Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

DEPARTMENT OF PHYSICS

Curriculum for B.Sc. Honours in Electronics (Major)
As per
NEP- 2020

SYLLABUS
FOR I to VIII SEMESTER
UNDERGRADUATE PROGRAMME
2024-2025 onwards

10th Board of Studies: August 2024

Pre-Approval Form

Programme: B.Sc., Electronics (Honours) Subject: Electronics Department: Physics

In pursuance of conferment of Autonomous status to Dr. V. S. Krishna Government Degree College (A), Visakhapatnam by UGC vide letter No…………………… dated …………… from ……………., ……………………Joint Secretary, UGC, New Delhi, and Proceedings No………………………………….. ………the 10th Board of studies in Physics subject is conducted on ……………………… …….with the following members. The changes were implemented from 2024-25 academic year onwards. The syllabus is also approved

Member	Name and Designation	Signature
Chairman of BoS	Dr. D. Sravan Kumar, HoD, Department of Physics	
Members	M.Rajeswara Rao, Lecturer in Physics	
	Dr. N.V.S. Bhagavan, Lecturer in Physics	
	Dr. B. Nageswara Rao, Lecturer in Physics	
	Smt. M. Ramya, lecturer in Physics	
	Ch. Rambabu, Lecturer in Physics	
Subject Expert (University Nominee)		
Subject Expert 1 (from outside the affiliated University)		
Subject Expert 2 (from outside the affiliated University)		
Representative member from industry/Corporate/Allied area relating to placement		
Member from alumni		
Coordinator, IQAC		
Academic Coordinator and member secretary academic council		
Principal and Chairperson Academic Council		

Resolutions adopted by the Board of Studies (BoS) of B.Sc. Honours in Electronics (Major) 2024-25

Scheme of Evaluation for Practical examinations

The duration of examination for each theory course is 3Hrs.
The duration of each practical examination is 3Hrs with 50 Max. Marks
Distribution of marks
Experiment: 30M
Viva-Voce: 10M
Record: 10M

Detailed Distribution:
1. Formula and Explanation: 6M
2. Tabular Form + Graph+ Circuit Diagram: 6M
3. Observations: 12M
4. Calculation + Precautions + Result: 6M
5. Viva- Voce: 10M
6. Record: 10M
7. **Internal Evaluation**

Internal: External Evaluation is 40:60

The Internal Evaluation Method (CIA)

Mid exam	Type of Assessment	Max Marks
I	Assignment	10M
	Seminar/ Study project/Filed trip/Quiz etc	10M
	NCC/NSS (extra-curricular)	10M
	Exam (Summative)	20M
II	Assignment	10M
	Seminar/ Study project/Filed trip/Quiz etc	10M
	NCC/NSS (extra-curricular)	10M
	Exam (Formative)	20M
Grand total		100M
Total marks Scaled down to 40M		

COURSE STRUCTURE

Year	Semester	S.No	Title of the Course	Course Code	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	24BSPM11	3+2	4
		2	Advances in Mathematical, Physical and Chemical Sciences	24BSPM12	3+2	4
	II	3	Fundamental of Electricity and Electronics	24ELEM21	3	3
			Fundamental of Electricity and Electronics Practical Course	24ELEM21P	2	1
		4	Circuit theory and electronic devices	24ELEM22	3	3
			Circuit theory and electronic devices Practical Course	24ELEM22P	2	1
			Community Service Project	INTERNSHIP001	4	8 weeks
II	III	5	Semiconductor devices and Materials	24ELEM31	3	3
			Semiconductor devices and Materials Practical Course	24ELEM31P	2	1
		6	Digital Electronics	24ELEM32	3	3
			Digital Electronics Practical Course	24ELEM32P	2	1
		7	Analog Electronics	24ELEM33	3	3
			Analog Electronics Practical Course	24ELEM33P	2	1
		8	Electronic communication system	24ELEM34	3	3
			Electronic communication system Practical Course	24ELEM34P	2	1
	IV	9	Electrical and electronics instrumentation	24ELEM41	3	3

<table>
<tr><td rowspan="6"></td><td rowspan="6"></td><td></td><td>Electrical and electronics instrumentation Practical Course</td><td>24ELEM41P</td><td>2</td><td>1</td></tr>
<tr><td rowspan="2">10</td><td>Microcontrol system</td><td>24ELEM42</td><td>3</td><td>3</td></tr>
<tr><td>Microcontrol system Practical Course</td><td>24ELEM42P</td><td>2</td><td>1</td></tr>
<tr><td rowspan="3">11</td><td>Microprocessor system</td><td>24ELEM43</td><td>3</td><td>3</td></tr>
<tr><td>Microprocessor system Practical Course</td><td>24ELEM43P</td><td>2</td><td>1</td></tr>
<tr><td>Short Term Internship</td><td>INTERNSHIP002</td><td>4</td><td>8weeks</td></tr>
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<tr><td rowspan="16">III</td><td rowspan="16">V</td><td rowspan="2">12</td><td>Cellular Mobile Communication</td><td>24ELEM51</td><td>3</td><td>3</td></tr>
<tr><td>Cellular Mobile Communication Practical Course</td><td>24ELEM51P</td><td>2</td><td>1</td></tr>
<tr><td rowspan="2">13</td><td>Computer Network</td><td>24ELEM52</td><td>3</td><td>3</td></tr>
<tr><td>Computer Network Practical Course</td><td>24ELEM52P</td><td>2</td><td>1</td></tr>
<tr><td rowspan="2">14 A</td><td>Industrial Electronics</td><td>24ELEM53A</td><td>3</td><td>3</td></tr>
<tr><td>Industrial Electronics Practical Course</td><td>24ELEM53AP</td><td>2</td><td>1</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td rowspan="2">14 B</td><td>Embedded system Design</td><td>24ELEM53B</td><td>3</td><td>3</td></tr>
<tr><td>Embedded system Design Practical Course</td><td>24ELEM53BP</td><td>2</td><td>1</td></tr>
<tr><td rowspan="2">15 A</td><td>Digital system Design</td><td>24ELEM54A</td><td>3</td><td>3</td></tr>
<tr><td>Digital system Design Practical Course</td><td>24ELEM54AP</td><td>2</td><td>1</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td rowspan="2">15 B</td><td>Consumer Electronics</td><td>24ELEM54B</td><td>3</td><td>3</td></tr>
<tr><td>Consumer Electronics Practical Course</td><td>24ELEM54BP</td><td>2</td><td>1</td></tr>
<tr><td></td><td>VI</td><td colspan="2">Internship</td><td>INTERNSHIP003</td><td>12</td><td>15 weeks</td></tr>
<tr><td></td><td rowspan="3">VII</td><td rowspan="2">16A</td><td>Medical Electronics</td><td>24ELEM71A</td><td>3</td><td>3</td></tr>
<tr><td></td><td>Medical Electronics Practical Course</td><td>24ELEM71AP</td><td>2</td><td>1</td></tr>
<tr><td></td><td>16B</td><td>(OR)</td><td></td><td></td><td></td></tr>
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			Advanced Communication Systems	24ELEM71B	3	3
			Advanced Communication Systems Practical Course	24ELEM71BP	2	1
		17A	Principles and utility of electronic domestic applications	24ELEM72A	3	3
			Principles and utility of electronic domestic applications Practical Course	24ELEM72AP	2	1
		17B	OR			3
			Digital and Data Communication Systems	24ELEM72B	3	3
			Digital and Data Communication Systems Practical Course	24ELEM72BP	2	1
		18A	RF Networks	24ELEM73A	3	3
			RF Networks Practical Course	24ELEM73AP	2	1
		18B	OR			
			Wireless Sensor Network Design	24ELEM73B	3	3
			Wireless Sensor Network Design Practical Course	24ELEM73BP	2	1
		SEC				
		19A	Sensors	24ELEM74A	3	3
			Sensors Practical Course	24ELEM74AP	2	1
		19B	OR			
			Bio-medical Instrumentation	24ELEM74B	3	3
			Bio-medical Instrumentation Practical Course	24ELEM74BP	2	1
		20A	Digital Signal Processing	24ELEM75A	3	3
			Digital Signal Processing Practical Course	24ELEM75AP	2	1
			OR			
		20B	IoT Fundamentals	24ELEM75B	3	3
			IoT Fundamentals Practical Course	24ELEM75BP	2	1
	VIII	21A	Microprocessors and Microcontrollers	24ELEM81A	3	3

			Microprocessors and Microcontrollers Practical Course	24ELEM81AP	2	1
		21B	OR			
			Electromagnetics	24ELEM81B	3	3
			Electromagnetics Practical Course	24ELEM81BP	2	1
		22A	Antenna and Waves Propagation	24ELEM82A	3	3
			Antenna and Waves Propagation Practical Course	24ELEM82AP	2	1
		22B	OR		3	3
			Power Electronics	24ELEM82B		
			Power Electronics Practical Course	24ELEM82BP	2	1
		23A	Microwave and Opto Electronics	24ELEM83A	3	3
			Microwave and Opto Electronics Practical Course	24ELEM83AP	2	1
		23B	OR	24ELEM83B	3	3
			Wireless Broadband Networks			
			Wireless Broadband Networks Practical Course	24ELEM83BP	2	1
		SEC				
		24A	Consumer Electronics	24ELEM84A	3	3
			Consumer Electronics Practical Course	24ELEM84AP	2	1
		24B	OR		3	3
			Mobile Computing	24ELEM84B		
			Mobile Computing Practical Course	24ELEM84BP	2	1
		25A	Robotics	24ELEM85A	3	3
			Robotics Practical Course	24ELEM85AP	2	1
		25B	OR			
			Introduction to MEMs	24ELEM85B	3	3
			Introduction to MEMs Practical Course	24ELEM85BP	2	1

Curriculum framework BSc Single major Programme

B.Sc (Honours) with Single Major																								
Semester	**Major* (4 Cr)**			**Minor (4 Cr)**			**Languages (3 Cr)**			**Multi Disny' (2 Cr)**			**Skill Enhancement Courses (2Cr)**			**OOTC**			**Env. Edn (2 Cr)**			**Total**		
	C	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	**Cr**
Sem 1	2*	10	8				2	8	6	1	2	2	2	4	4							7	24	20
Sem 2	2	6+4	8	1	3+2	4	2	8	6				2	4	4							7	27	22
Community Service Project of 180 hours with 4 Credits. Student is eligible for Exit Option-1 with the award of Certificate in respective discipline																								
Sem 3	4	12+8	16	1	3+2	4				1	2	2	1	2	2							7	29	24
Sem 4	3	9+6	12	2	6+4	8				1	2	2	1	2	2							7	29	24
Short-Term Internship/Apprenticeship/OJT of 180 hours with 4 Credits. Student is eligible for Exit Option-2 with the award of Diploma in respective major with minor																								
Sem 5	4	12+8	16	2	6+4	8													1	2	2	7	32	26
Sem 6	**Semester Internship/Apprenticeship/OJT with 12 Credits. Student is eligible for Exit Option-3 with the award of Degree in respetive major with**																							
																			IKS#					
Sem 7	3	9+6	12										2*	6+4	8	1	2	2	1	2	0	6	29	22
Sem 8	3	9+6	12										2*	6+4	8	1	2	2	1	2	0	6	29	22
	21		84	6		24	4		12	3	6	6	10	32	28	2	4	4	2	4	0	47		**160**

20 Additional Credits for 10 month mandatory Internship/OJT/Apprenticeship
C Courses **H** Hours **Cr** Credits **OOTC** Open Online Transdisciplinary
IKS# Indian Knowledge Systems - Audit Course

Credit Requirements

- For UG Honours Degree the number of credits required is 160 along with 20 additional credits assigned for Community Service Project (4 credits), Short Term Internship (4 credits) and Semester Internship (12 credits).
- These 160 credits are apportioned as, 84 for Major Courses, 24 for Minor Courses, 12 for Languages, 6 for Multidisciplinary Courses, 28 for Skill Courses, 4 for Open Online Transdisciplinary Courses and 2 for Common Value-Added Courses.
- **The thumb rule for assigning credits is 1 hour of theory per week is equivalent to 1 credit. Similarly, 2 hours of practical per week is equivalent to 1 credit. The credits assigned for Internship/Apprenticeship/OJT are not to be equalized with the hours of work done**.
- A student can acquire a maximum of 40% of credits online

Major Courses

- Major discipline is the discipline or subject of main focus and the degree will be awarded in that discipline. Students should secure the minimum prescribed number of credits, i.e., 84 (about 50% of total credits) through core courses in the major discipline.

- A student of UG Honours Degree has to study 21 course papers with 84 credits in the chosen major.

Minor Courses

- Students have to choose a Minor in the second semester. The student can choose a minor cutting across the disciplines or from the allied disciplines.
- A student has to study 6 courses in the chosen minor with 24 credits. The minor courses start from the second semester onwards
- **A student can complete a second minor online from approved sources during the period of study and submit the credits to the institution for inclusion in the Degree certificate.**
- **Minor courses can be studied offline or online or in blended mode**.

Languages

- Two courses in English Language and two courses in Modern Indian Language are to be completed in the first two semesters.

- Each language course is taught for 4 hours with 3 credits.

- A student can opt for doing the English Language Courses online which are equivalent to IELTS/TOEFL/OET, etc. Or the minimum required scores for qualifying in IELTS/TOEFL/OET can be reckoned for the 6 credits assigned for English Language

Skill Courses

- Enhancing student employability is the top priority for higher education. Employability is a measure of a student's ability to secure their first job and remain employed throughout their working lives.

- A pool of Skill Enhancement Courses is offered in Semesters I to IV. These Skill Enhancement Courses are contemporary in nature and not major-specific.

- A student has to complete 6 such courses (2 credits each) in Semesters I to IV assigned with 12 credits. Students are offered choices for selecting skill enhancement courses of their interest.

- Major subject-specific Skill Enhancement courses with choices are offered in Semester V/VI as two of the four major courses.

- And two Skill Enhancement courses each with choices are offered in Semesters VII and VIII in the concerned major.

Semester	Skill Courses	Title of the course	Course Code	No of credits	No of hours per week
I	**A student has to choose any TWO of the following four courses**	Entrepreneurship Development	24EPDS11	2	2
		Leadership Skills	24LSSS12	2	2
		Analytical Skills	24ALSS13	2	2
		Communication Skills	24CCSS14	2	2
II	**A student has to choose any TWO of the following five courses**	Business Writing	24BNSS21	2	2
		Marketing Skills	24MKTS22	2	2
		Investment Planning	24INVS23	2	2
		Stock Market Operations	24SMOS24	2	2
		Digital Literacy	24DTLS25	2	2
III	**A student has to choose any ONE of the following four courses**	Business Forecasting	24BFCS31	2	2
		Project Management	24PJMS32	2	2
		Information and Communication Technology	24ICTS33	2	2
		Data Analysis	24DTAS34	2	2
IV	**A student has to choose any ONE of the following four courses**	Cybersecurity	24CYSS41	2	2
		Digital Marketing	24DGMS42	2	2
		Tourism Guidance	24TRGS43	2	2
		Design thinking	24DGTS44	2	2

Multidisciplinary Courses

- In consonance with NEP – 2020 all UG students are required to undergo multidisciplinary courses. These courses are intended to broaden the intellectual experience.

- **Students are not allowed to choose the courses in a major discipline or repeat courses already undergone at the higher secondary level or Intermediate level or 12th class as the multidisciplinary course.**

- A student has to complete 3 multidisciplinary courses each carrying 2 credits.
- Students are offered choices for selecting multidisciplinary courses of their interest.

Semester	Multidiscipline Course	Title of the course	Course Code	No of Credits	No of Hours per week
I	**A student has to choose ONE course from the six courses listed against the semester.**	Introduction to Social Work	24ISWD11	2	2
		Principles of Psychology	24POPD12	2	2
		Indian History	24INHD13	2	2
		Principles of Biological Sciences	24PBSD14	2	2
		Principles of Chemical Sciences	24PCSD15	2	2
		Principles of Physical Sciences	24PPSD16	2	2
III	**A student has to choose ONE course the six courses listed against the semester.**	Introduction to Public Administration	24IPAD31	2	2
		Principles of Management	24POMD32	2	2
		Principles of Accounting	24POAD33	2	2
		Basic Electronics	24BELD34	2	2
		Health and Hygiene	24HAHD35	2	2
		Basic Mathematics	24BMTD36	2	2
IV	**A student has to choose ONE course from the six courses listed against the semester.**	Fundamentals of Economics	24FOED41	2	2
		Indian Philosophy	24IPYD42	2	2
		Performing Arts	24PATD43	2	2
		Introduction to Geography	24IOGD44	2	2
		Basic Statistics	24BSTD45	2	2
		Introduction to Nanotechnology	24ITND46	2	2

Common Value-Added Courses

- Common Valued Added Course includes Environmental science/education, and shall carry 2 credits.

