to solve real world problems

Annexure VII

Item 8

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batches admitted in 2021-22) **in online mode under Departmental Elective (DE-1) Course** with credit transfer, in the VI Semester.

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-1	140665	Electromagnetic Waves in Guided and Wireless Media	8	22/01/24	15/03/24	Dr. Laxmi Shrivastava
2		140662	Digital IC Design	12	22/01/24	12/04/24	Dr. Vikas Mahor
3		140663	Fuzzy sets, logic and System & Applications	12	22/01/24	12/04/24	Dr. Hemant Choubey

Annexure VIII

Item 9

To review and finalize the courses & syllabi to be offered (for batch admitted in 2021-22) under the Open Category (OC) Courses (in traditional mode) for VI semester students of other departments along with their COs.

S. No	Category	Subject Code	Subject Name
1	OC-1	900116	Embedded Systems
2	OC-1	900117	Intelligent Control

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Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
900104	OC	Intelligent Control	50	10	20	20	-	-		100	3	-	-	3

Intelligent Control (900117)

Course Objectives: The main objective of this course is to develop the basic understanding of an Intelligent control i.e. control system with optimization and prediction using Artificial Neural Network to the students.

Unit I 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, Self Tuning Regulators, Adaptive Smith predictor control, Auto tuning and self tuning smith predictor.

Unit II Artificial Neural Network (ANN) Based Control: Introduction to ANN, Different activation functions, Different architectures and different learning methods, Back Propagation and Radial Basis Function networks.

Unit III Modeling of Control System: 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 IV 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 and case studies , Stability issues in fuzzy control.

Unit V Hybrid Control: Introduction to Genetic Algorithm (GA), Neuro-Fuzzy and Fuzzy-GA based hybrid system design.

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, Third Edition, Mcgraw Hill India Ltd, 2015.

Reference Books:

1. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi 1994.
2. Bose and Liang, Artificial Neural Networks, Tata Mcgraw Hill, 1996.
3. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, Prentice Hall of India, New Delhi, 1992.
4. Chang C. Hong, Tong H. Lee and Weng K. Ho, Adaptive Control, ISA press, Research Triangle Park, 1993.

Course Outcomes:

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

CO1. Explain adaptive control systems.

CO2. Describe neural network architecture and learning algorithms.

CO3. Apply the concept of artificial neural network to model the control system.

CO4. Design fuzzy logic based control system**.**

CO5. Optimize control system using Genetic algorithm.

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
900116	OC	Embedded System	50	10	20	20	-	-		100	3	-	-	3

Embedded System (900116)

Course objectives: To introduce the basic concepts of microcontroller and to develop assembly languageprogramming 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 8051 Timer, Serial port, interrupt Programming: Basics of Timers/Counters, Programming 8051 timers/Counter, basics of serial communication, 8051 connection to RS232, 8051 serial port programming, basics of 8051 Interrupts, 8051 interrupts programming: Timer interrupts, external hardware interrupts and serial communication interrupt, 8051 Interrupt priority.

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 Interfacing real world devices with Arduino : 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 Book:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. Mckinlay, ―The 8051 Microcontroller and Embedded Systems using Assembly and C‖ Pearson Education India, 2nd Edition

Reference Books:

1. Kenneth Ayal, –The 8051 Microcontroller‖, Architecture, Programming and Applications.
2. SubrataGhoshal, ―Embedded Systems and Robots, Projects using the 8051Microcontroller.

Course Outcomes:

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

CO1. Explain the architecture of embedded system and 8051.
CO2. Write assembly language programs for 8051.
CO3. Describe the interfacing of 8051 microcontroller with Timers/Counters, Serial communication and interrupt.
CO4. Design memory and I/O interfacing circuits with 8051.
CO5. Explain the interfacing of Arduino with I/O devices.

Annexure IX

Item 10

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.VI semester ***(*for batch admitted in 2021-22).**

S. No	Category	Subject Code	Subject Name
1	DC	140616	VLSI Design
2	DC	140617	Artificial Intelligence & Machine Learning
3	DLC	140518	Minor Project-II

Subject Name: VLSI Design
Subject Code: 140616

Course Objectives

This course gives the ability to students to learn the design and simulation of SPICE simulation of basic CMOS logic circuits.

List of Experiments

Following experiments are to be designed and simulated on Symica EDA tool:

1. Design and simulation of inverter at 180 nm CMOS technology.
2. Design and simulation of NOR Gate at 180 nm CMOS technology.
3. Design of NOR Gate Symbol at 180 nm CMOS technology and simulate to verify the functionality.
4. Design and simulation of NAND Gate at 180 nm CMOS technology.
5. Design of NAND Gate Symbol at 180 nm CMOS technology and simulate to verify the functionality.
6. Design and simulation of AND Gate with its symbol at 180 nm CMOS technology.
7. Design and simulation of OR Gate with its symbol at 180 nm CMOS technology.
8. Design and simulation of Exclusive OR Gates with its symbol at 180 nm CMOS technology.
9. Design and simulation of Half Adder using symbols designed in experiment 7 and 8.
10. Design and simulation of Full Adder using symbols designed in experiment 7 and 8.

Course Outcomes:

After the completion of this course students will be able to:
CO1. **Demonstrate** a clear Understanding in hardware design language (SPICE).
CO2. Model a Combinational circuit using SPICE Netlist.
CO3. Simulate and validate the functionality of the CMOS VLSI circuits using CAD tools

Subject Name: Artificial Intelligence & Machine Learning (AIML)
Subject Code: 140617

Course Objectives:

This course provides the fundamentals programming skills, import, manipulate, and analyze data using NumPy and Pandas DataFrames and implement machine learning models using the scikit-learn package in Python.

List of Experiments

1. Perform creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: strings, list, tuples, dictionary and set.
2. Solve problems using decision and looping statements.
3. Apply Python built-in data types: strings, list, tuples, dictionary, set and their methods to solve any given problem.
4. Manipulation of NumPy arrays- indexing, slicing, reshaping, joining and splitting.
5. Computation on NumPy arrays using universal functions and mathematical methods.
6. Import a CSV file and perform various statistical and comparison operations on rows/columns.
7. Create Pandas series and Data Frame from various inputs.
8. Import any CSV file to Pandas Data Frame and perform the following:
    1. Visualize the first and last 10 records.
    2. Get the shape, index and column details.
    3. Select/Delete the records (rows/columns) based on conditions.
    4. Perform ranking and sorting operations.
    5. Do required statistical operations on the given columns.
    6. Find the count and uniqueness of the given categorical values.
9. Import any CSV file to Pandas Data Frame and perform the following:
    1. Handle missing data by detecting and dropping/ filling missing values.
    2. Transform data using different methods.
    3. Detect and filter outliers.
    4. Perform Vectorized String operations on Pandas Series.
    5. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
10. Use scikit-learn package in python to implement following machine learning models to solve real world problems using open source datasets:
    1. Linear Regression model.
    2. Multi-linear regression model.
    3. Decision tree classification model.
    4. Random forest model.
    5. SVM model.
    6. K-means clustering model.