Semester	Common Value-added Course	Title of the course	Course Code	No of credits	No of hours per week
V		Environmental Education	**24ENEV51**	2	2

List of add on/certificate/value added program which are optional and offered outside the curriculum of the programs by the department

S.No	**Title of the Value-added course**	**Course Code**	**No of credits**

Courses on Indian Knowledge Systems (IKS)

- Courses on IKS are integrated into the curricular framework. The IKS course shall be an Audit Course which is a mandatory course with only a Pass or Fail.

- A student has to complete 2 courses on IKS one in the VII semester and one in the VIII semester.

- Students are offered choices for selecting IKS courses of their interest.

Semester	IKS	Tile of the course	No of credits	No of hours per week
VII	IKS 1	IKS 1	0	2
VIII	IKS 2	IKS 2	0	2

Open Online Transdisciplinary Courses (OOTC)

- Two mandatory Open Online Transdisciplinary Courses, with 2 credits per course, are to be done by the students, one in each of Semesters VII and VIII.

- Students are free to select courses of their interest from any discipline.

Semester	OOTC	Tile of the course	No of credits	No of hours per week
VII		OOTC 1	2	2
VIII		OOTC 2	2	2

10-month mandatory Internship

Three internships are mandatory for all students irrespective of the of the Program of study.

A. First internship (April-May after 1st year examinations): Community Service Project
   - To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project.

   Learning outcomes:
   - To facilitate an understanding of the issues that confronts the vulnerable/marginalized sections of the society.
   - To initiate team processes with the student groups for societal change.
   - To provide students an opportunity to familiarize themselves with urban/rural community they live in.
   - To enable students to engage in the development of the community.
   - To plan activities based on the focused groups.
   - To know the ways of transforming society through systematic programme implementation.

B. Second Internship (April-May after 2^{nd} year examinations): Apprenticeship / Internship / On-the-job training / In-house Project / Off-site Project

   - To make the students employable, an Apprenticeship / Internship / On the job training / In-house Project / Off-site Project shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years.

   Learning outcomes
   - Explore career alternatives prior to graduation.
   - Integrate theory and practice.
   - Assess interests and abilities in their field of study.
   - Learn to appreciate work and its function towards future .
   - Develop work habits and attitudes necessary for job success.
   - Develop communication, interpersonal and other critical skills in the future job.
   - Build a record of work experience.
   - Acquire employment contacts leading directly to a full-time job following graduation from college.

C. Third internship (5th/6thSemester period):

During the entire 5th /6th Semester, the student shall undergo
Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work.

Learning outcomes

- Explore career alternatives prior to graduation.
- Integrate theory and practice.
- Assess interests and abilities in their field of study.
- Learn to appreciate work and its function towards future .
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the future job.
- Build a record of work experience.
- Acquire employment contacts leading directly to a full-time job following graduation from college.

Internal Evaluation

Internal: External Evaluation is 40:60

The Internal Evaluation Method (CIA)

Mid exam	**Type of Assessment**	**Max Marks**
I	**Assignment**	**10M**
	Seminar/ Study project/Filed trip/Quiz etc	**10M**
	NCC/NSS (extra-curricular)	**10M**
	Exam (Summative)	**20M**
II	**Assignment**	**10M**
	Seminar/ Study project/Filed trip/Quiz etc	**10M**
	NCC/NSS (extra-curricular)	**10M**
	Exam (Formative)	**20M**
Grand total		**100M**
Total marks Scaled down to 40M		

Multiple Entry and Exit Options

Operative Details of ME-ME

1st year of Entry 1: **The entry requirement for the 1st year of 4-year Degree (Level – 4.5 of National Credit Framework (NCrF) of UGC) is Intermediate/12th class of CBSE/ or any other equivalent certificate approved by the Board of Intermediate Education.**

Exit 1: A Certificate will be awarded when a student exits at the end of the year 1 (Level 4.5).

Certificate in Sciences is to be awarded, if students exit after successful completion of 1 year of study in B.Sc. However, the students are required to pass all courses, Languages, Multidisciplinary, Skill Enhancement and Core Courses in Major and Minor along with completion of Community Service Project in the summer term.

2nd year:

Entry 2: **The entry requirement for 2nd year of 4-year Degree (Level – 5 of NCrF of UGC) is a Certificate obtained after completing the first two semesters of the undergraduate programme. A student can seek entry into the 2nd year of study in a college, provided there are vacancies in that particular programme in that college. The transfer admission shall be within the intake permitted to the college**.

Exit 2: A Diploma will be awarded when a student exits at the end of the 2nd year (Level 5 of NCrF).

Diploma in Sciences is to be awarded if students exit after successful completion of 2nd year of study in B.Sc. However, the students are required to pass all courses, Languages, Multidisciplinary, Skill Enhancement and Core Courses in Major and Minor along with completion of Community Service Project in the summer term between 1st and 2nd year and short-term internship in the summer term between 2nd and 3rd year.

3rd year:

Entry 3: **The entry requirement for 3rd year of 4-year Degree (Level – 5.5 of NCrF of UGC) is a Diploma obtained after completing two years (4 semesters) of the undergraduate programme. A student can seek entry into the 3rd year of study in a college, provided there are vacancies in that particular programme in that college. The transfer admission shall be within the intake permitted to the college**.

Exit 3: A Degree will be awarded when a student exits at the end of the 3rd year (Level – 5.5 of NCrF). Bachelor’s Degree in Sciences B.Sc
is to be awarded if students exit after successful completion of 3rd year of study. However, the students are required to pass all courses, Languages, Multidisciplinary, Skill Enhancement and Core Courses in Major and Minor along with completion of Community Service Project in the summer term between 1st and 2nd year and short-term internship in the summer term between 2nd and 3rd year and a full-semester internship.

The Degree awarded shall include the Major and Minor/s in parenthesis. For Ex., **B.Sc (Electronics with Computer Science Minor)**

4th year:

Entry 4: **The entry requirement for 4th year of 4-year Degree (Level – 6 of NCrF of UGC) is a degree obtained after completing three years (6 semesters) of the undergraduate programme. A student can seek entry into the 4th year of study in a college, provided there are vacancies in that particular programme in that college. The transfer admission shall be within the intake permitted to the college**.

Exit 4: A Degree with Honours will be awarded when a student exits at the end of the 3rd year (Level – 6 of NCrF). Bachelor’s Degree with Honours in Sciences is to be awarded if students exit after successful completion of 4th year of study.

The name of the Major/s shall be indicated in parenthesis and the name of the Minor/s. For ex., B.Sc Honours (Electronics with Computer Science Minor).

If the student completes the 4th year with courses in research methodologies and a rigorous research project in one of the major courses of study, a Bachelor degree (Honours with research) is awarded.

Career Opportunities and Graduate Employability

- Career options and graduate employability are the significant program outcomes and benefits of the 4-year Honours Degree Program. The program equips students with the necessary knowledge, skills, and experiences to pursue diverse career paths and enhances their potential for successful employment after graduation.
- The 4-year Honours Degree Program provides students with specialized knowledge and expertise in their chosen field of study through advanced coursework and in-depth study.
- Graduates possess a deep understanding of their subject, making them more attractive to employers seeking candidates with specialized knowledge and skills.
- Throughout the program, students develop a range of industry-relevant skills such as critical thinking, problem-solving, data analysis, research, and communication skills.
- Graduates are well-prepared to meet the demands of the job market and can apply their skills effectively in professional settings.
- Honours Degree Program incorporate mandatory internships; hence graduates gain valuable practical experience during their studies, enhancing their employability by demonstrating hands-on skills and industry exposure.
- Honours Degree Program emphasizes critical thinking and adaptability, preparing students for the rapidly changing job market.
- Graduates are equipped to navigate and thrive in dynamic work environments, and they possess a strong foundation for continuous learning and skill development.
- As a result of the specialized knowledge, skills, and experiences gained, graduates are highly sought after by employers. And enjoy enhanced employability and marketability, increasing their chances of securing rewarding job opportunities and career advancement.

Further Education and Postgraduate Studies

- After completion of the first 3 years of study in the Honours Degree Program, if a student exits, he/she is awarded a Degree and is eligible to pursue a 2-year Postgraduate Program.
- A student getting a UG Honours Degree can do 1-year Postgraduate Program.
- A student awarded with UG Honours Degree with Research is eligible to get direct admission into Ph.D. program provided the student secures 75% and above marks

Guidelines for UG Honours with research

UG Honours with Research

1. Students have to choose after the completion of the third year of study, the Honours program for the fourth year of study.
2. They can pursue Honours program in the major/minor domain of joining in Honours with the research programme.
3. **If the student wants to join in Honours with research, he/she should pass all the courses in the first three years of the UG program and secure 75% or more marks.**

4. For Semester 7, the curricular structure includes 3 common courses on Research Methodologies and 2 discipline-specific courses in the 7th semester.
5. In the 8th Semester, the student has to complete an individual research project in one of the three subjects of his/her study in the first three years.
6. Courses on Research Methodology (7th Semester):

The course structure for the 7th Semester shall be as follows

B.Sc (Physical Sciences/Chemical Sciences)

1. Course 7.1 Research Methodology: Conceptual and Theoretical Perspectives
2. Course 7.2 Research Methodology: Observational and Empirical Perspectives
3. Course 7.3 Statistical Analysis using Computer Packages for Research Methodology
4. Course 7.4 Advanced Analytical Techniques for Science Research
5. Course 7.5 Materials Science

7. Open Online Courses

A Student shall do TWO Open Online Transdisciplinary Courses, in Semesters 7 & 8. The Online Courses can be of students' choice, either in the same domain/related domain or multidisciplinary in nature. The Online Courses can also be done either in SWAYAM or NPTEL or COURSEERA or from any other resources recognized by the APSCHE and the competent authority of the respective Universities. The Open Online Courses shall carry 4 Credits each. Students shall have a choice of choosing either two online courses of 2 credits each or one course of 4 credits or can acquire a greater number of credits. If a student is desirous of choosing Open Online Courses offered by industry or a recognized online course provider, the duration shall be not less than 60 hours for a 4-credit course.

Assessment for Online Courses:

If the Online Course is done from among the Online courses offered in SWAYAM or UGC MOOCs or NPTEL, the credits and marks awarded shall be recognised and calculated for the SGPA and CGPA. The same shall be the case if any service provider conducts an online examination (proctored). If no online examination is conducted either on SWAYAM or UGC MOOCs or NPTEL or proctored examination by the service provider, a pen and paper examination be conducted by the university.

Year	Semester	Course Code	Type of Course	Hrs/Week	Credits
4	VII	VII.1.8	Common Course	5	5
4	VII	VII.2.9	Common Course	5	5
4	VII	VII.3.10	Common Course	5	5
4	VII	VII.4.11	Discipline Specific Course	5	5
4	VII	VII.5.12	Discipline Specific Course	5	5
4	VII	VII.6.13	Transdisciplinary Online Course	15 Weeks	2
4	VII	VII. 7.14	IKS	15 Weeks	0

4	VIII	VIII.1.14	Research Project in major/minor	15 Weeks	25
4	VIII				
4	VIII				
4	VIII				
4	VIII				
4	VIII	VIII.2.15	Transdisciplinary Online Course	15 Weeks	2
4	VIII	VIII.3. 16	IKS	15 Weeks	0

Individual Research Project in Semester VIII for Students of Science:

- Guidelines for the Research Project to be done during VIII Semester
- Identification of Research Project:

The student has to select a topic which is interesting to him/her and related to subject which is relevant to society or industry. The title of the topic can be designed with the consultation of the research supervisor.

- Objectives:

The purpose of this course is to introduce students to the process of conducting science research projects. The students will be helped to conceptualise, design and execute a research project by a teacher guide. The students have to identify the objectives related to the topic of the research project proposed.

- Structure:

Most of the sessions in this semester will be designed in a seminar format. This will be supplemented by individual / group conference/supervision. The focus will be on discussions and analysis of assignments.

Learners will be encouraged to read books and research journals related to his/her research topic and share them in the seminars.

Learners will be initiated to think about research issues throughout the semester, debate these issues with teachers and classmates and synthesize these issues mentally to develop as a researcher.

Being a research degree, this course will entail (1) a much higher workload than any bachelor's degree course studied so far (2) a heavy dose of readings, and (3) a substantial amount of critical thinking.

Duration of the Project: 15 Weeks

Method of Assessment:

Continuous Internal Evaluation 100 marks (spread across the semester)

Semester-End External Evaluation

Dissertation 200 marks

Seminar 100 marks

Viva voce 100 marks

(shall be conducted at the end of the Semester)

There shall be a panel of three Examiners for the Semester End External Evaluation, comprising of Faculty Supervisor, one faculty member-internal examiner and one external examiner.

	Programme Outcome (POs)
PO 1	**Critical Thinking**: Ability to take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2	**Effective Communication:** Ability to speak, read, write, and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
PO 3	**Social Interaction:** Ability to elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO 4	**Effective Citizenship:** Ability to demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5	**Ethics:** Ability to recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6	**Environment and Sustainability:** Ability to understand the issues of environmental contexts and sustainable development
PO 7	**Employability skills:** **E**quipping graduates with the essential abilities and knowledge to excel in their chosen careers
PO 8	**Entrepreneurship skills:** Seeks to empower students with the competencies needed to be successful entrepreneurs, enabling them to launch, operate, and innovate in their own businesses or entrepreneurial ventures.
PO 9	**Multidisciplinary Knowledge:** Multidisciplinary knowledge is crucial for developing graduates who can think critically, innovate, and collaborate effectively. This approach not only enhances the educational experience but also ensures that students are well-prepared to meet the challenges of an increasingly complex and interconnected world.
PO 10	**Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

	Program specific Outcomes (PSOs)
PSO 1	**Knowledge and Skills Development** Knowledge and skills development can be explained as a crucial program outcome and benefit of a 4-year Honours Degree Program. As students progress through the program, they acquire a wide range of subject-specific knowledge and general skills that prepare them for success in their chosen field and beyond.
PSO 2	**Subject-Specific Knowledge:** In-Depth Understanding: The 4-year Honours Degree Program provides students with an opportunity to develop a deep understanding of their chosen major. Through advanced coursework and specialized study, students gain expertise in their field of interest. Critical Analysis: Students learn to critically analyze complex concepts and theories within their major. They acquire the ability to evaluate and apply knowledge to real-world scenarios, fostering problem-solving skills.
PSO 3	**Interdisciplinary/Multidisciplinary Knowledge:** Holistic Perspectives: Honours Degree Programs often encourage interdisciplinary learning, allowing students to explore connections between different fields of study. This broadens their perspectives and promotes a well-rounded education. Integrative Learning: Students develop the ability to integrate knowledge from various disciplines, enabling them to address multifaceted challenges with a comprehensive approach
PSO 4	**Communication Skills:** Written Communication: Students enhance their written communication skills by preparing reports, essays, and research papers. They learn to articulate complex ideas clearly and effectively. Oral Presentation: Through presentations and seminars, students develop strong oral communication skills, enabling them to present ideas confidently and persuasively
PSO 5	**Research and Analytical Skills:** Research Experience: Honours Degree Program with Research typically include research components such as a capstone project or thesis. Students engage in research methodologies, data analysis, and independent inquiry, honing their research skills. Critical Thinking: Through research and coursework, students cultivate critical thinking abilities, enabling them to analyze data, evaluate evidence, and form well-founded arguments

Courses mapped with Employability skills/Cross cutting issues

Year	Semester	S.No	Title of the Course	Course Code	Employability skills	Cross cutting issues
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	24BSPM11	√	√
		2	Advances in Mathematical, Physical and Chemical Sciences	24BSPM12	√	√
	II	3	Fundamental of Electricity and Electronics	24ELEM21	√	
			Fundamental of Electricity and Electronics Practical Course	24ELEM21P	√	
		4	Circuit theory and electronic devices	24ELEM22	√	
			Circuit theory and electronic devices Practical Course	24ELEM22P	√	
			Community Service Project	INTERNSHIP001	√	√
II	III	5	Semiconductor devices and Materials	24ELEM31	√	
			Semiconductor devices and Materials Practical Course	24ELEM31P	√	
		6	Digital Electronics	24ELEM32	√	√
			Digital Electronics Practical Course	24ELEM32P	√	
		7	Analog Electronics	24ELEM33	√	
			Analog Electronics Practical Course	24ELEM33P	√	

		8	Electronic communication system	24ELEM34	√	√
			Electronic communication system Practical Course	24ELEM34P	√	
	IV	9	Electrical and electronics instrumentation	24ELEM41	√	
			Electrical and electronics instrumentation Practical Course	24ELEM41P	√	
		10	Microcontrol system	24ELEM42	√	
			Microcontrol system Practical Course	24ELEM42P	√	
		11	Microprocessor system	24ELEM43	√	
			Microprocessor system Practical Course	24ELEM43P	√	
			Short Term Internship	INTERNSHIP002	√	√

III	V	12	Cellular Mobile Communication	24ELEM51	√	√
			Cellular Mobile Communication Practical Course	24ELEM51P	√	
		13	Computer Network	24ELEM52	√	√
			Computer Network Practical Course	24ELEM52P	√	
		14 A	Industrial Electronics	24ELEM53A	√	√
			Industrial Electronics Practical Course	24ELEM53AP	√	√
		OR				
		14 B	Embedded system Design	24ELEM53B	√	
			Embedded system Design Practical Course	24ELEM53BP	√	
		15 A	Digital system Design	24ELEM54A	√	
			Digital system Design Practical Course	24ELEM54AP	√	
		OR				
		15 B	Consumer Electronics	24ELEM54B	√	√
			Consumer Electronics Practical Course	24ELEM54BP	√	√
	VI		Internship	INTERNSHIP003	√	√

IV	VII	16A	Medical Electronics	24ELEM71A	√	√
			Medical Electronics Practical Course	24ELEM71AP	√	√
		16B	(OR)	24ELEM71B	√	
			Advanced Communication Systems			
			Advanced Communication Systems Practical Course	24ELEM71BP	√	
		17A	Principles and utility of electronic domestic applications	24ELEM72A	√	
			Principles and utility of electronic domestic applications Practical Course	24ELEM72AP	√	
		17B	OR	24ELEM72B	√	
			Digital and Data Communication Systems			
			Digital and Data Communication Systems Practical Course	24ELEM72BP	√	
		18A	RF Networks	24ELEM73A	√	
			RF Networks Practical Course	24ELEM73AP	√	
		18B	OR	24ELEM73B	√	
			Wireless Sensor Network Design			
			Wireless Sensor Network Design Practical Course	24ELEM73BP	√	
		SEC				
		19A	Sensors	24ELEM74A	√	
			Sensors Practical Course	24ELEM74AP	√	
		19B	OR	24ELEM74B	√	
			Bio-medical Instrumentation			
			Bio-medical Instrumentation Practical Course	24ELEM74BP	√	
		20A	Digital Signal Processing	24ELEM75A	√	
			Digital Signal Processing Practical Course	24ELEM75AP	√	
			OR			

		20B	IoT Fundamentals	24ELEM75B	√	√
			IoT Fundamentals Practical Course	24ELEM75BP	√	√
	VIII	21A	Microprocessors and Microcontrollers	24ELEM81A	√	√
			Microprocessors and Microcontrollers Practical Course	24ELEM81AP	√	
		21B	OR		√	
			Electromagnetics	24ELEM81B		
			Electromagnetics Practical Course	24ELEM81BP	√	
		22A	Antenna and Waves Propagation	24ELEM82A	√	
			Antenna and Waves Propagation Practical Course	24ELEM82AP	√	
		22B	OR		√	
			Power Electronics	24ELEM82B		
			Power Electronics Practical Course	24ELEM82BP	√	
		23A	Microwave and Opto Electronics	24ELEM83A	√	
			Microwave and Opto Electronics Practical Course	24ELEM83AP	√	
		23B	OR	24ELEM83B	√	
			Wireless Broadband Networks			
			Wireless Broadband Networks Practical Course	24ELEM83BP	√	
		SEC				
		24A	Consumer Electronics	24ELEM84A	√	√
			Consumer Electronics Practical Course	24ELEM84AP	√	√
		24B	OR		√	
			Mobile Computing	24ELEM84B		
			Mobile Computing Practical Course	24ELEM84BP	√	
		25A	Robotics	24ELEM85A	√	√
			Robotics Practical Course	24ELEM85AP	√	√

		25B	OR	24ELEM85B	√	√
			Introduction to MEMs			
			Introduction to MEMs Practical Course	24ELEM85BP	√	√

Courses Mapped with POs

Title of the Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
Essentials and Applications of Mathematical, Physical and Chemical Sciences	√	√	√	√	√	√	√	√	√	√
Advances in Mathematical, Physical and Chemical Sciences	√	√	√	√	√	√	√	√	√	√
Fundamental of Electricity and Electronics	√	√	√	√	√	√	√	√	√	√
Fundamental of Electricity and Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Circuit theory and electronic devices	√	√	√	√	√	√	√	√	√	√
Circuit theory and electronic devices Practical Course	√	√	√	√	√	√	√	√	√	√
Community Service Project	√	√	√	√	√	√	√	√	√	√
Semiconductor devices and Materials	√	√	√	√	√	√	√	√	√	√
Semiconductor devices and	√	√	√	√	√	√	√	√	√	√

Materials Practical Course										
Digital Electronics	√	√	√	√	√	√	√	√	√	√
Digital Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Analog Electronics	√	√	√	√	√	√	√	√	√	√
Analog Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Electronic communication system	√	√	√	√	√	√	√	√	√	√
Electronic communication system Practical Course	√	√	√	√	√	√	√	√	√	√
Electrical and electronics instrumentation	√	√	√	√	√	√	√	√	√	√
Electrical and electronics instrumentation Practical Course	√	√	√	√	√	√	√	√	√	√
Microcontrol system	√	√	√	√	√	√	√	√	√	√
Microcontrol system Practical Course	√	√	√	√	√	√	√	√	√	√
Microprocessor system	√	√	√	√	√	√	√	√	√	√
Microprocessor system Practical Course	√	√	√	√	√	√	√	√	√	√
Short Term Internship	√	√	√	√	√	√	√	√	√	√

Cellular Mobile Communication	√	√	√	√	√	√	√	√	√	√
Cellular Mobile Communication Practical Course	√	√	√	√	√	√	√	√	√	√
Computer Network	√	√	√	√	√	√	√	√	√	√
Computer Network Practical Course	√	√	√	√	√	√	√	√	√	√
Industrial Electronics	√	√	√	√	√	√	√	√	√	√
Industrial Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Embedded system Design	√	√	√	√	√	√	√	√	√	√
Embedded system Design Practical Course	√	√	√	√	√	√	√	√	√	√
Digital system Design	√	√	√	√	√	√	√	√	√	√
Digital system Design Practical Course	√	√	√	√	√	√	√	√	√	√
Consumer Electronics	√	√	√	√	√	√	√	√	√	√
Consumer Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Internship	√	√	√	√	√	√	√	√	√	√
Medical Electronics	√	√	√	√	√	√	√	√	√	√
Medical Electronics Practical Course	√	√	√	√	√	√	√	√	√	√

Advanced Communication Systems	√	√	√	√	√	√	√	√	√	√
Advanced Communication Systems Practical Course	√	√	√	√	√	√	√	√	√	√
Principles and utility of electronic domestic applications	√	√	√	√	√	√	√	√	√	√
Principles and utility of electronic domestic applications Practical Course	√	√	√	√	√	√	√	√	√	√
Digital and Data Communication Systems	√	√	√	√	√	√	√	√	√	√
Digital and Data Communication Systems Practical Course	√	√	√	√	√	√	√	√	√	√
RF Networks	√	√	√	√	√	√	√	√	√	√
RF Networks Practical Course	√	√	√	√	√	√	√	√	√	√
OR	√	√	√	√	√	√	√	√	√	√
Wireless Sensor Network Design	√	√	√	√	√	√	√	√	√	√
Wireless Sensor Network Design Practical Course	√	√	√	√	√	√	√	√	√	√
Sensors	√	√	√	√	√	√	√	√	√	√
Sensors Practical Course	√	√	√	√	√	√	√	√	√	√
Bio-medical Instrumentation	√	√	√	√	√	√	√	√	√	√
Bio-medical Instrumentation Practical Course	√	√	√	√	√	√	√	√	√	√

Digital Signal Processing	√	√	√	√	√	√	√	√	√	√
Digital Signal Processing Practical Course	√	√	√	√	√	√	√	√	√	√
IoT Fundamentals	√	√	√	√	√	√	√	√	√	√
IoT Fundamentals Practical Course	√	√	√	√	√	√	√	√	√	√
Microprocessors and Microcontrollers	√	√	√	√	√	√	√	√	√	√
Microprocessors and Microcontrollers Practical Course	√	√	√	√	√	√	√	√	√	√
Electromagnetics	√	√	√	√	√	√	√	√	√	√
Electromagnetics Practical Course	√	√	√	√	√	√	√	√	√	√
Antenna and Waves Propagation	√	√	√	√	√	√	√	√	√	√
Antenna and Waves Propagation Practical Course	√	√	√	√	√	√	√	√	√	√
OR	√	√	√	√	√	√	√	√	√	√
Power Electronics	√	√	√	√	√	√	√	√	√	√
Power Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Microwave and Opto Electronics	√	√	√	√	√	√	√	√	√	√
Microwave and Opto Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
Wireless Broadband Networks	√	√	√	√	√	√	√	√	√	√
Wireless Broadband	√	√	√	√	√	√	√	√	√	√

Networks Practical Course										
Consumer Electronics	√	√	√	√	√	√	√	√	√	√
Consumer Electronics Practical Course	√	√	√	√	√	√	√	√	√	√
OR	√	√	√	√	√	√	√	√	√	√
Mobile Computing	√	√	√	√	√	√	√	√	√	√
Mobile Computing Practical Course	√	√	√	√	√	√	√	√	√	√
Robotics	√	√	√	√	√	√	√	√	√	√
Robotics Practical Course	√	√	√	√	√	√	√	√	√	√
OR	√	√	√	√	√	√	√	√	√	√
Introduction to MEMs	√	√	√	√	√	√	√	√	√	√
Introduction to MEMs Practical Course	√	√	√	√	√	√	√	√	√	√

List of new courses introduced

S.No	Title of the course	Course code	Year of introduction
1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	24BSPM11	2023-24
2	Advances in Mathematical, Physical and Chemical Sciences	24BSPM12	2023-24
3	Fundamental of Electricity and Electronics	24ELEM21	2023-24
4	Fundamental of Electricity and Electronics Practical Course	24ELEM21P	2023-24
5	Circuit theory and electronic devices	24ELEM22	2023-24
6	Circuit theory and electronic devices Practical Course	24ELEM22P	2023-24
7	Semiconductor devices and Materials	24ELEM31	2024-25
8	Semiconductor devices and Materials Practical Course	24ELEM31P	2024-25
9	Digital Electronics	24ELEM32	2024-25
10	Digital Electronics Practical Course	24ELEM32P	2024-25
11	Analog Electronics	24ELEM33	2024-25
12	Analog Electronics Practical Course	24ELEM33P	2024-25
13	Electronic communication system	24ELEM34	2024-25
14	Electronic communication system Practical Course	24ELEM34P	2024-25
15	Electrical and electronics instrumentation	24ELEM41	2024-25

16	Electrical and electronics instrumentation Practical Course	24ELEM41P	2024-25
17	Microcontrol system	24ELEM42	2024-25
18	Microcontrol system Practical Course	24ELEM42P	2024-25
19	Microprocessor system	24ELEM43	2024-25
20	Microprocessor system Practical Course	24ELEM43P	2024-25

BLUE PRINT

Programme: B.Sc. Honors in Electronics (Major) -2024-2025

SEMESTER-I

COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

(COURSE CODE: 24BSPM11)

Theory MARKS: 60 Credits: 4 5 hrs. /week

Blue Print for Semester End Theory Examinations

QUESTION PAPER TAXONOMY										
Level of Bloom's Taxonomy	Type of Question & m Assigned									
	MCQs		FIB		VSQ		MC		T/F	
	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE
Remembering	4 m	8 m								
Understanding	4 m	8 m								
Applying	5 m	8 m								
Analyzing					7 m	8 m				
Evaluating							7 m	10 m	6 m	10 m
Creating			7 m	8 m						

MCQs: Multiple Choice Questions 1 mark per question. 1.5 minutes to answer

FIB: Fill in the blanks. 1 mark for question. 1.5 minute to answer

VSQ: Very short answer questions. 1 mark per question. 1.5 minute to answer

MC: Matching. 5 marks for matching of 5 items. 2.5 minutes to answer

T/F: True or False. 1 mark per question. 1.5 minutes to answer

(M: marks; CIA: Continuous Internal Assessment; SEE: Semester End Examinations)

Programme: B.Sc. Honorus in Electronics (Major) -2024-2025

SEMESTER-I

COURSE 1:
ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES **(COURSE CODE: 24 BSPM11)**

Theory Credits: 4 5 hrs/week

SYLLUBUS

UNIT-I **<u>ESSENTIALS OF MATHEMATICS</u>**

Complex Numbers: Introduction of the new symbol (i) – General form of a complex number – Modulus- Amplitude form and conversions.
Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles. **Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product and problems. **Statistical Measures**: Mean, Median, Mode of a data and problems.

UNIT- II **<u>ESSENTIALS OF PHYSICS</u>**

Definition and Scope of Physics- Measurements and Units.

Motion of objects: Newtonian mechanics and relativistic mechanics perspective.

Laws of Thermodynamics and Significance. ***Entropy definition,***

Acoustic waves and electromagnetic waves. ***Types of mechanical waves.***

Electric and Magnetic fields and their interactions. ***Lorentz force***

Behaviour of atomic and nuclear particles. ***Nuclei radii***

Wave-particle duality, the uncertainty principle. ***Heisenberg principle***

Theories and understanding of universe. ***Big-bang theory,* Galaxies**

UNIT –III **<u>ESSENTIALS OF CHEMISTRY</u>**

Definition and Scope of Chemistry- Importance of Chemistry in daily life - Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: **<u>APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY</u>**

Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis.

Application of Physics in Industry and Technology: ***Basics of electronics, types of semiconductors,*** Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, materials science, Food and Beverage Industry.

UNIT-V **ESSENTIALS OF COMPUTER SCIENCE**

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: - Network and security. Information Assurance

Fundamentals, Cryptography-Symmetric and Asymmetric, Malware,

Firewalls, Fraud Techniques- Privacy and Data Protection.