Course Outcomes:

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

CO1. Perform the fundamental operations on Python built-in data types.
CO2. Develop problem-solving skills using decision and looping statements in Python.
CO3. Perform Data Handling with Python built-in functions..
CO4. Analyze data using Pandas Data Frames.

Annexure X

Item 11

To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B.Tech. VI Semester **(for the batch admitted in 2021-22)**.

S. No	Category	Subject Code	Subject Name
1	DC	140616	VLSI Design
2	DC	140617	Artificial Intelligence & Machine Learning

Subject Name: VLSI Design
Subject Code: 140616

Skill Based Mini Project

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

Subject Name: Artificial Intelligence & Machine Learning (AIML)
Subject Code: 140617

Skill Based Mini Project

1. Write a program to Predicting Iris Flower Species [Dataset: Iris dataset (available in scikit-learn).]
2. Write a program for Handwritten Digits Recognition [Dataset: MNIST dataset of handwritten digits.]
3. Write a program for Sentiment Analysis on Movie Reviews [Dataset: IMDb movie reviews dataset.]
4. Write a program to Predict House Prices [Dataset: Housing price data from Kaggle.]
5. Write a program for Spam Email Detection [Dataset: Enron Email Dataset.]
6. Write a program for Image Classification on CIFAR-10 [Dataset: CIFAR-10 dataset.]
7. Write a program for Credit Card Fraud Detection [Dataset: Credit Card Fraud Detection dataset from Kaggle.]
8. Write a program for Predicting Stock Prices [Dataset: Yahoo Finance or Alpha Vantage API.]
9. Write a program for Customer Segmentation [Dataset: Online Retail Data from UCI Machine Learning Repository.]
10. Write a program to Digit Recognition in Sign Language [Dataset: ASL Alphabet dataset.]
11. Write a program for Predicting Diabetes Onset [Dataset: Diabetes dataset from UCI ML Repository.]
12. Write a program for Facial Recognition [Dataset: Labeled Faces in the Wild (LFW) dataset.]
13. Write a program for Movie Recommendation System [Dataset: MovieLens dataset.]
14. Write a program for Predicting Employee Churn [Dataset: Human Resources Analytics dataset from Kaggle.]
15. Write a program for Text Generation with LSTM [Dataset: Various books, articles, or Kaggle text datasets.]
16. Write a program for Fake News Detection [Dataset: Fake news dataset from Kaggle.]
17. Write a program for Predicting Wine Quality [Dataset: Wine Quality dataset from UCI ML Repository.]
18. Write a program for Object Detection with YOLO [Dataset: COCO (Common Objects in Context) dataset.]
19. Write a program for Customer Lifetime Value Prediction [Dataset: Online Retail Data from UCI ML Repository.]
20. Write a program for Predicting Cardiovascular Disease [Dataset: Framingham Heart Study dataset.]

Annexure XI

Item 12

To review and finalize the scheme and syllabi of B. Tech. IV Semester (**for batch admitted in 2022-23**) under the flexible curriculum along with their COs.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Scheme of Evaluation

B. Tech IV Semester (Electronics Engineering) *(for batch admitted in academic session 2022-23)*

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 Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation			L	T	P				
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	2100003	BSC	Engineering Mathematics-III	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP	2 Hrs
2.	2140411	DC	Digital Communication	50	10	20	20	60	20	20	200	2	1	2	4	Blended	PP	2 Hrs
3.	2140412	DC	Linear Control Theory	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP	2 Hrs
4.	2140413	DC	Microprocessor & Interfacing	50	10	20	20	60	20	20	200	2	1	2	4	Blended	PP	2 Hrs
5	2140414	DLC	Software Lab (Introduction to MATLAB)	-	-	-	-	60	20	20	100	-	-	2	1	Offline	SO	-
5.	2140415	DC	Cyber Security	50	10	20	20	-	-	-	100	2	-	-	2	Blended	MCQ	1.5 Hrs
6.	200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-		50	-	-	50	-	-	2	1	Interactive	SO	-
Total				**250**	**50**	**100**	**100**	**230**	**60**	**60**	**850**	**12**	**4**	**8**	**20**	**-**	**-**	**-**
7.	3000004	Natural Sciences & Skills	Language	50	10	20	20	-	-	-	100	1	-	-	Grade	Blended	MCQ	1.5 Hrs
8.	1000005	MAC	Project Management & Financing	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ	1.5 Hrs
Summer Internship Project – II (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in V Semester.																		

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject.

Credits of Natural Sciences & Skills will be added in the VI Semester.

Mode of Teaching					Mode of Examination				Total Credits
Theory				Lab	Theory			Lab	
Offline	Online	Blended		Offline	PP	AO	MCQ	SO	
		Offline	Online						
-	-	12	6	2	15	-	3	2	20
-	-	60.00%	30.00%	10.00%	75.00%	-	15.00%	10.00%	100%

B.Tech IV 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 proj		L	T	P	
2140411	DC	Digital Communication	50	10	20	20	60	20	20	200	2	1	2	4

Digital Communication (2140411)

Course Objectives: The main objective of this course is to understand the basic concepts of digital modulations and digital transmission techniques.

Unit I Sampling Techniques: Sampling theorem for Low pass signal, Ideal sampling, Natural sampling and Flat top sampling, Time division Multiplexing, Generation and detection of PAM, PPM and PWM.

Unit II Waveform coding techniques: Introduction, Quantization, Quantization noise, Companding, Types of companding: A law and μlaw, Eye pattern, Delta modulation, Adaptive delta modulation and Differential Pulse Code Modulation.

Unit III Band Pass Data Transmission: Binary amplitude shift keying (BASK), Binary phase shift keying (BPSK), Quadrature phase shift keying(QPSK), Differential phase shift keying (DPSK), Coherent and Non coherent Binary frequency shift keying (BFSK), Quadrature amplitude modulation (QAM).

UNIT IV Detection Techniques: Optimum filter, Matched filter and Correlator detector, Gram Schmidt orthogonalization procedure and Concept of signal space for the computation of probability of error, Calculation of error probability for BPSK, QPSK and coherent BFSK, Comparison of different modulation techniques.

Unit V Information Theory & Coding: Concept of information theory, Entropy and Information rate, Channel capacity, Shannon's theorem, Shannon Hartley theorem, Coding Efficiency, Shannon Fano coding, Huffman coding.

Text Books:

1. Singh, R.P. & Sapre, S.D, "Communication Systems: Analog & Digital", Tata McGraw-Hill, 5threprint, 2000.
2. John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008.

Reference Books:

1. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition, 2000.
2. Taub & Schilling, "Principle of Communication Systems", 2nd Edition, 2003.