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer-Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh

10. Chemistry of bio molecules by S. P. Bhutan

11. Fundamentals of Computers by V. Raja Raman

12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS

1: Complex Number Exploration, Provide students with a set of complex numbers in both rectangular and polar forms. They will plot the complex numbers on the complex plane and identify their properties

2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations. Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications. Provide students with a set of vectors in Cartesian form. Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis. Give students a dataset containing numerical values. Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyse the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS

1. Concept Mapping: Divide students into groups and assign each group one of the topics. Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic. Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.
2. Laboratory Experiment. Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields. Provide the

necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyse the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect. 2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyse trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter: Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction. Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4: Biomolecules Investigation: Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins. Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body. They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.
Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analysing the behaviour of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modelling

Present students with real-world problems that require mathematical modelling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of

2. Your college network) and prepare a report covering network architecture.

3. Identify the types of malwares and required firewalls to provide security.

4. Latest Fraud techniques used by hackers.

B.Sc. Honours in Electronics (Major) W.e.f. AY 2024-25

I SEMESTER Course 1 (COURSE CODE: 24 BSPM11)

Essentials and Applications of Mathematical, Physical and Chemical Sciences

MODEL PAPER

TIME: 3 HOURS MAXIMUM MARKS: 60

ANSWER ALL THE FOLLOWING QUESTIONS 60×1M=60M

SECTION-A: MULTIPLE CHOICE QUESTIONS 24×1M=24M

1. If $z = -3\ 4i$ is a complex number, what is its modulus?

a) 5 c) 3

b) 7 d) 4

2. Which form of a complex number involves both modulus and amplitude?

a) Rectangular form c) Exponential form

b) Polar form d) Logarithmic form

3. In a right-angled triangle with sides 3, 4, and 5 units, what is the sine of the angle opposite the side of length 3 units?

a) 3/5 c) 3/4

b) 4/5 d) 4/3

4. What is the result of the scalar product of two perpendicular vectors?

a) 1 c) -1

b) 0 d) They cannot be perpendicular

5. If $A= +2\ 3i \quad j$ and $B = -4\ 2i \quad j$ what is the vector product of $\vec{A}$ and $\vec{B}$

a) 10i−14j c) 14i−10j

b) 10i+14j d) 14i+10j

6. If a set of data has an even number of observations, how is the median calculated?

a) Average of two middle values c) The middle value

b) The value that occurs most frequently d) It's impossible to calculate

7. The mean of five numbers is 12. If one number is removed and the mean becomes 15, what is the value of the removed number?

a) 8 c) 12

b) 10 d) 20

8. Which of these is a derived unit?

a) Kilogram c) Newton

b) Meter d) Second

9. According to Newton's first law of motion, an object will remain at rest or in uniform motion unless acted upon by

a) a net external force c) friction

b) gravity d) air resistance

10. The second law of thermodynamics states that in an isolated system, entropy tends to

a) decrease c) increase

b) remain constant d) fluctuate randomly

11. Which type of wave requires a medium for propagation?

a) Electromagnetic waves c) Radio waves

b) Acoustic waves d) Gamma rays

12. A changing magnetic field induces an electric field, as described by

a) Faraday's law c) Gauss's law

b) Ampere's law d) Coulomb's law

13. What is the charge of a proton?

a) +1.6 x 10^-19 C c) +1.6 x 10^-10 C

b) -1.6 x 10^-19 C d) -1.6 x 10^-10 C

14. The wave-particle duality suggests that particles like electrons exhibit both wave-like and particle-like behaviour, as demonstrated by the

a) Double-slit experiment c) Photoelectric effect

b) Stern-Gerlach experiment d) Compton effect

15. Which theory proposes that the universe began from a singularity and has been expanding ever since?
a) Theory of General Relativity c) String Theory b) Big Bang Theory d) Steady-State Theory

16. According to the cosmological principle, the universe is
a) Homogeneous and isotropic

b) Cantered around our solar system

c) Constantly contracting

d) Non-uniform

17. What is the primary goal of chemistry?

a) Understanding the behaviour of living

b) Exploring historical events organisms

c) Studying the structure of planets

d) Understanding the properties and interactions of matter

18. Which of the following is an example of a chemical reaction occurring in daily life?

a) Water evaporating from a lake c) Rust forming on iron

b) Chopping wood into smaller pieces d) Cutting a piece of paper

19. Which branch of chemistry primarily deals with the study of carbon compounds?

a) Organic chemistry c) Physical chemistry

b) Inorganic chemistry d) Analytical chemistry

20. Elements in the same group of the periodic table tend to have

a) similar chemical properties and the same number of valence electrons

b) different chemical properties and the same number of valence electrons

c) similar chemical properties and different numbers of valence electrons

d) different chemical properties and different numbers of valence electrons

21. What is the electronic configuration of oxygen?

a) $1s^2\ 2s^2\ 2p^4$

b) $1s^2\ 2s^2\ 2p^2$

c) $1s^2\ 2s^1\ 2p^6$

d) $1s^2\ 2s^2\ 2p^3$

22. When iron rusts, it is an example of a

a) Physical change

b) Chemical change

c) Biological change

d) Nuclear change

23. Carbohydrates primarily function as

a). Energy storage molecules

b)Structural components of cell membranes

c). Enzymes in metabolic reactions

d)Signalling molecules in the body

24. Proteins are composed of:

a) Monosaccharides

b) Amino acids

c) Fatty acids

d) Nucleotides

VERY SHORT ANSWR QUESTIONS **8×1=8M**

25. Which biomolecule is a major component of cell membranes?

26. Which branch of mathematics is extensively used to describe rates of change and accumulation in physics and chemistry?

27. Differential equations find significant applications
in describing?

28. In the electronics and semiconductor industry, which physics principles are fundamental for creating transistors and microchips?

29. Which industry heavily relies on robotics and automation to enhance efficiency and precision?

30. Which industry heavily relies on chemical manufacturing processes to produce a wide array of products?

31. What was the first electronic general-purpose computer called?

32. Who is credited with inventing the World Wide Web (WWW) in 1989?

SECTION-B: FILL IN THE BLANKS **8×1=8M**

33. The general form of a complex number is written as _______________.

34. The calculation of angles often involves the use of trigonometric functions like __________.

35. Vector addition involves the combination of vectors in _______________.

36. The argument or amplitude of a complex number z=a+bi is expressed as _______________.

37. Tangent in a right-angled triangle is determined by dividing the _______________ by the adjacent side.

38. The cross product or vector product yields a vector that is _______________ to both original vectors.

39. Cosine of an angle in a right-angled triangle is computed as the _______________ divided by the hypotenuse.

40. Trigonometric ratios like sine, cosine, and tangent are interrelated through ___________.

SECTION-B: TRUE or FALSE **10×1=10M**

41. Solar panels generate electricity **True/False**

42. Hydrogen fuel cells convert chemical energy into electrical energy through a combustion process **True/False**

43. Quantum dots are semiconductor nanoparticles with unique electronic properties **True/False**

44. Shape memory materials can revert to their original shape when subjected to certain stimuli. **True/False**

45. Grid integration involves incorporating renewable energy sources into existing power grids. **True/False**

46. Smart grids enable real-time monitoring and control of electricity consumption. **True/False**

47. Renewable energy sources are always dispatch able, meaning they can be controlled and scheduled as needed. **True/False**

48. Shape memory materials find applications in orthopaedic implants and stents. **True/False**

49. Energy-efficient materials and devices help reduce energy consumption without compromising performance. **True/False**

50. Nanotechnology deals exclusively with structures smaller than one millimetre. **True/False**

MATCH THE FALLOWING
2×5=10M

51 to 60 **Two questions each carries 5 marks**

S.No	Group-A		Group-B
1	1. wind energy	A	Captures the earth's internal heat for electricity generation
	2. Solar energy	B	Converts sunlight into electricity using photovoltaic cells
	3. Hydropower	C	Utilizes the kinetic energy of moving water to generate power
	4. Geothermal energy	D	Harness the kinetic energy of the wind to produce elctricity
2	Group-A		Group-B
	1. Photovoltaic cells	A	Produces electricity by harnessing the gravitational pull of the moon on earth's oceans
	2. Tidal energy	B	Converts sunlight directly into electricity
	3. Biomass	C	Uses mirrors or lenses to focus sunlight onto a small area for power generation
	4. Concentrated solar power (csp)	D	Generates energy from organic materials such as plant matter and waste

B.Sc. Honours in Electronics (Major)

W.e.f. AY 2024-25 I SEMESTER

Course 1:

Essentials and Applications of Mathematical, Physical and Chemical Sciences

(COURSE CODE: 24 BSPM11)

Learning outcomes: On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.	Level 2 (Understanding) Level 3 (applying)
CO 2	To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.	Level 2 (Understanding) Level 3 (applying)
CO 3	To explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to connect their knowledge of chemistry to daily life.	Level 2 (Understanding) Level 3 (applying) Level 4 (Analysing)
CO 4	Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical Principles can be used to explain and predict phenomena in different contexts.	Level 1 (Understanding)
CO 5	To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.	Level 2 (Understanding) Level 3 (applying)

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24BSPM12

SEMESTER-I COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Theory | Credits: 4 | 5 hrs/week

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences.

The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.	Level 2 (Understanding) Level 3 (applying)
CO 2	Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.	Level 2 (Understanding) Level 3 (applying)
CO 3	Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials	Level 2 (Understanding) Level 3 (applying) Level 4 (Analysing)
CO 4	Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nano sensors. Explore the effects of chemical pollutants on ecosystems and human health.	Level 1 (Understanding)

CO 5	Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fibre optics) and wireless (e.g., radio waves, microwave, satellite).	Level 2 (Understanding) Level 3 (applying)

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration
Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices.

Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids,

Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neuro physics,

Application of medical physics: Radiation Therapy, Nuclear medicine, Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	2	3
CO 2	3	3	3	2	3
CO 3	3	3	3	2	3
CO 4	3	3	3	2	3
CO 5	3	3	3	2	3

STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.
2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analysing rates of change or optimizing functions.

3: Integration Exploration
Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry 4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.
Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.
They will consider factors such as energy generation, energy storage, efficiency,

sustainability, materials design, biomedical applications, or technological advancements.
2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.
They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyse data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field. 3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.
Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.
Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.
Students will analyse the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.
For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.
Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation. 3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems. Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.
Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.
They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.
2: Case Studies and Group Discussions

Assign students to analyse case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.
Students will discuss the mathematical models and computational methods used in the case studies, analyse the outcomes, and evaluate the effectiveness of the modelling approach. Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices. Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

Students must be able to convert numbers from other number system to binary number systems

1. Identify the networking media used for your college network
2. Identify all the networking devices used in your college premises.

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
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Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24BSPM12

SEMESTER-I COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Theory Credits: 4 5 hrs/week

Blue Print for Semester End Theory Examinations

QUESTION PAPER TAXONOMY										
Level of Bloom's Taxonomy	Type of Question & m Assigned									
	MCQs		FIB		VSQ		MC		T/F	
	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE
Remembering	4 m	8 m								
Understanding	4 m	8 m								
Applying	5 m	8 m								
Analyzing					7 m	8 m				
Evaluating							7 m	10 m	6 m	10 m
Creating			7 m	8 m						

MCQs: Multiple Choice Questions 1 mark per question. 1.5 minutes to answer

FIB: Fill in the blanks. 1 mark for question. 1.5 minute to answer

VSQ: Very short answer questions. 1 mark per question. 1.5 minute to answer

MC: Matching. 5 marks for matching of 5 items. 2.5 minutes to answer

T/F: True or False. 1 mark per question. 1.5 minutes to answer
(m: marks; CIA: Continuous Internal Assessment; SEE: Semester End Examinations)

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Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24BSPM12

SEMESTER-I COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Duration 3Hrs **MODEL PAPER** **(Max Marks 60)**

SECTION-A

(MULTIPLE CHOICE QUESTIONS)

1.Two lines with slopes m1 & m2 are perpendicular to each other if [ ]
A. m1= m2 B. m1+m2=1
C. m1m2=1 D. m1m2= -1

2. $\lim_{x\to 4} \frac{x^2-16}{x-4} =$ [ ]
A. 2 B. 4 C. 8 D. undefined

3.What is the standard form of LNG? [ ]
A. Liquefied Natural Gas B. Liquefied Nuclear Gas
C. Liquefied Natural or Nuclear Gas D.None of the above

4. Which one of the following damages the ozone layer? [ ]
A. CFCS B. Aerosols C. Freons D. All of the above

5.. In which era CADD molecular biology started? [ ]
A. 1890 B. 1795
C. 1980 D. 1675

6. In which year the GIT developed the first nanosensor? [ ]
A.1888 B. 1988 C. 1788 D. 1999

7.Which mathematical concept is the basis for error-correcting codes used in Computer Science ? [ ]
A.Group theory B. Probability theory
C. Game theory D. Differential Equations

8. In which one of the following nanomaterials quantum confinement occurs in two directions? [ ]
A. One dimensional B.Two dimensional

C.Three dimensional D.Zero dimensional

9. Which of the following number system is known as base-10 system. [ ]
A.Binary Number System B.Hexadecimal Number System
C.Octal Number System D.Decimal Number System

10. Which one of the following network devices stores the IP addresses? [ ]
A.Router B.Switch
C.Both A and B D.None of the above

11. In what ratio the x-axis divide the line segment joining the points (2,-3) and (5,6)[ ]
A. 1:2 B. 2:1
C. 1:3 D. None of these

12. If the matrices $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 5 & y-2 \\ 8 & 4 \end{bmatrix}$ then the values of x and y are [ ]
A. x=-1/3, y=7 B. x=-1/3, y=-2/3
C. x=-2/3, y=7 D. x=5, y=-2/3
13.The measurement range of small angle X-ray scattering is around _____________ meters? [ ]
A.5 nm B. 5-500 m
C. 20 m D.12 mm

14.The carbon nanotubes, graphene, and fullerenes are the ______________ based nanoparticles? [ ]
A. Organic B. Inorganic
C. Carbon based D. None of the above

15. Expand QSARs [ ]
A. Quantitative structure activity relationship
B. Quality strong applicable relationship
C. Quality strengthen affordable ratio
D. Quantitative sorted affinity refund

16. In which drug design structure of the target protein is known? [ ]
A. SBDD B. CBDD
C. QSAR D. GIT

17.Which of the tool is used to find favorable bioactive compounds? [ ]
A. Virtual screening B. QSAR
C. CADD D. None of the above

18.What is the primary focus of Biophysics? [ ]
A.The study of living organisms' behavior
B.The study of the physical properties of living organisms
C.The study of the chemical reactions in living organisms
D.The study of the genetics of living organisms

19. Binary equivalent of decimal number 65 is [ ]

A.1000001 B.1000000
C.1000011 D.100001

20. What is the name for converting digital signal to analog signal? [ ]
A.Modulation B.Demodulation
C.Bypass D.Encapsulation

21. If y=log(tanx), then dy/dx is [ ]
a) $\frac{1}{tanx}$ b) $\frac{sec^2 x}{tanx}$ c) $-sec^2 x$ d) 0

22. $\lim_{x \to 1} \frac{x^{15}-1}{x^{10}-1} =$ [ ]
A. 3/2 B. 5/2 C. 1/2 D.. 7/2

23. How does Biophysics contribute to the field of neuroscience? [ ]
A.By studying the social behavior of organisms
B.By developing new brain imaging techniques
C.By analyzing the genetic basis of neurological disorders
D. By studying the electrical signaling in neurons

24.The forces acting on a runner near the end of a race are [ ]
A.Weight B.friction
C. Air resistance D.all the above.

SECTION-B
(FILL IN THE BLANKS)

25. $\int 10^{5x}\, dx =$

26. The line which cuts off equal intercepts from the axes and pass through the point (1, -2) is_____________

27. Standard form of CNT is —-----------------------------++

28. The ratio of the surface of the collector receiving light divided by the total surface of the collector is known as _______________

29. Full form of CADD___________________

30.___________________ developed the first nanosensor.

31.___________________ chemical cause cancer and heart disease as well as infertility in human being.

32. Radiosotope used for estimation of plasma volume is __________________

SECTION-C
(VERY SHORT ANSWERS)

33. Find the equation of the straight line cutting off an intercept 3 from the negative direction of the y-axis and inclined at 60° to the axis of x

34. Evaluate $\int e^x(1 + x^2)dx$

35. what is Quantum Key distribution

36.How does Biophysics contribute to the field of medical imaging?

37. What is chemical biology ?

38. State chemical pollution ?

39. If x = -9 is a root of $\begin{vmatrix} x37 \\ 2x2 \\ 76x \end{vmatrix} = 0$, , then find the other roots?

40. What is the standard form of NOMFET?

SECTION-D
(MATCH THE FOLLOWING)

41.Intercept form of a straight-line A)Quantum Confinement in all directions

42. Mathematical modeling for rate of chemical reaction B) Brain and spinal cord

43. Zeo dimension C)Network Device

44. Central Nervous system D) Dye removal

45. LBDD E) Arrhenius Equation

66. Molecular docking methods F) The Address of The Web Page

47. Nano sensors G) $\frac{x}{a}+\frac{y}{b} = 1$

48. $\int \frac{f'(x)}{f(x)} dx =$ H) affinity and virtual screening

49.HUB I) ligand based drug design

50.URL J) log |f(x|+ C

K) y=mx+c

L)$e^{f(x)}$

SECTION-E
(TRUE/FALSE)

51. If ɵ is the angle between two lines with slopes $m_1$and m_2, then $tan\theta = \frac{m_1+m_2}{1+ m_1m_2}$ [ ]

52. If A = $\begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$, then $(A + B)^2 \neq A^2 + B^2$ [ ]

53. At memory Transfer temperature a shape memory alloy return to its original shape [ ]

54. Radiation kills fast-growing cells in the area of treatment [ ]

55. Carbon nanotubes, quantum dots,etc are examples of nano sensors [ ]

56. Bisphenol A (BPA) is an extremely harmful chemical. [ ]

57. Mining, agriculture and waste disposal doesn't cause any pollution [ ]

58. The high temperature phase in shape memory effect is Martensite [ ]

59. A hub connects two different LANs. [ ]

60.The computer network that began the internet was called ARPANET. [ ]

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Major Courses offered w.e.f. AY 2024-25

SEMESTER-II COUSE CODE :24ELEM21
COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

Theory Credits: 3 3 hrs/week

VARIATION OF SYLLABUS FROM THE APCHE PRESCRIBED SYLLABUS

S.No.	Unit	Name of the Unit	Syllabus Added/Deleted	Percentage Variation
1	I	ELECTROSTATICS	Application of Gauss law to Uniformly charged infinite sheet	10
	III	NUMBER SYSTEMS, CODES AND LOGIC GATES	Comparison of capacitors using B.G.	
	V	Transistor circuits	NAND and NOR Logic Gates	

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. AY 2024-25

COURSE CODE 24ELEM21

COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

Theory   Credits: 3   3 hrs/week

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand basics of electrostatics, Gauss theorem and its applications.	Level 2
CO 2	Understand concept of a capacitor, design various types of capacitors and dielectric constant	Level 3 Level 6
CO 3	Study magnetic effects of current, cells and apply the concepts in the design of the measuring instruments like ammeter and voltmeter	Level 2 Level 4
CO 4	Understand the basics of p-n junction, rectifying action of a diode, regulated power supplies and wave shaping circuits	Level 2
CO 5	Analyse transistor and its three modes of operation, h-parameter model of a transistor and the frequency response of an amplifier	Level 4

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2024-25
COURSE CODE 24ELEM21
COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	2	2	2	2	2	2	2	3
CO 2	3	1	1	1	2	1	3	2	2	3
CO 3	3	2	3	2	1	1	3	2	2	3
CO 4	3	1	1	2	1	2	3	2	2	3
CO 5	3	2	1	1	1	1	3	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	2	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

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Major Courses offered w.e.f. AY 2024-25

SEMESTER-II COUSE CODE :24ELEM21

COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

Theory Credits: 4 5 hrs/week

Objectives

The students will learn:

1)Understand basics of electrostatics, Gauss theorem and its applications,
2)Understand concept of a capacitor, design various types of capacitors and dielectric constant,
3)Study magnetic effects of current, cells and apply the concepts in the design of the measuring instruments like ammeter and voltmeter,
4)Understand the basics of p-n junction, rectifying action of a diode, regulated power supplies and wave shaping circuits, and
5)Analyse transistor and its three modes of operation, h-parameter model of a transistor and the frequency response of an amplifier.

UNIT-I

Electrostatics: Electric charges - Coulomb's law - Electric field - Electric intensity and electric potential
- Relation between electric potential and intensity - Electric intensity and potential due to a uniform charged conducting sphere at a point outside, on, and inside the conductor.

Electric dipole - Dipole moment - Intensity and potential due to a dipole – Statement and proof of Gauss law - Application of Gauss law to uniformly charged solid sphere-Application of Gauss law to Uniformly charged infinite sheet NOT FOR EXAMINATION PURPOSE

UNIT-II

Capacitors: Definition and unit of capacity - Capacitance of a parallel plate capacitor - Effect of dielectric on capacity - Capacitors in series and parallel - Energy stored in acharged capacitors - Loss of energy on sharing of charges between two capacitors - Force of attraction between plates of charged parallel plate capacitor - Kelvin's attracted disc electrometer - Measurement of potential and dielectric constant.

Type of capacitors - Mica capacitor, Electrolytic capacitors, Variable air capacitor - Uses of capacitors.

UNIT-III

Electrical Measurements: Carey-Foster bridge - Determination of specific resistance - Potentiometer - Calibration of low and high range voltmeters - Calibration of Low range ammeter.

Magnetic Effect of Current: Biot-Savart's law, Force on a conductor carrying current placed in a magnetic field - Principle, construction and theory of a moving coil ballistic galvanometer - Measurement of figure of merit of B.G. - ~~Comparison of capacitors using BG~~..

UNIT-IV

Diode circuits and power Supplies: Junction diode characteristics - Half and full wave rectifiers - Expression for efficiency and ripple factor - Construction of low range power peak using diodes - Bridge rectifier - Filter circuits - Zener Diode - Characteristics - Regulated power supply using Zener diode - Clipper and Clamper using diodes.

Differentiator and integrator using resistor and capacitor.

UNIT-V

Transistor circuits: Characteristics of a transistor in CB, CE modes - Relatively merits Graphical analysis in CE configuration - Transistor as a amplifier - RC coupled

Single stage amplifier - Frequency response - Thevenin's and Norton's theorems - h parameters.

Basis logic gates AND, OR, NOT - Construction of basic logic gates using diodes and transistors. NAND and NOR Logic gates

Text Books

Electricity and Magnetism - *M. Narayanamoorthi and Others*, National PublishingCo., Chennai. Electricity and Magnetism - *R. Murugeshan*, S. Chand & Co. Ltd., New Delhi,Revised Edition, 2006.

Principles of Electronics - *V.K. Mehta*, S. Chand & Co., 4/e, 2001. Basic Electronics - *B.L. Theraja*, S. Chand & Co., 4/e, 2001.

Reference Books

Electricity and Magnetism - *Brijlal & Subrahmanyam*, Ratan Prakashan Mandir,Agra. Fundamentals of Electricity and Magnetism - *B.D. Duggal & C.L. Chhabra*, ShobanLal Nagin Chand & Co., Jallundur.

Physics, Vol. II - *Resnick, Halliday & Krane*, 5/e, John Wiley & Sons, Inc.,. Basic Electronics - *B. Grob*, McGraw - hill, 6/e, NY, 1989.

Elements of Electronics - *Bagde & Singh*, S. Chand

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COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

COUSE CODE :24ELEM21

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	UNIT-I	Electrostatics	2(one out of two)	2
2	UNIT-II	Capacitors	2(one out of two)	2
3	UNIT-III	Electrical Measurements	2(one out of two)	2
4	UNIT-IV	Diode circuits and power Supplies	2(one out of two)	2
5	UNIT-V	Transistor circuits	2(one out of two)	2

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COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS
COUSE CODE :24ELEM21

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_2_)

Time: 3 hours Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7.
8. ---
9. –
10. –

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

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Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-II COURSE CODE 24ELEM22: CIRCUIT THEORY AND ELECTRONIC DEVICES

Theory Credits: 3 3 hrs/week

Objectives

The students will learn:

1) basics of electrostatics, Gauss theorem and its applications, concept of a capacitor, various types of capacitors and dielectric constant, magnetic effects of current, cells and the measuring instruments like ammeter and voltmeter,

2) basics of p-n junction, rectifying action of a diode, regulated power supplies and wave shaping circuits, and

3) transistor and its three modes of operation, h-parameter model of a transistor and the frequency response of an amplifier.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems including the use of computer simulation	Level 3 (Applying)
CO 2	Apply time and frequency concepts of analysis.	Level 3 (Applying)
CO 3	Synthesize the network using passive elements	Level 6 (Creation)
CO 4	Know about amplifier circuits, switching circuits and oscillator circuits their design and use in electronics	Level 1 (Knowledge) Level 3 (Applying)
CO 5	Design and construction of a power supply	Level 6 (Creation)

UNIT- 1:

SINUSOIDAL ALTERNATING WAVEFORMS:

Definition of current and voltage. The sine wave, general format of sine wave for voltage or current, phase relations, average value, effective (R.M.S) values. Differences between A.C and D.C. Phase relation of R, L and C, phasor diagrams-concept of impedance, **power factor***

UNIT-II:

PASSIVE NETWORKS AND NETWORKS THEOREMS (D.C):

Ohm's Law, Kirchoff's current law, Kirchoff's voltage law*, Branch current method, Nodal Analysis, star to delta & delta to star conversions. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power, Milliman and Reciprocity theorems.

UNIT-III:

RC, RL AND RLC CIRCUITS:

Frequency response of RC and RL circuits, their action as low pass and high pass filters. Passive differentiating and integrating circuits. Series resonance and parallel resonance circuits, Q – Factor. bandwidth, selectivity. Comparisons of series and parallel resonance.

UNIT-IV:

BJT, FET and UJT:

BJT: Construction, working, and characteristics of CE Configurations. **Comparison of CB, CC, CE Configurations***, Hybrid parameters and hybrid equivalent circuit of CE Transistor,

FET: Construction, working and characteristics of JFET and MOSFET. Advantages of FET over BJT.

UJT: Construction, working and characteristics of UJT. UJT as a Relaxation oscillator.

UNIT-V:

POWER SUPPLIES & PHOTO ELECTRIC DEVICES

Rectifiers: Half wave, full wave rectifiers-Efficiency-ripple factor- Filters- L- section&π-section filters. Three terminal fixed voltage I.C. regulators (78XX and &79XX). Light Emitting Diode – Photo diode and LDR.

- **Topics added under Autonomy**,

TEXT BOOKS:

1. Introductory circuit Analysis (UBS Publications) ----- Robert L. Boylestad.

2. Electronic Devices and Circuit Theory --- Robert L. Boylestad & Louisashelsky.

3. Circuit Analysis by P.Gnanasivam- Pearson Education

4. Electronic Devices and Circuit Theory ---- Robert L. Boylestad & Louis Nashelsky.

5. Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition

REFERENCE BOOKS:

1.Engineering Circuit Analysis By: Hayt & Kemmerly - MG.

2.Networks and Systems – D.Roy Chowdary.

3.Unified Electronics (Circuit Analysis and Electronic Devices) by Agarwal- Arora

4.Electric Circuit Analysis- S.R. Paranjothi- New Age International.

5.Integrated Electronics – Millmam & Halkias.

6.Electronic Devices & Circuits – Bogart.

7.Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER II COURSE CODE 24ELEM22P: CIRCUIT THEORY AND ELECTRONIC DEVICES

Practical Credits: 1 2hrs/week

COURSE OBJECTIVE:

To develop practical skills in the use of laboratory equipment and experimental techniques for design and applications of circuits and electronic devices.

COURSE OOUTCOMES:

CO	Description	Blooms Level
CO 1	Formulate the equivalent Thevenin circuit and verify the theoretical results through experimental observation.	Level 6 (Create)
CO 2	Construct the equivalent Norton circuit and validate its accuracy by comparing it with measured data	Level 6 (Create)
CO 3	Demonstrate the conditions for maximum power transfer and verify the theorem through practical measurements.	Level 3 (Apply)
CO 4	Analyze the resonance conditions in an LCR series circuit and determine the resonance frequency experimentally.	Level 4 (analyze)
CO 5	Evaluate the input and output characteristics of a BJT and interpret the results to understand transistor behavior.	Level 5 (evaluate)

Minimum of 6 experiments to be done and recorded

1. Thevenin’s Theorem-verification
2. Norton's Theorem-verification
3. Maximum Power Transfer Theorem-verification
4. LCR series resonance circuit.
5. BJT input and output characteristics 6.FET Output and transfer characteristics
7. UJT VI characteristics
8. LDR characteristics

9. IC regulated power supply (IC-7805)

Lab experiments are to be done on breadboard and simulation software (using multisim) and output values are to be compared and justified for variation

CO-PO Mapping
2- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	2	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	2	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
2- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER II COURSE CODE 24ELEM22: CIRCUIT THEORY AND ELECTRONIC DEVICES

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER II COURSE CODE 24ELEM22: CIRCUIT THEORY AND ELECTRONIC DEVICES

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**	Sinusoidal alternating waveforms	2(one out of two)	2
2	**II**	Passive networks and networks theorems (D.C):	2(one out of two)	2
3	**III**	RC, RL AND RLC CIRCUITS	2(one out of two)	2
4	**IV**	BJT, FET and UJT	2(one out of two)	2
5	**V**	Power supplies & photo electric devices	2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

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SEMESTER II COURSE CODE 24ELEM22: CIRCUIT THEORY AND ELECTRONIC DEVICES

Question Bank

UNIT-I: SINUSOIDAL ALTERNATING WAVEFORMS

Essay Type Questions:

1. Define sinusoidal alternating waveforms. Discuss the general format of a sine wave for voltage or current. Explain phase relations, average value, and effective (R.M.S) values in detail.
2. Compare and contrast A.C and D.C waveforms. Describe the phase relations of resistors (R), inductors (L), and capacitors (C) in an AC circuit. Support your explanation with phasor diagrams and the concept of impedance.
3. Explain the concept of impedance and its importance in AC circuits. How do phasor diagrams help in understanding the phase relations in AC circuits? Provide examples with R, L, and C components.

Short Answer Questions:

1. What is the average value of a sine wave, and how is it calculated?
2. Define the effective (R.M.S) value of a sine wave and explain its significance in AC circuits.

UNIT-II: PASSIVE NETWORKS AND NETWORKS THEOREMS (D.C)

Essay Type Questions:

1. Describe the branch current method and nodal analysis for solving D.C networks. Provide a detailed example of each method.
2. Explain Thevenin's Theorem and Norton's Theorem. How are these theorems used to simplify complex circuits? Provide examples to illustrate their application.
3. Discuss the Superposition Theorem and its importance in analyzing linear circuits. Provide a step-by-step solution of a circuit using this theorem.

Short Answer Questions:

1. What are the star to delta and delta to star conversions? Provide the formulas used for these conversions.
2. Define the Maximum Power Transfer Theorem and explain its significance in circuit design.

UNIT-III: RC, RL AND RLC CIRCUITS

Essay Type Questions:

1. Explain the frequency response of RC and RL circuits. How do these circuits function as low pass and high pass filters? Provide diagrams to support your explanation.
2. Discuss the concepts of series and parallel resonance in RLC circuits. Explain Q-Factor, bandwidth, and selectivity with relevant formulas and diagrams.
3. Compare and contrast series resonance and parallel resonance circuits. Explain the applications of each type of resonance circuit.

Short Answer Questions:

1. What is the role of the Q-Factor in resonance circuits?
2. How do passive differentiating and integrating circuits function? Provide basic circuit diagrams.

UNIT-IV: BJT, FET, AND UJT

Essay Type Questions:

1. Describe the construction, working, and characteristics of Bipolar Junction Transistors (BJT) in CE configuration. Explain the significance of hybrid parameters and the hybrid equivalent circuit.
2. Explain the construction, working, and characteristics of Junction Field Effect Transistors (JFET) and Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFET). Discuss the advantages of FETs over BJTs.
3. Describe the construction, working, and characteristics of Unijunction Transistors (UJT). Explain how a UJT can be used as a relaxation oscillator.

Short Answer Questions:

1. What are the hybrid parameters in a CE transistor configuration, and why are they important?
2. Compare the working principles of JFET and MOSFET.

UNIT-V: POWER SUPPLIES & PHOTO ELECTRIC DEVICES

Essay Type Questions:

1. Explain the working of half-wave and full-wave rectifiers. Discuss their efficiency and ripple factor. How do L-section and π-section filters help in reducing ripple in rectifiers?
2. Describe the working of three-terminal fixed voltage IC regulators (78XX and 79XX series). How are these regulators used in power supply circuits?
3. Discuss the working principles of Light Emitting Diodes (LEDs), Photodiodes, and Light Dependent Resistors (LDRs). Provide applications for each device.

Short Answer Questions:

1. What are the differences between half-wave and full-wave rectifiers in terms of efficiency and ripple factor?
2. How does a photodiode function and where is it commonly used?