Course Outcomes:

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

CO1: Explain the sampling process and reconstruction.
CO2: Analyze the performance of waveform coding techniques.
CO3: Describe the mathematical model of digital modulation techniques.
CO4: Determine the error probability of band pass transmission techniques.
CO5: Illustrate the concepts of information theory and coding.

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B.Tech IV 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 proj		L	T	P	
2140412	DC	Linear Control Theory	50	10	20	20	-	-	-	100	3	1	-	4

Linear Control Theory (2140412)

Course Objectives: learning of control system theory and its implementation in practical systems using electronic devices.

UNIT I: Introduction to Control Systems: Basic control system terminology, Open loop and Closed loop system, Feedback control, Different modeling of physical systems, Linear approximation of physical systems. Transfer function of linear systems, Block diagram algebra and Signal flow graphs, Effects of negative feedback.

UNIT II: **Time Domain Analysis:** Test input signals, First order systems, Second order systems, Effects of addition of poles and zeros to open and closed loop transfer functions, Steady state error, Constant and error coefficients for type 0, 1, and 2 systems.

UNIT III: Stability Analysis: Concept of stability of linear systems, Relation between the closed loop poles and stability, Relative stability, Absolute stability, Routh Hurwitz criteria and its applications, Root locus plot.

UNIT IV: Frequency Domain Analysis: Performance specifications in frequency domain, Co-relation between frequency domain and time domain, Polar plots and Bode plots of transfer function, Nyquist stability criterion, Assessment of relative stability.

Unit V: Introduction to Controllers: Introduction to Proportional, Integral, and Derivative controller, PD controller, PI controller, PID controller, Design of various controllers and their limitations.

Text Books:

1. Control System Engineering- I. J. Nagrath & M. Gopal, New Age International.
2. Modern Control Engineering –K. Ogata, Prentice Hall.
3. Control System- A. Anand Kumar, PHI
4. Control System Engineering – B.S. Manke, Khanna publications.

Reference Books:

1. Automatic Control System— B. C. Kuo,Wiley.
2. Control System Engineering- Norman Nise, John Wiley & Sons.

Course Outcomes:

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

CO1. Determine the mathematical model of physical systems.
CO2. Represent the complex system into standard canonical form using BDR and SFG.
CO3. Evaluate the time domain response of control system.
CO4. Analyze the stability of control system using time and frequency domain methods.
CO5. Design Describe the effects of proportional, integral, and derivative control action on system response.

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B.Tech. IV 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	
2140413	DC	Microprocessor & Interfacing	50	10	20	20	60	20	20	200	2	1	2	4

Microprocessor & Interfacing (2140413)

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: 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, Data transfer operations, Arithmetic operations, logic operations, Branch operations, 8085 assembly language programming, Debugging the program, Addressing modes of 8085.

Unit III: Timing diagram and interfacing with 8085: Counters and Time delays, Instruction cycle, Machine cycle, T-states, timing diagram for different 8085 arithmetic, logical and branch instructions, Introduction to Memory interfacing and I/O interfacing with 8085.

Unit IV: Peripheral ICs: Memory interfacing and various interfacingschips like: Programmable input/output ports 8155/8255(PPI), Programmable interval timer 8253/8254 (PIT), Programmable interrupt controller 8259 (PIC) and DMA controller 8257.

Unit V: 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.

Text Book:

1. Ramesh. S. Gaonkar, Microprocessor architecture Programming and Application with 8085 Penram International Publishing, 4thEdition.
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. Describe the architecture and organization of 8085, 8086 microprocessors.
CO2. Describe the instruction sets of 8085, 8086 microprocessors.
CO3. Develop assembly language programs for 8085.
CO4. Design memory and I/O interfacing circuits with 8085.
CO5. Explain interface of 8085 with 8255 PPI, 8254 PIT, 8259 PIC and 8257 DMA controller.

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B.Tech IV 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 proj		L	T	P	
2140415	DC	Cyber Security	50	10	20	20	-	-	-	100	2	-	-	2

TOPIC-WISE MOOC LINKS FOR CYBER SECURITY (2140415)

UNIT - 1:

Topic of the lecture: Overview of Cyber Security
Topic of the lecture: Introduction to Cyber Security, Cyber-crime
Topic of the lecture: Types of Cyber Attacks
Topic of the lecture: Cyber Vandalism (Hacking), Cyber Stalking, Internet Frauds and Software Piracy

UNIT - 2:

Topic of the lecture: Basics of Internet and Networking
Topic of the lecture: Network Topologies
Topic of the lecture: Wired and Wireless networks, E-commerce
Topic of the lecture: OSI Model:
Topic of the lecture: Internetworking Devices:
Topic of the lecture: Firewall:

UNIT - 3:

Topic of the lecture: Security Principles and Attacks
Topic of the lecture: Cryptography:
Topic of the lecture: Symmetric key Cryptography
Topic of the lecture: Symmetric key Ciphers
Topic of the lecture: Public key cryptography
Topic of the lecture: SSL

UNIT - 4:

Topic of the lecture: Hacker, Types of Hacker
Topic of the lecture: Malicious Softwares (Part 1)
Topic of the lecture: Malicious Softwares (Part 2)

UNIT - 5:

Topic of the lecture: Introduction of Intellectual Property and patent
Topic of the lecture: More About Patent
Topic of the lecture: All about Trademark
Topic of the lecture: Industrial Design
Topic of the lecture: Geographical Indication
Topic of the lecture: All about copyright
Topic of the lecture: IT act 2000
Topic of the lecture: Digital Crime Investigation

Course Outcomes

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

CO1. Discuss the basic terminologies of cyber security.

CO2. Explain the basic concept of networking and internet.

CO3. Apply various methods used to protect data in the internet environment in real-world Situations.

CO4. Examine the concept of IP security and architecture.

CO5. Compare various types of cyber security threats/vulnerabilities.

CO6. Develop the understanding of cybercrime investigation and IT ACT 2000

Annexure XII

Item 13

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch IV semester **(for batch admitted in 2022-23)**

S. No	Category	Subject Code	Subject Name
1	DC	2140411	Digital Communication
2	DC	2140413	Microprocessor & Interfacing
3	DLC	2140414	Software Lab

Subject Name: Digital Communication
Subject Code: 2140411

Course Objective

This course gives the ability to the students to learn the concepts of communication for digital signals using various modulation techniques.

List of Experiment

1. Perform sampling and reconstruction.
2. Analysis of the process of Time Division Multiplexing and demultiplexing.
3. Analyze Pulse Amplitude Modulation on MATLAB.
4. Analyze Pulse Width Modulation on MATLAB.
5. Analyze Pulse Position Modulation on MATLAB.
6. To generate Amplitude Shift Keying signal using MATLAB
7. To generate Phase Shift Keying signal using MATLAB software
8. To generate Frequency Shift Keying signal using MATLAB
9. To generate Quadrature Phase Shift Keying signal using MATLAB
10. To generate Pulse code modulation signal using MATLAB
11. To generate Time Division Multiplexing signal using MATLAB

Course Outcomes:

On completion of this Lab the student will be able to:

CO1. Verify sampling theorem.
CO2. Demonstrate digital modulation techniques.
CO3. Evaluate the performance of the digital communication system using MATLAB.