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER II COURSE CODE 24ELEM22: CIRCUIT THEORY AND ELECTRONIC DEVICES

Theory | Credits: 3 | 3 hrs/week

Model Question Paper

Duration: 3Hrs **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1. What is the average value of a sine wave, and how is it calculated?
2. Define the effective (R.M.S) value of a sine wave and explain its significance in AC circuits
3. What are the star to delta and delta to star conversions? Provide the formulas used for these conversions.
4. Define the Maximum Power Transfer Theorem and explain its significance in circuit design.
5. What is the role of the Q-Factor in resonance circuits?
6. How do passive differentiating and integrating circuits function? Provide basic circuit diagrams.
7. What are the hybrid parameters in a CE transistor configuration, and why are they important?
8. Compare the working principles of JFET and MOSFET.
9. What are the differences between half-wave and full-wave rectifiers in terms of efficiency and ripple factor?
10. How does a photodiode function and where is it commonly used?

Section B

Answer all the questions (8M$\times 5 = 50M$)

11. **(a)** Define sinusoidal alternating waveforms. Discuss the general format of a sine wave for voltage or current. Explain phase relations, average value, and effective (R.M.S) values in detail.

(b) How do phasor diagrams help in understanding the phase relations in AC circuits? Provide examples with R, L, and C components.

12. (a) Explain Thevenin's Theorem? How it is used to simplify complex circuits?

(OR)

(b) Discuss the Superposition Theorem and its importance in analyzing linear circuits

13. (a) Explain the frequency response of RC and RL circuits?

(OR)

(b) Discuss the concept of series resonance in RLC circuits. Explain Q-Factor, bandwidth with relevant formulas and diagrams

14. (a) Describe the construction, working, and characteristics of Bipolar Junction Transistors(BJT) in CE configuration.

(OR)

(b) Explain the construction, working, and characteristics of Junction Field Effect Transistors (JFET)

15. (a) Explain the working of half-wave and full-wave rectifiers. Discuss their efficiency and ripple factor

(OR)

(b) Discuss the working principles of Light Emitting Diodes (LEDs), Photodiodes? Provide applications for each device.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M31

II Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-III

COURSE 5: SEMICONDUCTOR DEVICES AND MATERIALS

Theory Credits: 3 3 hrs/week

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	Ability to apply basic concepts of Inorganic and Organic Semiconductor materials for electronic device application in modern electronic industry.	**Level-5**
2.	**CO-2**	Detailed knowledge of various classifications and applications to VLSI, LEDs and solar cells.	**Level-4**
3.	**CO-3**	Holistic view of the latest progress in two-dimensional (2D)-one-dimensional (1D) and nano materials.	**Level-5**
4.	**CO-4**	Emphasis on nano-electronic applications such as Schottky barrier transistors, flexible Electronics.	**Level-5**
5.	**CO-5**	**Evaluate** BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier.	**Level-5**

Unit I:

INORGANIC AND ORGANIC SEMICONDUCTOR: **Kranig-Penny model, E-K diagrams**, Energy bands, carrier transport, mobility, drift- diffusivity, excess carrier, injection and recombination of the excess carriers, carrier statistics; High field effects: velocity saturation, hot carriers and avalanche breakdown. **hot electron effects, and multi-carrier effects in high field regimes.**

Unit II:

MAJORITY CARRIER DEVICES: MS contacts rectifier and non-rectifier, MIS structures, MESFET, hetero-junction, **graded heterojunctions and their impact on device performance**. HEMT and band diagrams, I-V and C-V characteristics. **Gallium Nitride (GaN) and Silicon Carbide (SiC), their device structures.**

Unit III:

MOS STRUCTURES: SEMICONDUCTOR SURFACES; The ideal and non-ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states. MOSFET: Structures and Device Characteristics, Short-Channel effects**. Fin FETs and Gate-All-Around (GAA) transistors, their structure, and advantages over traditional planar MOSFETs**. Charge coupled Devices (CCDs), application to VLSI.

Unit IV:

NONVOLATILE MEMORY DEVICE: Optoelectronic Devices: solar cell, photo detectors, LEDs, laser diodes. Nano structures and concepts: quantum wells, supper lattice structures, nanorod, quantum dot, CNTs, 2D materials: grapheme, BN, MoS_2 etc, matamaterials. **Phase Change Memory (PCM) and Resistive RAM (ReRAM), including their operating principles and applications**.

UNIT-V:

MULTISTAGE AMPLIFIERS: BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier. **Study of differential amplifier and operational amplifier, focusing on their frequency response and stability.**

Reference Books:

1. Donald A. Neamen, Semiconductor Physics and Devices Basic Principles, 3rd edn. McGraw-Hil (2003)
2. B.G. Streetman and Sanjay Banerjee, Solid State Electronic Devices, 6th Edn., Prentice Hall, 2006.
3. S. M. Sze and Kwok K. Ng Physics of Semiconductor Devices, Wiley (2013).

4. M. Hussa, A. Dimoulas and A. Molle, 2D Materials for NanoElectronics, CRC press (2016)
5. M.S.Tyagi, Introduction to Semiconductor Materials and Devices, Willey, Student Edition

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[W.E.F. AY 2023-24 Batch onwards]

Course Code: Code: 24(ELE)M31

II Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-III

COURSE 5: SEMICONDUCTOR DEVICES AND MATERIALS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	2	1	2	2	3	3
CO 2	3	3	1	2	1	1	3	3	3	2
CO 3	3	2	2	1	1	1	3	3	2	3
CO 4	3	3	1	1	1	2	3	2	2	2
CO 5	3	2	2	2	1	1	2	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	2	2
CO 2	2	3	2	2	3
CO 3	3	2	2	2	2
CO 4	3	3	2	2	3
CO 5	2	3	2	3	3

Course Code: 24(ELE)M31P

SEMESTER-III
COURSE 5: SEMICONDUCTOR DEVICES AND MATERIALS

Practical Credits: 1 2 hrs/week

List of Experiments

1. To study the Hall Effect: determine the Hall coefficient, type of semiconductor and carrier concentration in the given semiconductor sample.
2. To study the four probe method: calculate the resistivity and energy band gap of given semiconductor sample.
3. To determine the resistivity of the given semiconductor specimen using Vander Pauw method.
4. To design a MOSFET as switching regulator for given duty cycle and plot the current- voltage (I-V) characteristic of MOSFET using Keithley.
5. To design a phase controlled rectifier using SCR and plot the I-V characteristic of SCR using Keithley.
6. To design a relaxation oscillator using UJT and plot the I-V characteristic of UJT using Keithley.
7. I-V characteristics measurement of a p-n diode/LEDs using Keithley - calculate its ideality factor.

Course Code: 24(ELE)M31

BLUE PRINT (:: SEMICONDUCTOR DEVICES AND MATERIALS)
IIB.Sc. (Hons.) Electronics- SEM-III/Course : 5
Max Marks-75 Time-3Hrs. Credits: 3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	INORGANIC AND ORGANIC SEMICONDUCTOR:	2	2	30
2.	II	MAJORITY CARRIER DEVICES	2	2	30
3.	III	MOS STRUCTURES: SEMICONDUCTOR SURFACES	2	2	30
4.	IV	NONVOLATILE MEMORY DEVICE	2	2	30
5.	V	MULTISTAGE AMPLIFIERS	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M31
II Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-III COURSE 5: SEMICONDUCTOR DEVICES AND MATERIALS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following [5 X 8 = 40]

1. a) Explain the concept of energy bands in semiconductors?

[OR]

b) Discuss the injection, recombination, and lifetime of excess carriers in semiconductors?

2. a) Explain the operation and characteristics of MS (Metal-Semiconductor) contacts?

[OR]

b) Discuss the operation and band diagrams of MESFET?

3. a) Describe the structure and operating principles of MOSFET?

[OR]

b) Explain the application of Charge Coupled Devices (CCDs) in VLSI technology?

4. a) Explain the concepts of various nanostructures?

[OR]

b) Discuss the concept of metamaterials in optics and novel optical properties and functionalities?

5. a) Describe the frequency response of RC coupled amplifiers and transformer-coupled amplifiers?

[OR]

b) Explain the design and operation of multistage amplifiers?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) What are the high-field effects in semiconductors?
7. a) What are the key differences between inorganic and organic semiconductors?
8. a) Discuss the significance of interface states in MOS structures?
9. a) What are the key differences between MOSFETs and other types of field-effect transistors?
10. a) How does a solar cell convert sunlight into electrical energy?
11. a) What are the unique properties of 2D materials such as graphene and MoS2?
12. a) How does the frequency response of a BJT amplifier change at high frequencies?
13. a) Explain the role of feedback in improving the stability and linearity of amplifiers?
14. a) Compare the band diagrams of ideal and non-ideal MOS capacitors?
15. a) Explain the band diagrams of hetero-junctions in semiconductor devices?

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M31
II Year B.Sc (Hons.)-ELECTRONICS
SEMESTER-III COURSE 5: SEMICONDUCTOR DEVICES AND MATERIALS

QUESTION BANK

Unit I: INORGANIC AND ORGANIC SEMICONDUCTOR

Essay Questions:

1. Explain the concept of energy bands in semiconductors. Discuss the formation of energy bands and their significance in determining electronic properties.
2. Describe the mechanisms of carrier transport in semiconductors. Discuss carrier mobility, drift-diffusivity, and their relationship with carrier statistics.
3. Discuss the injection, recombination, and lifetime of excess carriers in semiconductors. How do these factors affect device performance?

Short Questions:

1. Define mobility and drift-diffusivity in the context of semiconductor physics.
2. Explain the concept of excess carriers in semiconductors. How are they generated and recombined?
3. What are the high-field effects in semiconductors? Discuss velocity saturation, hot carriers, and avalanche breakdown.
4. How does carrier statistics influence the behavior of carriers in semiconductors?
5. Discuss the role of energy bands in determining the electrical conductivity of semiconductors.
6. What are the key differences between inorganic and organic semiconductors in terms of electronic properties?

Unit II: MAJORITY CARRIER DEVICES

Essay Questions:

1. Explain the operation and characteristics of MS (Metal-Semiconductor) contacts. Differentiate between rectifying and non-rectifying contacts.
2. Describe the structure and working principle of MIS (Metal-Insulator-Semiconductor) structures. Discuss their applications and advantages.
3. Discuss the operation and band diagrams of MESFET (Metal-Semiconductor Field-Effect Transistor) and HEMT (High Electron Mobility Transistor). Compare their characteristics and applications.

Short Questions:

1. Explain the band diagrams of hetero-junctions in semiconductor devices.
2. Describe the I-V (current-voltage) characteristics of MESFET and HEMT.
3. What are the key differences between MESFET and HEMT in terms of structure and performance?
4. Discuss the significance of band diagrams in understanding the behavior of semiconductor devices.
5. How does the C-V (capacitance-voltage) characteristics vary with bias voltage in MIS structures?
6. Explain the concept of majority carriers and their role in semiconductor device operation.

Unit III: MOS STRUCTURES AND MOSFET

Essay Questions:

1. Discuss the ideal and non-ideal characteristics of MOS (Metal-Oxide-Semiconductor) capacitors. Explain the effects of oxide charges, defects, and interface states on MOS device performance.
2. Describe the structure and operating principles of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor). Discuss short-channel effects and their impact on device scaling.
3. Explain the application of Charge Coupled Devices (CCDs) in VLSI technology. How do CCDs improve signal processing and imaging capabilities?

Short Questions:

1. Compare the band diagrams of ideal and non-ideal MOS capacitors. What role do oxide charges play in device behavior?
2. Discuss the significance of interface states in MOS structures. How do they affect device reliability and performance?
3. What are short-channel effects in MOSFETs? How are they mitigated in modern semiconductor technologies?
4. Explain the principle of operation and applications of Charge Coupled Devices (CCDs).
5. How does the capacitance-voltage (C-V) characteristic vary with bias voltage in MOS capacitors?
6. What are the key differences between MOSFETs and other types of field-effect transistors?

Unit IV: OPTOELECTRONIC DEVICES AND NANOSTRUCTURES

Essay Questions:

1. Describe the working principles of optoelectronic devices such as solar cells, photodetectors, LEDs, and laser diodes. Discuss their applications in modern technology.
2. Explain the concepts of nanostructures including quantum wells, superlattice structures, nanorods, quantum dots, CNTs (Carbon Nanotubes), and 2D materials (e.g., graphene, BN, MoS2). Discuss their unique properties and potential applications.
3. Discuss the concept of metamaterials in optics. How do metamaterials enable novel optical properties and functionalities?

Short Questions:

1. How does a solar cell convert sunlight into electrical energy? Discuss its efficiency and applications.
2. Explain the operation of LEDs (Light-Emitting Diodes) and their advantages over traditional light sources.
3. Describe the principle of operation of quantum dots. What are their potential applications in optoelectronics?
4. Discuss the properties and applications of carbon nanotubes (CNTs) in nanoelectronics and optoelectronics.
5. What are the unique properties of 2D materials such as graphene and MoS2? How are they utilized in semiconductor devices?
6. Explain the concept of optical metamaterials and their role in manipulating light at the nanoscale.

Unit V: MULTISTAGE AMPLIFIERS AND HIGH-FREQUENCY BEHAVIOR

Essay Questions:

1. Discuss the behavior of BJTs (Bipolar Junction Transistors) at high frequencies. Explain the factors affecting high-frequency response and their implications in amplifier design.
2. Describe the frequency response of RC coupled amplifiers and transformer-coupled amplifiers. What are the advantages and limitations of each type?
3. Explain the design and operation of multistage amplifiers. How do they improve overall gain and bandwidth compared to single-stage amplifiers?

Short Questions:

1. How does the frequency response of a BJT amplifier change at high frequencies? What mechanisms contribute to this change?
2. Compare the frequency response of RC coupled and transformer-coupled amplifiers.
3. Describe the concept of multistage amplification. How are multiple stages interconnected to achieve high gain and bandwidth?
4. Discuss the importance of bandwidth in amplifier design. How is it related to the overall performance of electronic systems?
5. Explain the role of feedback in improving the stability and linearity of amplifiers.
6. What are the key factors to consider when designing an amplifier for specific frequency ranges?

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Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM32**
SEMESTER-III (II Year) COURSE 6: DIGITAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

Course Objectives: The course on Digital Electronics aims to provide a basic understanding of the principles of Number systems, Combinational and sequential digital circuits as well as Memory devices.

Learning Outcomes:

On successful completion of this course, the students will be able to:		Knowledge level (Bloom's Taxonomy)
CO 1	Understand the number systems, Binary codes and Complements.	Level 2 (Understanding)
CO 2	Understand the Boolean algebra and simplification of Boolean expressions.	Level 2 (Understanding)
CO 3	Analyze logic processes and implement logical operations using combinational logic circuits.	Level 4 (Analysing)
CO 4	Understand the concepts of sequential circuits and to analyze sequential systems in terms of state machines.	Level 2 (Understanding) Level 4 (Analysing)
CO 5	Understands characteristics of memory and their classification. Implement combinational and sequential circuits using VHDL.	Level 2 (Understanding) Level 3 (Applying)

SYLLABUS

Unit–I

NUMBER SYSTEM AND CODES: Decimal, Binary, Hexadecimal, Octal. Codes: BCD, Gray and Excess-3 codes- code conversions- Complements (1's, 2's,9's and 10's), Addition -Subtraction using complement methods.

Unit- II

BOOLEAN ALGEBRA AND THEOREMS: Boolean Theorems, De-Morgan's laws. Digital logic gates, Multi-level NAND & NOR gates. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh Map Method: 2,3 variables).

Unit-III

COMBINATIONAL DIGITAL CIRCUITS: Adders-Half & full adder, Subtractor-Half and full subtractors, Parallel binary adder, Magnitude Comparator, Multiplexers (4:1)) and Demultiplexers (1:4), Encoder (8- line-to-3- line) and Decoder (3-line-to-8-line). IC-LOGIC FAMILIES: TTL logic, CMOS Logic families (NAND&NOR Gates).

UNIT-IV

SEQUENTIAL DIGITAL CIRCUITS: *Basic NAND, NOR Latches*, Flip Flops: S-R FF, J-K FF, T and D type FFs, Master-Slave FFs, *Conversion of Flip-Flops*, Excitation tables, Registers: - Serial In Serial Out and Parallel In and Parallel Out, Counters Asynchronous-, Mod-8, Mod- 10, Synchronous-4-bit &Ring counter.

UNIT-V

MEMORY DEVICES: General Memory Operations, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAROM.

TEXT BOOKS:

1. M. Morris Mano, "Digital Design" 3rd Edition, PHI, New Delhi.
2. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV)
3. G.K. Kharate-Digital electronics-oxford university press
4. S. Salivahana & S. Arivazhagan-Digital circuits and design
5. Fundamentals of Digital Circuits by Anand Kumar

Reference Books:

1. Herbert Taub and Donald Schilling. "Digital Integrated Electronics". McGraw Hill. 1985.
2. S.K. Bose. "Digital Systems". 2/e. New Age International. 1992.
3. D.K. Anvekar and B.S. Sonade. "Electronic Data Converters: Fundamentals & Applications". TMH. 1994.
4. Malvino and Leach. "Digital Principles and Applications". TMG Hill Edition.

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	2	3	3
CO 2	3	1	1	1	1	2	3	2	3	3
CO 3	3	1	1	1	1	2	3	2	3	3
CO 4	3	1	1	1	1	2	3	2	3	3
CO 5	3	1	1	1	1	2	2	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM32P**
SEMESTER-III (II Year) COURSE 6: DIGITAL ELECTRONICS Practical Course
Practical Credits: 1 2 Hrs/Week

Course objective:

- To familiarize students with experimental techniques and methodologies used in Digital electronics.
- To provide hands-on experience in conducting experiments related to Digital electronics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Develop a digital logic and apply it to solve real life problems.	Level 6 (Create)
CO 2	Analyze, design and implement combinational logic circuits.	Level 3 (Applying) Level 4 (Analysing) Level 6 (Create)
CO 3	Classify different semiconductor memories.	Level 4 (Analysing)
CO 4	Analyze, design and implement sequential logic circuits.	Level 2 (Understanding) Level 4 (Analysing) Level 6 (Create)
CO 5	Simulate and implement combinational and sequential logic circuits using VHDL.	Level 2 (Understanding) Level 6 (Create)

List of Experiments:

1. Verification of IC-logic gates.
2. Realization of basic gates using discrete components (resistor, diodes &transistor).
3. Realization of basic gates using Universal gates (NAND & NOR gates).
4. Verify Half adder and full adder using gates.
5. Verify Half subtractor and full subtractor using gates.
6. Verify the truth table Multiplexer and demultiplexer.
7. Verify the truth table Encoder and decoder.
8. Verify the truth table of RS, JK, T-F/F using NAND gates.
9. 4-bit binary parallel adder and subtractor using IC 7483.
10. BCD to Seven Segment Decoder using IC -7447/7448.

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM32**

SEMESTER-III (II Year) COURSE 6: DIGITAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM32**
SEMESTER-III (II Year) COURSE 6: DIGITAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	Module/ Unit	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	NUMBER SYSTEM AND CODES	2 (One out of two)	2
2	Unit – II	BOOLEAN ALGEBRA AND THEOREMS	2 (One out of two)	2
3	Unit – III	COMBINATIONAL DIGITAL CIRCUITS	2 (One out of two)	2
4	Unit – IV	SEQUENTIAL DIGITAL CIRCUITS	2 (One out of two)	2
5	Unit – V	MEMORY DEVICES	2 (One out of two)	2

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w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM32**

SEMESTER-III (II Year) COURSE 6: DIGITAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. What is the significance of Gray code in digital systems, and how is it different from Binary Coded Decimal (BCD)?
2. Convert the hexadecimal number 3A7F to its binary and decimal equivalents.
3. Differentiate between Sum of Products (SOP) and Product of Sums (POS) forms of Boolean expressions.
4. State and prove the duality principle in Boolean algebra with an example.
5. What is a magnitude comparator, and how does it function in digital circuits?
6. Compare and contrast TTL and CMOS logic families, focusing on their key characteristics and applications.
7. What is the difference between Serial In Serial Out (SISO) and Parallel In Parallel Out (PIPO) registers?
8. Define a ring counter and explain its operation with a simple diagram.
9. What are the general memory operations in digital systems?
10. Define and differentiate between volatile and non-volatile memory, providing examples of each.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Explain in detail the different number systems: Decimal, Binary, Hexadecimal, and Octal. Discuss how code conversions are performed between these number systems, providing examples for each conversion.

OR

(b) Describe the process of performing arithmetic operations using complements. Provide examples of addition and subtraction using 1's complement, 2's complement, 9's complement, and 10's complement methods.

12. (a) Discuss the importance of Boolean algebra in digital circuit design. Explain De-Morgan's laws and provide examples to illustrate their application in simplifying logic expressions.

OR

(b) Explain the Karnaugh Map (K-Map) method for minimizing Boolean expressions. Describe the process for a three-variable function and provide an example of how to simplify a logic function using a K-Map.

13. (a) Explain the design and operation of a 4-bit parallel binary adder. Discuss its significance in digital systems and how it can be extended for higher bit operations.

OR

(b) Describe the working of multiplexers and demultiplexers, focusing on the 4:1 multiplexer and 1:4 demultiplexer. Provide examples of practical applications where these devices are used.

14. (a) Discuss the different types of flip-flops (S-R, J-K, T, D). Explain their working principles and their role in sequential circuits, providing relevant examples.

OR

(b) Explain the concept of counters in digital electronics. Compare asynchronous and synchronous counters, and describe the operation of a Mod-10 counter.

15. (a) Discuss the various types of Read-Only Memory (ROM) and their applications. How do PROM, EPROM, EEPROM, and EAROM differ from each other in terms of functionality and usage?

OR

(b) Explain the difference between Static RAM (SRAM) and Dynamic RAM (DRAM). Discuss their advantages and disadvantages, and where each type is typically used.

Question Bank
Short answer Questions

1. What is the significance of Gray code in digital systems, and how is it different from Binary Coded Decimal (BCD)?
2. Convert the hexadecimal number 3A7F to its binary and decimal equivalents.
3. Discuss about 1. Binary, and 2. Hexadecimal Number Systems.
4. Explain the Multi-level NAND & NOR gates.
5. Differentiate between Sum of Products (SOP) and Product of Sums (POS) forms of Boolean expressions.
6. State and prove the duality principle in Boolean algebra with an example.
7. What is a magnitude comparator, and how does it function in digital circuits?
8. Write short note on Half Adder.
9. Write a short note on Half Subtractor.
10. Discuss about J-K Flip Flops.
11. Compare and contrast TTL and CMOS logic families, focusing on their key characteristics and applications.
12. What is the difference between Serial In Serial Out (SISO) and Parallel In Parallel Out (PIPO) registers?
13. Define a ring counter and explain its operation with a simple diagram.
14. What are the general memory operations in digital systems?
15. Define and differentiate between volatile and non-volatile memory, providing examples of each.

Long answer Questions

1. Explain in detail the different number systems: Decimal, Binary, Hexadecimal, and Octal. Discuss how code conversions are performed between these number systems, providing examples for each conversion.
2. Describe the process of performing arithmetic operations using complements. Provide examples of addition and subtraction using 1's complement, 2's complement, 9's complement, and 10's complement methods.
3. Discuss the importance of Boolean algebra in digital circuit design. Explain De-Morgan's laws and provide examples to illustrate their application in simplifying logic expressions.

4. Explain the Karnaugh Map (K-Map) method for minimizing Boolean expressions. Describe the process for a three-variable function and provide an example of how to simplify a logic function using a K-Map.
5. Explain the design and operation of a 4-bit parallel binary adder. Discuss its significance in digital systems and how it can be extended for higher bit operations.
6. Describe the working of multiplexers and demultiplexers, focusing on the 4:1 multiplexer and 1:4 demultiplexer. Provide examples of practical applications where these devices are used.
7. Discuss the different types of flip-flops (S-R, J-K, T, D). Explain their working principles and their role in sequential circuits, providing relevant examples.
8. Explain the concept of counters in digital electronics. Compare asynchronous and synchronous counters, and describe the operation of a Mod-10 counter.
9. Discuss the various types of Read-Only Memory (ROM) and their applications. How do PROM, EPROM, EEPROM, and EAROM differ from each other in terms of functionality and usage?
10. Explain the difference between Static RAM (SRAM) and Dynamic RAM (DRAM). Discuss their advantages and disadvantages, and where each type is typically used.

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Electronics (Major)
(w.e.f. AY 2023-24)
II Year SEMESTER-III
COURSE CODE: 24ELEM33 ANALOG ELECTRONICS

Theory Credits:4 5hrs/week

COURSE OBJECTIVES

The design and working of RC coupled amplifiers, transformer coupled amplifiers and power amplifiers,

The concept of negative and positive feedback, pulse shaping and Schmitt trigger, and the op-amp characteristics, frequency response and its linear and non-linear applications.

Learning outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Analyze small signal and power amplifiers' principles, frequency response, and impedance characteristics, including RC and transformer coupled amplifiers.	**Level 4**
CO 2	Evaluate the effects of negative feedback on gain stability, distortion, bandwidth, and input/output resistance in various feedback amplifier circuits.	**Level 5**
CO 3	Understand operational amplifiers' principles, transfer characteristics, offset parameters, differential gain, CMRR, and slew rate.	**Level 2**
CO 4	Design and analyze basic op-amp circuits, including adders, subtractors, integrators, differentiators, comparators, waveform generators, active filters, and sample and hold circuits.	**Level 6**
CO 5	Apply principles of oscillators, including positive feedback and Barkhausen criterion, to design various oscillators and multivibrators.	**Level 3**

SYLLABUS

UNIT-I

Amplifiers: General principles of small signal amplifiers - Classifications - RC Coupled amplifiers - Gain - Frequency response - Input and output impedance - Multistage amplifiers - Transformer coupled amplifiers - Equivalent circuits at low, medium and high frequencies – Emitter follower. Class A and Class B power amplifiers - Single ended and push-pull configurations - Power dissipation and output power calculations.

UNIT-II

Feedback Amplifiers: Basic concept of feedback amplifiers - Transfer gain with feedback - General characteristics of negative feedback amplifier - Effect of negative feedback on gain - Gain stability - Distortion and bandwidth - Input and output resistance in the case of various types of feedback - Analysis of voltage and current in feedback amplifier circuits.

UNIT-III

Operational Amplifiers: Principles - Transfer characteristics - Various offset parameters - Differential gain - CMRR - Slew rate – Bandwi

UNIT-IV

Op-amp Circuits: Basic operational amplifier circuits under inverting and non- inverting modes - Adder - Subtractor - Integrator - Differentiator - Comparator - Sine, square and triangular waveform generators - Active filters - Sample and Hold circuits.

UNIT-V

Oscillators: Positive feedback - Stability issues - Feedback requirement of oscillations - Barkhausen criterion for oscillation - Hartley, Colpitts, Phase shift and Wien bridge oscillators - Condition for oscillation and frequency derivation - Crystal oscillator - UJT relaxation oscillator. Monostable, bistable and astable multivibrators - Schmitt trigger.

Text Books

1. 1.Introduction to Integrated Electronics - *V. Vijayendran*, S.Viswanathan (Printers & Publishers) Pvt. Ltd., Chennai, 2005.
2. Electronic Circuits and Systems - *Y.N. Bapat*, Tata McGraw Hill Publishing Co. Ltd.

Reference Books

1. Electronic Devices and Circuits - *G.K. Mithal*, Khanna Publishers, Delhi.
2. Hand Book of Electronics - *Gupta & Kumar*, Pragati Prakashan, Meerut.
3. Electronic Devices and Circuit Theory - *R. Boylestad & L. Nashelsky*, Prentice Hall of India Private Limited, 6/e.
4. 4. Electronic Devices and Circuits - *J.P. Agarwal & Amit Agarwal*,Prakasam Publishers.
5. Linear Integrated Circuits - *D. Roy Choudhury & Shail Jain*, New Age International (P) Limited.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. AY 2023-24

II B.Sc. PHYSICS - SEM-III

COURSE CODE: 24ELEM33

Course :7 ANALOG ELECTRONICS

Max Marks- 60 **Time-3Hrs. Credits: 3**

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2023-24

SEMESTER III COURSE CODE: 24ELEM33

ANALOG ELECTRONICS

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2 (two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2 (two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2 (two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	100%	60	5 (each question has internal choice)	5 out of 10 questions

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	**8 marks**	**4 marks**
1	**I**	Amplifiers	**2 (one out of two)**	**2**
2	**II**	Feedback Amplifiers	**2 (one out of two**	**2**
3	**III**	Operational Amplifiers	**2 (one out of two**	**2**
4	**IV**	Op-amp Circuits	**2 (one out of two**	**2**
5	**V**	Oscillators	**2 (one out of two**	**2**
		TOTAL QUESTIONS	**5 (each question has internal choice)**	**5 out of given 10**

III SEMESTER END EXAMINATION II BSC. REGULAR PAPER-4

COURSE CODE: 24ELEM33

ANALOG ELECTRONICS

(MODEL PAPER)

DURATION::3 hrs **MAX.MARKS :: 60**

SECTION-A

Answer any FIVE questions of the following (5 X 4 = 20 M)

1. What are the key differences between RC-coupled and transformer-coupled amplifiers?
2. How does frequency response impact the performance of a small signal amplifier?
3. How does negative feedback reduce distortion in an amplifier?
4. Explain the impact of feedback on the bandwidth of an amplifier.
5. How does the slew rate impact the performance of an op-amp in a high-frequency application?
6. What is the gain-bandwidth product, and why is it important in op-amp design?
7. Describe the operation of an active filter using an op-amp.
8. What is the purpose of a sample and hold circuit, and how is it implemented using an op-amp?
9. Describe the working of a UJT relaxation oscillator and its typical applications.
10. Explain the function of a Schmitt trigger and its role in electronic circuits.

SECTION-B

Answer ALL the questions Of the following (5 X 8 = 40 M)

11. (a)Compare and contrast single-stage and multistage amplifiers. How does the use of transformer coupling affect the performance of these amplifiers at different frequencies?

[OR]

(b) Analyze the operation of Class A and Class B power amplifiers. Explain the differences between single-ended and push-pull configurations, focusing on their efficiency, power dissipation, and output power calculations.

12. (a) Analyze the effects of negative feedback on input and output resistance in amplifiers.

Compare the different types of feedback and their applications in voltage and current feedback circuits.

[OR]

(b) Provide a detailed analysis of voltage and current feedback in amplifier circuits. How does feedback improve the overall performance of an amplifier?

13. (a) Explain the concepts of differential gain and Common Mode Rejection Ratio (CMRR) in operational amplifiers. How do these parameters influence the design and performance of analog circuits?

[OR]

(b)Analyze the significance of the slew rate in operational amplifiers. How does the slew rate affect the performance of an op-amp in high-speed applications?

14. (a) Discuss the design and operation of op-amp-based adder and subtractor circuits. How are these circuits applied in analog signal processing?

[OR]

(b) Analyze the operation of integrator and differentiator circuits using op-amps. What are their applications in signal processing and control systems?

15. (a)Discuss the working principles of Hartley, Colpitts, and Wien bridge oscillators. Compare their design, operation, and applications in electronic circuits.

[OR]

(b) Analyze the condition for oscillation and frequency derivation in crystal oscillators. How does a crystal oscillator achieve high-frequency stability and accuracy?

Programme: B.Sc. Honours in Electronics (Major)
(w.e.f. AY 2023-24)
II Year SEMESTER-III
COURSE CODE: 24ELEM33 ANALOG ELECTRONICS

UNIT I: Amplifiers

Essay Questions:

1. Discuss the general principles of small signal amplifiers and their classifications. Explain the importance of gain, frequency response, and input-output impedance in the performance of RC-coupled amplifiers.
2. Compare and contrast single-stage and multistage amplifiers. How does the use of transformer coupling affect the performance of these amplifiers at different frequencies?
3. Analyze the operation of Class A and Class B power amplifiers. Explain the differences between single-ended and push-pull configurations, focusing on their efficiency, power dissipation, and output power calculations.
4. Explain the concept of equivalent circuits at low, medium, and high frequencies in amplifier design. Discuss the role of the emitter follower in providing impedance matching.