Subject Name: Microprocessor & Interfacing
Subject Code: 2140413

Course Objective

This course gives the ability to the students to learn the assembly language programming of 8085 and 8086 microprocessors and their interfacing with different peripherals.

List of Experiments

1. Write an assembly language program to perform addition operation on two immediately given 8 bit numbers using 8085 microprocessor.
2. Write an assembly language program to perform addition operation on two 8 bit numbers stored in memory using an 8085 microprocessor.
3. Write an assembly language program to find whether the number is even or odd using an 8085 microprocessor.
4. Write an assembly language program to obtain 2's complement of a given number using 8085 microprocessor.
5. Write an assembly language program to perform arithmetic operations of two BCD numbers using an 8085 microprocessor.
6. Interface a Stepper Motor to the 8085 microprocessor system using 8255 and write an 8085 assembly language program to control the Stepper Motor.
7. Write an assembly language program to generate standard waveforms using DAC and display waveforms on CRO with an 8085 microprocessor.
8. Write an assembly language program to Move a Block of Data from one memory location to another with an 8086 microprocessor.
9. Write an assembly language program to Multiply Two 16-Bit Numbers with 8086 microprocessor.
10. Write an assembly language program to find the square of a given number with an 8086 microprocessor.

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 and 8086 microprocessors.

CO2. Design interfacing circuits for different I/O devices using PPIs with 8085.

Subject Name: Software Lab
Subject Code: 2140414

List of Experiments

1. Study of MATLAB.
2. Write a program performing the MATRIX manipulation using the MATLAB command window.
3. Write a program to plot the various ANALOG functions using plot command. Also label x axis ,y axis and provide the title of figure.
4. Write a program to plot the various DISCRETE functions using plot command. Also label x axis, y axis and provide the title of figure.
5. Write a program to plot more than one ANALOG function in a single window using subplot.
6. Write a program to plot more than one DISCRETE function in a single window using subplot.
7. Write a program to plot Amplitude Modulated signal along with baseband signal.
8. Write a program to plot SSB Modulated signal along with baseband signal.
9. Write a program to plot Frequency Modulated signal along with baseband signal.
10. Write a program to plot Phase Modulated signal along with baseband signal.
11. Write a program to draw root locus of the given function.
    1/(2s^4+5s^3+4s^2+6s+8)
12. Write a program to draw the Bode Plot of the given function.
    1/(2s^4+5s^3+4s^2+6s+8)
13. Write a program to draw Nyquist Plot of the given function.
    1/(2s^4+5s^3+4s^2+6s+8)

Course Outcomes:

After successful completion of the course, students will be able to:
CO1. Develop MATLAB codes for signal representation and modulation techniques.
CO2. Use MATLAB tools for analysis of system performance.
CO3. Simulate the real life problems for performance analysis using MATLAB Simulink.

Annexure XIII

Item 14

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

S. No	Category	Subject Code	Subject Name
1	DC	2140411	Digital Communication
2	DC	2140413	Microprocessor & Interfacing
3	DLC	2140414	Software Lab

Subject Name: Digital Communication Lab

Subject Code: 2140411

Skill Based Mini Project

1. Implementation of sampling theorem. (a) Sampling at Nyquist rate (b) Over sampling and (c) Under sampling.
2. Implementation of Eye Diagram/Eye Pattern for any of the modulation technique.
3. PPM using IC 555.
4. PAM using IC 555.
5. PWM using IC 555.
6. Generation of On-off Keying signal.
7. Generation of ASK, FSK and PSK signal.
8. Generation of QAM signal and its constellation diagram.
9. To develop a GUI based project in MATLAB for PCM.
10. To develop a GUI based project in MATLAB for Differential-PCM.
11. To develop a GUI based project in MATLAB for Delta Modulation.
12. To develop a GUI based project in MATLAB for Adaptive Delta Modulation
13. Digital Communication through Audio Signals
14. Develop a digital pulse counter system to count pulses in a given signal using digital communication
15. Implement a basic digital signal encryption system for secure communication
16. Explore techniques for digital signal compression and implement a simple compression algorithm
17. Create a MATLAB project to visualize signal constellations for different digital modulation schemes
18. Implement a basic error detection system for digital signals using techniques like parity checks
19. Extend the Delta Modulation project to incorporate adaptive techniques for better performance
20. Develop a system to digitize and transmit voice signals using basic digital communication principles

Subject Name: Microprocessor & Interfacing
Subject Code; 2140413

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 8085 microprocessor assembly language program to check a string as palindrome or not on using 8085 Simulator.
4. Develop an 8085 microprocessor assembly language program to calculate the square root using 8085 Simulator.
5. Develop an 8085 microprocessor assembly language program to multiply two 16-bit numbers using 8085 Simulator.
6. Develop an 8085 microprocessor assembly language program to convert binary to BCD using 8085 Simulator.
7. Develop an 8085 microprocessor assembly language program to find the cube of a number using 8085 Simulator.
8. Develop an 8085 microprocessor assembly language program to divide two numbers using 8085 Simulator.
9. Develop an 8085 microprocessor assembly language program to check a given byte is bitwise palindrome or not using 8085 Simulator.
10. Develop an 8085 microprocessor assembly language program to find smallest no from the given array using 8085 Simulator.
11. Develop an 8086 microprocessor assembly language program to generate Fibonacci series using Simulator emu8086.
12. Develop an 8086 microprocessor assembly language program to calculate the square root using emu8086 Simulator.
13. Develop an 8086 microprocessor assembly language program to check a string as palindrome or not on using emu8086 Simulator.
14. Develop an 8086 microprocessor assembly language program to calculate the square root using emu8086 Simulator.
15. Develop an 8086 microprocessor assembly language program to multiply two 16-bit numbers using emu8086 Simulator.
16. Develop an 8086 microprocessor assembly language program to convert binary to BCD using emu8086 Simulator.
17. Develop an 8086 microprocessor assembly language program to find the cube of a number using emu8086 Simulator.
18. Develop an 8086 microprocessor assembly language program to divide two numbers using emu8086 Simulator.
19. Develop an 8086 microprocessor assembly language program to check a given byte is bitwise palindrome or not using emu8086 Simulator.
20. Develop an 8086 microprocessor assembly language program to find smallest no from the given array using emu8086 Simulator.

Subject Name: Software Lab (Introduction to MATLAB)
Subject Code: 2140414

Skill Based Mini Project

1. Generation of wave of any given expression.
2. Calculator Design using MATLAB.
3. Draw and calculate the area of circle of given radius.
4. GUI model for various waveform generation and display.
5. GUI model for display of various transform of specific waves.
6. Create a GUI model in MATLAB to display various transforms (e.g., Fourier, Laplace) of input waveforms.
7. Perform filtering, convolution, and other signal processing operations using MATLAB Signal Processing ToolBox.
8. Develop a MATLAB script to generate and plot 3D surfaces based on mathematical expressions
9. Import data from Excel into MATLAB and create visualizations like bar charts, scatter plots, and histograms.
10. Use MATLAB to perform basic image processing operations like resizing, cropping, and filtering
11. Implement a script to fit curves to experimental data and visualize the best-fit curves.
12. Draw and calculate the area of any 3D object of given dimension.
13. Build a GUI in MATLAB for performing basic statistical analyses on datasets
14. Use MATLAB to perform spectral analysis on signals and visualize frequency content
15. Write a MATLAB script to generate a specified number of random numbers and visualize their distribution using histograms
16. Develop a GUI-based unit converter that allows users to input values in one unit and convert them to another (e.g., Celsius to Fahrenheit)
17. Create a simple digital clock using MATLAB's GUI capabilities, displaying the current time.
18. Import data from Excel into MATLAB and perform mathematical calculations such as mean, median, mode.
19. Write a MATLAB program to perform various operations on matrix like addition, multiplication, and inverse.
20. Write a MATLAB program to solve a simple first order differential equation.

Annexure XIV

Item 15

To review and finalize the scheme and syllabi of B. Tech. II Semester (**for batch admitted in 2023-24**) under the flexible curriculum along with their COs.

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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.														
				End Term Evaluation	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work & Sessional	Skill Based Mini Project		L	T	P				
1.	3100011	BSC	Engineering Mathematics –I	50	10	20	20	-	-	-	100	3	1	-	4	Offline	PP	2 Hrs
2.	3140221	DC	Digital Circuits & Systems	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
3.	3140222	DC	Electronics Circuits	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
4.	3140223	DC	Signals and Systems	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
5.	3140224	DC	Python Programming	50	10	20	20	40	30	30	200	2	1	2	4	Blended	AO	1.5 Hrs
Total				**250**	**50**	**100**	**100**	**120**	**90**	**90**	**800**	**11**	**5**	**6**	**19**			
6	3000001	Natural Sciences and Skills	Engineering Physics	50	10	20	20	-	-	-	-	1	-	2	GRADE	Blended	MCQ	1.5 Hrs
Summer Internship Project – I (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in III Semester.																		

$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

Credits of Natural Sciences & Skills will be added in the VI Semester.

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						
4	0	8	4	6	15	4	0	0	19
21.05%	0%	42.10%	21.05%	31.57%	78.94%	21.05%	0%	0%	

B.Tech. II 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	
3140221	DC	Digital Circuits & Systems	60	20	20	40	30	30	200	3	-	2	4

Digital Circuits & Systems (3140221)

Course Objective: To understand the concept of digital systems, design& analyze the combinational and sequential logic circuits.

Unit I: Boolean algebra and switching functions: Minimization of Boolean functions, Canonical & standard form, concept of prime implicant etc. Karnaugh's map method, Quine-McCluskey's method, Universal gates, NAND/NOR realization of Boolean functions.

Unit II: Combinational Logic circuits: Half adder, Half subtractor, Full adder, Full subtratctor circuits. Serial and parallel adder, BCD adders, look-ahead carry generator, Code Converters, Decoders, Encoders, Multiplexers & demultiplexers.

Unit III: Sequential Circuits: Latches, Flip-flops - SR, JK, D, T, and Master-Slave, Characteristic table and equation, Application table, Edge triggering, Level Triggering, Realization of one flip flopusing other flip flops, Multivibrators**:** Monostable, Astable, Bistable (transistorized).

Unit IV: Registers and Counters: Asynchronous Ripple or serial counter, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Downcounters, Programmable counters, Design of Synchronous counters: State diagram, State table, State minimization, State assignment, Excitation table and Maps Circuit, Implementation: Modulo-n-counter, Registers:Shift registers, Universal shift registers, Shift register counters, Ring counter, Shift counters, Sequence generators.

Unit V: Logic Families: RTL, DTL, all types of TTL circuits, ECL, HTL and PMOS, NMOS & CMOS logic etc. Comparison of various logic families, ROM organization- PROM, EPROM, EEPROM, EAPROM, RAM organization- Static RAM, Dynamic RAM.

Text Books:

1. Digital Design: M. Mano,4th Edition**,** Prentice Hall of India.
2. Logic & Computer Design Fundamental: M.Mano, 5th Edition, Pearson Education India.
3. Digital Circuits and Design: S. Salivahanan,5th Edition**,** Oxford University Press.

Reference Books:

1. Digital Electronics: W.H. Gothman, Prentice Hall of India.
2. Digital System Principles & Applications: R.J. Tocci,11th Edition**,** Pearson Education India.
3. Pulse, Digital & Switching Waveforms: Millman&Taub,McGraw Hill Education.

Course Outcomes

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

CO1. **Develop/implement** the Boolean expression using logic gates.

CO2. **Design** different combinational logic circuits such as adder, subtractor, decoder etc.

CO3. **Analyze** sequential circuits such as flip-flops, latches etc.

CO4. **Design** shift registers and counters using flip-flops.

CO5. **Compare** logic families, semiconductor memories, & multivibrators.

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	
3200222	DC	Electronics circuits	60	20	20	40	30	30	200	2	1	2	4

Electronics Circuits (3200222)

Course Objective: To understand different semiconductor circuits and grab the way to design circuits and perform measurements of circuit parameters.

Unit I: Diode Circuits: Review of P-N Junction Diodes, Power supply parameters, SMPS, Zener and Avalanche Breakdown, Zener voltage regulator, series pass regulator (with feedback) and shunt voltage regulators, Short circuit protection.

Unit II: Introduction to BJT Biasing and Stability: Review of BJTs, Transistor biasing and bias stabilization, the operating point, stability factor, analysis of fixed base bias, Voltage divider bias, collector to base bias, Emitter resistance bias circuit and Bias compensation techniques.

Unit III: BJT as an Amplifier: Low frequency BJT amplifiers, equivalent circuit of BJT using h parameter for CB, CE, CC configurations, calculation of transistor parameter for CB, CE, CC using h parameters. High frequency BJT amplifier: Hybrid-pi (π) common emitter transistor model, hybrid – π conductance and capacitance, gain-bandwidth product.

Unit IV: Feedback amplifiers: Introduction to Feedback Amplifiers & their design parameters, comparison of different feedback amplifier configuration viz (gain, input impedance, output impedance, current gain, voltage gain), cascading of BJT amplifier, Darlington Pair.

Unit V: Oscillators and Tuned Amplifiers: Barkhausen criterion, Sinusoidal oscillators, L-C (Hartley-Colpitts) oscillators, RC phase shift, resonant oscillator, Wien Bridge and crystal oscillators, Clapp oscillator, Tuned amplifier design using BJTs.

Text Books:

1. Microelectronic Circuits: Theory and Application: Sedra & Smith, 7th Edition, Oxford University Press.
2. Electronics Devices and Circuits: Boylested &Nashelsky,11th Edition, Pearson Education India

Reference Books:

3. Electrical Engineering material: A.J Dekker, 1st Edition, Prentice Hall of India.
4. Micro Electronics: Millman, &Grabel,2nd Edition, McGraw Hill Education
5. Integrated Electronics: Millman & Halkias, McGraw Hill Education.

Course Outcomes

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

CO 1. **Implement** electronic circuits using diodes.

CO 2. **Analyze** BJTs biasing circuits for stability.

CO 3. **Analyze** BJTs amplifiers using equivalent circuit models.

CO 4. **Evaluate** design parameters of feedback amplifier configurations such as gain, input impedance, output impedance, current gain, voltage gain

CO 5. **Design** the Oscillator and Tuned amplifier circuits.

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B.Tech. III Semester (Electronics Engineering)

Signals & Systems (3140223)

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	
3140223	DC	Signals & Systems	60	20	20	-	-	-	100	3	-	-	3

Course objective: Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that is necessary for the analysis of continuous and discrete-time signals and systems.

Unit-1 Introduction: Mathematical Description of Continuous& Discrete– Time Signals Definition, Classification of signals, Complex Exponential and Sinusoidal Function; Unit Step, Signum, Unit Ramp, Unit Impulse, Periodic Impulse or Impulse Train, Rectangle, Triangle, Sinc and Gaussian pulse functions, Even and Odd Functions, Periodic and non periodic Functions, Signal Energy and Power, Scaling and Shifting, Amplitude Scaling, Time Shifting, Differential and Integration.

Unit 2 Fourier series and Fourier transform: Fourier Transform: Exponential Fourier series, and Trigonometric Fourier series, properties of Fourier series, Introduction to Fourier transform, Fourier Transforms of elementary functions. Properties of Fourier Transform.

Unit 3: Z transforms: Introduction to Z-transform, relation between Laplace and Z-transform, relation between Fourier transform and Z-transform, ROC, properties of ROC, Properties of Z-transform, Inverse Z-transform, Unilateral Z-transform.

Unit-4 Properties of Continuous and Discrete Time Systems: System Modeling, System Properties, Homogeneity, Time Invariance, Additivity, Linearity & Superposition, Stability, Incremental Linearity, Causality, Memory, Static, Nonlinearity, Inevitability, continuous & discrete LTI system.

Unit-5 Continuous and Discrete system analysis: The Convolution Integral, and Convolution Sum, Impulse Response, Convolution & Properties, System Interconnections, Stability and Impulse Response, Response of Systems to Standard Systems, Realization of Differential Equations, Analysis of discrete time LTI system using Z-transform, Analysis of continuous time LTI system using Laplace transform.

Text Books:

1. Digital Signals and Systems, 2nd Edition: Simon Haykin, Barry Van Veen, 2nd Edition, Wiley India Pvt. Ltd.
2. Signals and Systems: Hwei. P. Hsu, Schaum's outlines, 2 nd Edition, Tata Mcgraw Hill Education.

Reference Books:

1. Fundamentals of Signals & Systems: Michael J Roberts, 2 nd Edition, Mc Graw Hill Education.
2. Signal and Systems: Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, 2 nd Edition,Pearson Education India.

Course Outcomes

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

CO1. **Describe** continuous and discrete time signals mathematically.

CO2. **Determine** the spectral characteristics of signals using Fourier series and Fourier transform.

CO3. **Apply** z-transform for analysis of discrete time signals.

CO4. **Evaluate** the performance parameters of LTI systems.

CO5. **Analyze** continuous and discrete time systems.

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	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
3140224	DC	Python Programming	60	20	20	40	30	30	200	3	-	2	4

Python Programming (3140224)

Course Objectives:

- To understand the structure and components of a Python program.
- To learn the basic construct of python programming for implementing interdisciplinary research-based problems.
- To plot data using appropriate Python visualization libraries for analysis.

Unit I Introduction to Python: Setting up programming environment, running python programs from a terminal, variables and simple data types: variables, strings, numbers and maths, comments.

Unit II Tuples and Lists: Tuples, lists, list operations, using if statements with lists, organizing a list, working with lists: looping through an entire list, making numeric lists, working with part of a list. Dictionaries and sets.

Unit III Functions: Defining a function, passing arguments, return values, passing a list, passing an arbitrary number of arguments, storing your functions in module, inbuilt functions.

Unit IV Files and Exceptions: Reading from a file, writing to a file, file operations, assertions, exceptions, exception example, debugging.

Unit V Data Visualization: Installing matplotlib, plotting a simple line graph, random walks, making histogram, graphical user interfaces.

Reference Books

1. Python Crash Course:A Hands-On, Project-Based Introduction to Programming, By Eric Matthes
2. Learn Python the Hard Way :3rd Edition
3. T. R. Padmanabhan, Programming with Python, Springer, 1st Ed., 2016.
4. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning, 1st Ed., 2012.

Course Outcomes

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

CO 1. **Describe** data types of python programming.

CO 2. **Describe** sequential and non-sequential data types.

CO 3. **Implement** in-built and user defined functions.

CO 4. **Apply** File handling operations

CO 5. **Illustrate** the data using Matplotlib.

Annexure XV

Item 16

To review and finalize the Experiment list/ Lab manual for all the Laboratory Courses to be offered in Batch II semester **(for batch admitted in 2023-24)**

S. No	Category	Subject Code	Subject Name
1	DC	3140221	Digital Circuits &Systems
2	DC	3140222	Electronics Circuits
3	DC	3140224	Python Programming

Subject Name: Digital Circuits &Systems
Subject Code: 3140221

List of Experiment

1 To Verify the truth tables for logic gates – AND, OR, NOT, EX-OR, EX- NOR, NAND, NOR
2 To realize basic logic gates using universal gates
3 To verify the truth table of half adder and full adder
4 To verify the truth table of half subtractor and full subtractor
5 To design R-S Flip-Flop
6 To design J-K Flip-Flop
7 To examine parity generator / checker
8 To design ripple counter using J-K Flip-Flop.

Course Outcomes:

After completing the lab, students will be able to

CO1. Verify the DE Morgan's theorem.
CO2. Design the basic and universal gates.
CO3. Design adder & subtractor circuits.
CO4. Verify the truth table of flip-flops.
CO5. Design Counters and Registers.

Subject Name: Electronic Circuit Design
Subject Code: 3140222

List of Experiment

1. To design a voltage regulator using BJT and Zener Diode.
2. To design BJT as a switch.
3. To design a Common Emitter amplifier and determine its voltage gain and output resistance.
4. To determine the gain and bandwidth of 2-stage RC coupled amplifier.
5. To verify the working operation of Crystal Oscillator.
6. To analyse the working of RC Phase shift Oscillator using BJT.
7. To analyse the working of Hartley and Colpitt's Oscillators.
8. To analyse the working of Clapp Oscillator.

Course Outcomes:

After completing the lab, students will be able to

CO1. **Design** the voltage regulator with specific voltage range.
CO2. **Design** switch using BJT.
CO3. **Implement** the voltage amplifier using BJT.
CO4. **Design** RC, LC and Clapp oscillator using BJT for given frequency.

Subject Name: Python Programming
Subject Code: 3140224

List of Experiments

1. Write python programming to declare various data type and display it's data type.
2. Write python programming to declare sequential data types and display its data type.
3. Write python programming to perform addition and subtraction and display the result.
4. Write python programming to perform multiplication and division and display the result.
5. Write a python programming to perform Boolean operation and display the result.
6. Write a python programming to perform logical operations and display the result.
7. Write a python programming to declare a string, display it's different index position and also change the letter of string with some other letter.

8. Write python programming to declare array and display it's different index position.
9. Write python programming to declare a string then.
    - Capitalize it
    - Convert into title format
    - Swap the case of string
10. Write a python programming to declare a string use slice object to slice the given sequence.

Course Outcomes:

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

CO1. Write basic programs in Python.
CO2. Visualize data using Python packages.

Annexure XVI

Item 17

To review and finalize the suggestive list of projects which can be offered under the '**Skill based mini-project**' category in various laboratory components based courses to be offered in B. Tech IV Semester ***(for the batch admitted in 2023-24)***.

S. No	Category	Subject Code	Subject Name
1	DC	3140221	Digital Circuits &Systems
2	DC	3140222	Electronics Circuits
3	DC	3140224	Python Programming

Subject Name: Digital Circuits & Systems
Subject Code: 3140221

Skill Based Mini Project

1. Design ring counter using J-K flip flop
2. Design Johnson counter using J-K flip flop
3. Design mod 11 counter using S-R flip flop
4. Design mod 11 asynchronous counter using SR flip flop
5. Design twisted tail counter using SR flip
6. Design Johnson counter using SR flip flop
7. Design ring counter using SR flip flop
8. Implement 3 input AND gate using multiplexer
9. Implement 3 input OR gate using multiplexer
10. Implement 3 input XOR gate using multiplexer
11. Implement universal gates using multiplexer
12. Design an ADDER using multiplexer
13. Design a SUBSTRACTOR using multiplexer
14. Design BCD to 7 Segment Decoder
15. Design a BCD to Excess 3 Code Convertor
16. Design a BCD to Gray Code Convertor
17. Design a mod 7 counter using JK flip flop
18. Design a ADDER using universal logic gate
19. Design a ADDER using Encoder
20. Design a 4:1 multiplexer using NAND gate.

Subject Name: Electronic Circuit
Subject Code: 3140222

Skill Based Mini Project

1. Design a +5V/+9/+12 V regulated power supply.
2. Design a Voltage Doubler Circuit.
3. Design a Voltage Tripler Circuit.
4. Build a LED Blinking Circuit using basic circuit components
5. Build a Light Detector (LDR) using basic circuit components
6. Build a LED based Water Level Indicator
7. Build a Traffic Light Simulator using resistors and LEDs
8. Build a Simple Audio Amplifier using transistor resistor & speaker
9. Build a Temperature Sensor to read ambient temperature using sensor and display
10. Build a Digital Dice using 7-Segment Display and microcontroller
11. Turn on/off a device with a clap sound using microphone, amplifier and relay.
12. Infrared (IR) Remote Tester IR sensor & LED.
13. Water Flow Sensor to measure the flow of water in a pipe
14. Build a Rain Detector using water sensor & LED
15. Detect smoke and trigger an alarm using smoke sensor and buzzer (Fire Alarm)
16. Design a single stage RC coupled amplifier circuit
17. Design an oscillator circuit to generate 1 kHz sine wave
18. Design a voltage regulator for variable load using Zener diode
19. Design a voltage regulator for variable line voltage using Zener diode
20. Design a sound generator circuit

Subject Name: Python Programming
Subject Code: 3140224

Skill Based Mini Project

1. Write a code to Generate palindrome word using Python.
2. Write a python code to convert roman number to Decimal.
3. Write a python code using Matplotlib library for scatter annotations plot.
4. Write a python code to generate sine, cosine and exponential functions
5. Write a python code that counts the number of words in the input sentence.
6. Write a python code that performs operations of inversing the matrix
7. Write a python code to implement a simple text-based Hangman game.
8. Write a python code to determine the prime factors of a given number.
9. Write a python code that generates the calendar for the month by taking the month and year as the input.
10. Write a python code that takes converts an amount from one currency to the other currency.
11. Write a python code that converts a binary number to decimal number.
12. Write a python code that reverses the words in the sentence.
13. Write a python code that converts the decimal number into any other number system of choice.
14. Write python program that imports data from Excel file and calculate the mean, mode and median.
15. Write python program that imports data from Excel file draw line chart, scatter plot, box plot.
16. Write a python program that takes the voltage across the diode as the input a calculate the current through it (use the diode current equation)
17. Write a python program that converts the height from inch to cms.
18. Write a python program that performs addition that solves the system of linear equation using matrix method.
19. Write a python program to determine the exact age of the person based on the user date of birth.
20. Write a python code that converts the hexadecimal number into any other number system of choice.

Annexure XVII

Item 21

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

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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	Assign ment	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)

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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

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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**

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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**

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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)

Course Objective: 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", Mc Graw 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:

CO1. Analyze computer networks

CO2. Describe network model and their architectures.

CO3. Describe data link layer and its protocols.

CO4. Illustrate media access control systems.

CO5. Analyze wireless lan architecture and its connecting devices

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 Masoud Salehi, 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:

CO1. Analyze random variables and random processes.

CO2. Explain base band transmission and reception schemes.

CO3. Illustrate communication through band limited linear filter channels.

CO4. Discuss spread spectrum signals and its synchronization.

CO5. Describe the generation and the processing of OFDM signals.

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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	Elective-I	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. Iti Saha Misra, "Wireless Communication and Networks: 3G and Beyond", McGraw Hill Education (India) Private Ltd, New Delhi, 2013.

Course Outcomes:

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

CO1. Explain basics of Network Architecture.

CO2. Implement wireless LAN for corresponding protocols.

CO3. Analyze WAN and MAN wireless network protocols.

CO4. Understand Ad-hoc network and mobile network technology.

CO5. Illustrate recent wireless technologies.

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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:

CO1. Analyze the Radar signals and networks**.**

CO2. Describe the pulse compression in radar signals processing.

CO3. Calculate the Radar resolution.

CO4. 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:

CO1. Apply the state space techniques in control systems.

CO2. Design the compensators.

CO3. Demonstrate the behavior of adaptive control system.

CO4. Analyze the adaptive model for control system.

CO5. Derive discrete-time mathematical models in Z domain.

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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 (800102)

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

Unit I Modelling 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. Vijaylakshmi Pai 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:

CO1. Illustrate the concept of modelling and optimization for RF design.

CO2. Explain neural network structures.

CO3. Evaluate the performance of neural networks.

CO4. Describe RF and microwave circuits.

CO5. Apply neural network techniques for the modelling of RF and microwave components.

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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 (800103)

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. Afif Osseiran, 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

CO1. Compare mobile technologies.

CO2. Describe 5G wireless propagation channels and transmission.

CO3. **Explain** multiplexing techniques for 5G.

CO4. **Illustrate** the multiple access techniques & millimeter wave communication for 5G.

CO5. Understand the device-to-device and machine-to-machine communications.

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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 (800104)

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. Suhel Dhanani and Michael Parker, Digital Video Processing for Engineer, Newnes Publication, 2012.

Course Outcomes:

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

CO1. Differentiate between Image, Signal and Video Processing.

CO2. Analyze the principal working of various transform on the Images.

CO3. Implement image enhancement techniques.

CO4. Examine the fundamental principal of video processing.

CO5. Implement video compression and motion estimation techniques.

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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:

CO1. Explain the concepts of source coding and Galois field GF (2^m).

CO2. Implement of BCH code and Reed Solomon Code.

CO3. Compute entropy, channel capacity, bit error rate, code rate, steady-state probability.

CO4. Design the encoder and decoder of convolution code.

CO5. Apply the mathematical tools for designing error correcting codes including finite fields.

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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.
3. Chang C. Hong, Tong H. Lee and Weng K. Ho, Adaptive Control, ISA press, Research TrianglePark, 1993.
4. Bose and Liang, Artificial Neural Networks, Tata Mcgraw Hill, 1996
5. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, Prentice Hall of India, New Delhi, 1992.
6. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi 1994.
7. Introduction to computer based control systems; IDC Technologies Pty Ltd

(Soft- copy online available).

Course Outcomes:

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

CO1. Explain the principle of computer based Control System.

CO2. Design ladder logics of process control applications using PLC.

CO3. Describe the principal of Adaptive Controls.

CO4. Estimate the parameters of control system using ANN.

CO5. Design fuzzy controllers.

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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		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 ltiMate 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 filter 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:

CO1. Compute DFT using FFT algorithms.

CO2. Design digital filters.

CO3. Describe multi-rate signal processing in practical applications.

CO4. Apply algorithms in DSP application.

CO5. 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 Outcomes:

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

CO1. Simulate the fading channel models.
CO2. Compare the simulated BER with the theoretical BER for digital modulation schemes.
CO3. Compare the PSD of Line coding schemes.
CO4. 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 Outcomes:

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

CO1. **Implement** modulation and demodulation techniques.
CO2. **Design** multiplexer and de-multiplexer
CO3. **Design** various latches and flip-flops
CO4. **Design** various shift registers and counters using flip-flops
CO5. **Analyze** different types of logic families, semiconductor memories & multivibrators.

Annexure XVIII

Item 22

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

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Scheme of Ph.D. Course work for *Varnika Sharma* admitted in 2023

As per Ph.D. New Ordinence Notification No: F5/Acad/ RGPV/2021/4406 dated 03/11/2021

Semester I

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.	Wireless Adhoc Networks	70	20	10	-	-	100	3	1	-	4
3.	Simulation Lab	-	-	-	60	40	100	-	-	4	2
Total		140	40	20	60	40	300	6	2	4	10

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Semester II

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.	Swayam NPTEL course*	75	-	25	-	-	100	3	1	-	4
Total		75	-	25	-	-	100	3	1	-	4

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

Department of Electronics Engineering

Wireless Ad Hoc Networks

Course objective:

To understand the basics of Ad-hoc Networks, learn various fundamental and emerging protocols of all layers, the nature, applications and various security practices and protocols of Ad-hoc Networks.

UNIT I: An overview of wireless communication systems: 1G, 2G and higher systems standards for Wireless communications systems, GSM, Mobile satellite communication GEO, MEO, LEO, Terrestrial mobile system.

UNIT II: Cellular communication fundamentals: - Cellular systems, Geometry of a Hexagonal Cell, Co-channel interference ratio, Cellular system design in worst case with an omnidirectional antenna-channel interference reduction with use of directional antenna Cell splitting, Frequency and spectrum management and handoff Access Techniques.

UNIT III: GSM architecture and interfaces, GSM frequency bands, GSM services GSM interfaces. The radio interface data services in GSM, GPRS, Privacy and security in GSM

UNIT IV: Ad Hoc Networking concepts, Routing techniques, comparison with wired protocols. QualNet and programming.

UNIT V: Security aspects of Ad-Hoc Networking, WAP issues, WLAN and its security.

Books:

1. Wireless Digital communication- Feher1991.PHI.
2. Principles & Applications of GSM- Vijay k. Garg, and J.E. Wilkes 1999 - Prentice Hall PTR.
3. Telecom Transmission handbook 4th edition Roger L Freeman 1998 John Wiley &Sons Inc. Network.
4. Mobile Cellular Telecom. Lee 1995 McGraw Hill Inc.

Course Outcomes:

At the end of this course, students will be able to:

1. **Identify** different issues in wireless Ad Hoc networks.
2. **Analyze** protocols developed for Ad Hoc networks.
3. **Identify** and address the security threats in Ad Hoc networks.
4. **Apply** GSM and GPRS.
5. **Create** an Ad Hoc network environment for different type of applications.

SIMULATION LAB

Course Objective:

1. To expose students to search as an problem solving tool, knowledge representation using rules, conceptual dependency, handling uncertainty.
2. To provide students hands on experience on QualNet and MATLAB to implement various strategies.

LIST OF EXPERIMENTS:

1. Introduction to QualNet, MATLAB and its tool boxes.
2. Create a sample wireless topology using QualNet.
3. Create a mobile Ad-hoc network using QualNet.
4. Implement an Ad-hoc On-demand Distance Vector protocol using QualNet.
5. Implement a Transmission Control Protocol using QualNet.
6. Implement a User Datagram Protocol using QualNet.
7. Crete a sample wireless topology using MATLAB.
8. Crete a mobile Ad-hoc network using MATLAB.
9. Implement an optimized energy protocol using MATLAB.

TEXT BOOKS:

1. C. Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Second Edition, Pearson Publication, 2015.
2. Holger Karl and Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", First Edition, John wiley publication, 2011.

Course Outcomes:

At the end of the course the student will be able to:

CO1. Simulate different topologies of Ad-hoc networks.
CO2. Implement the physical and MAC layer protocols of Ad-hoc networks.
CO3. Apply TCP and UDP protocols for Ad-hoc networks.