Short Answer Questions:

1. What are the key differences between RC-coupled and transformer-coupled amplifiers?
2. How does frequency response impact the performance of a small signal amplifier?
3. What is the significance of input and output impedance in amplifier circuits?
4. Define power dissipation in Class A and Class B amplifiers and explain how it is calculated.

UNIT II: Feedback Amplifiers

Essay Questions:

1. Explain the basic concept of feedback in amplifiers and its significance. How does feedback influence the transfer gain and overall performance of an amplifier?
2. Discuss the characteristics of negative feedback amplifiers. How does negative feedback affect gain stability, distortion, and bandwidth in amplifier circuits?
3. Analyze the effects of negative feedback on input and output resistance in amplifiers. Compare the different types of feedback and their applications in voltage and current

feedback circuits.

4. Provide a detailed analysis of voltage and current feedback in amplifier circuits. How does feedback improve the overall performance of an amplifier?

Short Answer Questions:

1. What is the role of feedback in controlling gain stability in amplifiers?
2. How does negative feedback reduce distortion in an amplifier?
3. Explain the impact of feedback on the bandwidth of an amplifier.
4. What are the different types of feedback in amplifier circuits, and how do they differ?

UNIT III: Operational Amplifiers

Essay Questions:

1. Discuss the principles and transfer characteristics of operational amplifiers. How do various offset parameters impact the accuracy and performance of op-amps?
2. Explain the concepts of differential gain and Common Mode Rejection Ratio (CMRR) in operational amplifiers. How do these parameters influence the design and performance of analog circuits?
3. Analyze the significance of the slew rate in operational amplifiers. How does the slew rate affect the performance of an op-amp in high-speed applications?
4. Explain the relationship between bandwidth and gain in operational amplifiers. How does the gain-bandwidth product influence the design of op-amp circuits?

Short Answer Questions:

1. What is the significance of offset voltage in operational amplifiers?
2. Define CMRR and explain its importance in differential amplifier circuits.
3. How does the slew rate impact the performance of an op-amp in a high-frequency application?
4. What is the gain-bandwidth product, and why is it important in op-amp design?

UNIT IV: Op-amp Circuits

Essay Questions:

1. Compare the working principles of inverting and non-inverting operational amplifier circuits. How do these configurations affect the overall performance of the circuit?
2. Discuss the design and operation of op-amp-based adder and subtractor circuits. How are these circuits applied in analog signal processing?
3. Analyze the operation of integrator and differentiator circuits using op-amps. What are their

applications in signal processing and control systems?

4. Explain the design and functionality of sine, square, and triangular waveform generators using operational amplifiers. How do these circuits contribute to signal generation?

Short Answer Questions:

1. What is the primary difference between inverting and non-inverting op-amp configurations?
2. How does an op-amp-based comparator function, and what are its typical applications?
3. Describe the operation of an active filter using an op-amp.
4. What is the purpose of a sample and hold circuit, and how is it implemented using an op-amp?

UNIT V: Oscillators

Essay Questions:

1. Explain the Barkhausen criterion for oscillation and its significance in oscillator design. How do positive feedback and stability issues affect the performance of oscillators?
2. Discuss the working principles of Hartley, Colpitts, and Wien bridge oscillators. Compare their design, operation, and applications in electronic circuits.
3. Analyze the condition for oscillation and frequency derivation in crystal oscillators. How does a crystal oscillator achieve high-frequency stability and accuracy?
4. Compare and contrast monostable, bistable, and astable multivibrators. How are these circuits implemented, and what are their key applications?

Short Answer Questions:

1. What are the necessary conditions for an oscillator to sustain oscillations?
2. Describe the working of a UJT relaxation oscillator and its typical applications.
3. Explain the function of a Schmitt trigger and its role in electronic circuits.
4. How does a crystal oscillator differ from other types of oscillators in terms of frequency stability?

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

(COURSE CODE: 24ELEM34)

Dr. VS KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM

BLUE PRINT
Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-III
COURSE 8: ELECTRONIC COMMUNICATION SYSTEMS

MAX MARKS – 60 TIME – 3 HOURS
(CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-A) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-B) Each one 4 marks
1	I	Antenna	1	2
2	II	Modulation	1	2
3	III	Frequency Modulation	1	2
4	IV	Pulse Modulation	1	2
5	V	Multiplexing	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120 - 60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

(COURSE CODE: 24ELEM34)

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-III

COURSE 8: ELECTRONIC COMMUNICATION SYSTEMS

Theory Credits: 3 3 hrs/week

Learning outcomes: On Completion of the course, the students will be able to acquire application, knowledge, understanding, analysing skill.

CO 1	Application critical thinking skills in fundamentals of antenna, understanding of their characteristics and types.	Level 2 (Understanding) Level 3 (applying)
CO 2	Understanding basic principles of modulation and concepts underlying a broad range of fundamental areas of radio waves to Connect their knowledge of physics to everyday situations. amplitude modulation and demodulation and radio wave transmission and reception,	Level 2 (Understanding) Level 3 (applying)
CO 3	Knowledge of FM radio. Frequency modulation and demodulation and FM radio wave transmission and reception.	Level 2 (Understanding) Level 3 (applying)
CO 4	Application. Principle of analog and digital pulse modulation and their applications	Level 2 (Understanding)
CO 5	To explore in FM industry, transmission and detection of digital signals	Level 2 (Understanding) Level 3 (applying)

(COURSE CODE: 24ELEM34)

COURSE 8: ELECTRONIC COMMUNICATION SYSTEMS

SYLLUBUS

UNIT-I: Antenna - ***Overview of antennas and their applications, Electromagnetic waves and their propagation, Basic antenna parameters (gain, directivity, beam width)***, Effective resistance - Efficiency - Directive gain - Bandwidth, Beam width and polarization - Dipole - Folded dipole - Arrays - Yagi - Uda - Helical - Discone - Parabolic - Dish Antennas - Ground wave, sky wave and space ware propagation - Skip distance - Maximum usable frequency.

UNIT-II: Modulation - ***Introduction to Modulation, Overview of communication systems, Purpose and benefits of modulation, Basic concepts: Carrier signal, message signal, modulation index.*** Needs for Modulation - Types of Modulation - Amplitude Modulation - Generation and detections circuits - Balanced Modulator - DSB/SC and SSB Modulation - VSB modulation. Block diagram of AM Radio transmitter and super heterodyne Receiver.

UNIT-III: Frequency Modulation - ***FM signal representation, Mathematical analysis of FM, FM spectrum and bandwidth considerations, FM demodulation techniques.*** Definition - Derivation of Modulated wave - Generation of FM - Varactor diode and Reactance tube Modulators - Detectors - Balanced slope detector, Foster Seeley discriminator, and ratio detector - Block diagram of FM transmitter and receiver.

UNIT-IV: Pulse Modulation - ***PM signal representation, Relationship between PM and FM, Phase modulation techniques., Spectrum and bandwidth analysis*** Sampling theorem - PAM, PWM, PCM - quantizing, sampling, coding, decoding, quantization error, delta modulation and adaptive delta modulation.

UNIT-V: Multiplexing - FDM, TDM, CDMA - ASK, FSK, PSK –Advantages of Digital Communication - Introduction to Microwave, Fiber optic, Satellite,Communications- RADAR - range equation. ***Dependent factors, Radar Power, Antenna Size, Frequency, Signal Processing, Environmental Conditions.***

Text Books : **1**. Electronic Communication Systems - *George Kennedy*, McGraw Hill Book Company, 4/e, 2005. **2**. Communication Engineering - *T.G. Palanivelu*, Anuradha Publicatons, 1/e, 2002.

Reference Books: **1.** Communication System - *Roddy & Coolen*, 4/e, Pearson Education, 2005. **2.** Principles of Communication Engineering - *Anok Singh*, 4/e, Sathyaprakasam Publications, 2004.

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
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Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

(COURSE CODE: 24ELEM34)

Programme: B.Sc. Honours in Electronics (Major) -2024-2025

SEMESTER-III

COURSE 8: ELECTRONIC COMMUNICATION SYSTEMS
(COURSE CODE: 24ELEM34)

Theory   Credits: 3   3 hrs/week

Model Paper   **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times$ $\mathbf{5 = 20}\boldsymbol{M}$)

1. Define antenna efficiency. How is it calculated?

2. What factors determine the bandwidth of an antenna?

3. What is modulation? Why is it necessary in communication systems?

4. Differentiate between DSB-SC modulation and SSB modulation.

5. What is frequency modulation (FM)? How it is different from amplitude modulation (AM)?

6. Describe the generation of FM using direct method and indirect method

7. Define pulse modulation. What are its main types?

8. Explain the process of quantization in PCM. What is quantization error?

9. Briefly describe the working principle of delta modulation.

10. Describe the basic applications of microwave and satellite communications.

Section B   **Answer all the questions (8M$\times$ $\mathbf{5 = 40}\boldsymbol{M}$)**

11. (A) Discuss the concept of effective resistance in antennas. How does it affect antenna performance? **(OR)**

(B) Explain the term 'directive gain' in antennas. How is it related to antenna design and applications?

(COURSE CODE: 24ELEM34)

12. (A) Describe the need for modulation in communication systems. Discuss the types of modulation techniques used in AM radio transmission.

(OR)

(B) Compare and contrast amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM) in terms of their advantages and disadvantages.

13. (A) derive the expression for frequency-modulated wave and discuss the advantages of frequency modulation over amplitude modulation.

(OR)

(B) Explain the operation of VARACTOR DIODE and reactance tube modulators in FM transmitters.

14. (A) Explain the sampling theorem and its significance in pulse modulation techniques.

(OR)

(B) Discuss the principles of pulse amplitude modulation (PAM), pulse width modulation (PWM), and pulse code modulation (PCM). Compare their applications and advantages

15. (A) Define multiplexing. What are the common multiplexing techniques used in communication systems?

(OR)

(B) What is the radar range equation? How is it used in radar systems?

(COURSE CODE: 24ELEM34)

QUESTION BANK

UNIT-I: Antenna and Propagation

Essay Type Questions:

1. Discuss the concept of effective resistance in antennas. How does it affect antenna performance?
2. Explain the term 'directive gain' in antennas. How is it related to antenna design and applications?
3. Compare and contrast the characteristics of ground wave, sky wave, and space wave propagation. How do they differ in terms of propagation mechanisms and applications?

Short Answer Questions:

1. Define antenna efficiency. How is it calculated?
2. What factors determine the bandwidth of an antenna?
3. Explain the concept of beam width and its significance in antenna design.

UNIT-II: Modulation and AM **Essay Type Questions:**

1. Describe the need for modulation in communication systems. Discuss the types of modulation techniques used in AM radio transmission.
2. Explain the block diagram of an AM radio transmitter and a super heterodyne receiver. Highlight the key components and their functions.
3. Compare and contrast amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM) in terms of their advantages and disadvantages.

Short Answer Questions:

1. What is modulation? Why is it necessary in communication systems?
2. Briefly explain the working principle of a balanced modulator.
3. Differentiate between DSB-SC modulation and SSB modulation.

UNIT-III: Frequency Modulation (FM) **Essay Type Questions:**

1. Derive the expression for frequency-modulated wave and discuss the advantages of frequency modulation over amplitude modulation.
2. Explain the operation of VARACTOR DIODE and reactance tube modulators in FM transmitters.
3. Compare and contrast different types of FM detectors: balanced slope detector, Foster Seeley discriminator, and ratio detector.

(COURSE CODE: 24ELEM34)

Short Answer Questions:

1. What is frequency modulation (FM)? How is it different from amplitude modulation (AM)?
2. Describe the generation of FM using direct method and indirect method.
3. What is the function of a limiter in an FM receiver?

UNIT-IV: Pulse Modulation **Essay Type Questions:**

1. Explain the sampling theorem and its significance in pulse modulation techniques.
2. Discuss the principles of pulse amplitude modulation (PAM), pulse width modulation (PWM), and pulse code modulation (PCM). Compare their applications and advantages.
3. Describe the concept of delta modulation and adaptive delta modulation. How do they differ from PCM?

Short Answer Questions:

1. Define pulse modulation. What are its main types?
2. Explain the process of quantization in PCM. What is quantization error?
3. Briefly describe the working principle of delta modulation.

UNIT-V: Multiplexing and Digital Communication **Essay Type Questions:**

1. Compare and contrast frequency division multiplexing (FDM) and time division multiplexing (TDM). Discuss their applications in modern communication systems.
2. Explain the advantages of digital communication over analog communication. How does digital modulation facilitate reliable data transmission?
3. Describe the basic principles and applications of microwave, fiber optic, and satellite communications.

Short Answer Questions:

1. Define multiplexing. What are the common multiplexing techniques used in communication systems?
2. Briefly explain the differences between ASK, FSK, and PSK modulation techniques.
3. What is the radar range equation? How is it used in radar systems?

Major Courses offered w.e.f. AY 2024-25

SEMESTER-IV COURSE CODE: 24ELEM41

COURSE 9: ELECTRICAL AND ELECTRONIC INSTRUMENTATION

Theory Credits: 3 3 hrs/week

VARIATION OF SYLLABUS FROM THE APCHE PRESCRIBED SYLLABUS

S.No.	Unit	Name of the Unit	Syllabus Added/Deleted	Percentage Variation
1	II	DC and AC bridges	Sensitivity of Wheatstone Bridge	5

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2024-25

SEMESTER-IV COURSE CODE: 24ELEM41

COURSE 9: ELECTRICAL AND ELECTRONIC INSTRUMENTATION

Theory Credits: 3 3 hrs/week

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand basic concepts of indicating instruments.	Level 2
CO 2	Analyse basic concepts of bridges	Level 4
CO 3	Design various electronic instruments such as CRO, storage oscilloscopes	Level 6
CO 4	Analyse gunctiongenerators, spectrum analyzer etc.,	Level 4
CO 5	Working of transducers, sensors and display devices	Level 4

Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2024-25

SEMESTER-IV COURSE CODE: 24ELEM41

COURSE 9: ELECTRICAL AND ELECTRONIC INSTRUMENTATION

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	2	--	1	2	2	2	3
CO 2	3	1	1	2	1	2	3	2	2	3
CO 3	3	2	1	1	1	1	3	2	2	3
CO 4	3	1	1	1	--	1	3	2	2	3
CO 5	3	1	2	1	1	1	3	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	--	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Major Courses offered w.e.f. AY 2024-25

SEMESTER-II COUSE CODE :24ELEM21

COURSE 3: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

Theory Credits: 4 5 hrs/week

Objectives

The students will learn:

1)Understand basics of electrostatics, Gauss theorem and its applications,
2)Understand concept of a capacitor, design various types of capacitors and dielectric constant,
3)Study magnetic effects of current, cells and apply the concepts in the design of the measuring instruments like ammeter and voltmeter,
4)Understand the basics of p-n junction, rectifying action of a diode, regulated power supplies and wave shaping circuits, and
5)Analyse transistor and its three modes of operation, h-parameter model of a transistor and the frequency response of an amplifier.

UNIT-I

Electrostatics: Electric charges - Coulomb's law - Electric field - Electric intensity and electric potential
- Relation between electric potential and intensity - Electric intensity and potential due to a uniform charged conducting sphere at a point outside, on, and inside the conductor.

Electric dipole - Dipole moment - Intensity and potential due to a dipole – Statement and proof of Gauss law - Application of Gauss law to uniformly charged solid sphere-Application of Gauss law to Uniformly charged infinite sheet NOT FOR EXAMINATION PURPOSE

UNIT-II

Capacitors: Definition and unit of capacity - Capacitance of a parallel plate capacitor - Effect of dielectric on capacity - Capacitors in series and parallel - Energy stored in acharged capacitors - Loss of energy on sharing of charges between two capacitors - Force of attraction between plates of charged parallel plate capacitor - Kelvin's attracted disc electrometer - Measurement of potential and dielectric constant.

Type of capacitors - Mica capacitor, Electrolytic capacitors, Variable air capacitor - Uses of capacitors.

UNIT-III

Electrical Measurements: Carey-Foster bridge - Determination of specific resistance - Potentiometer - Calibration of low and high range voltmeters - Calibration of Low range ammeter.

Magnetic Effect of Current: Biot-Savart's law, Force on a conductor carrying current placed in a magnetic field - Principle, construction and theory of a moving coil ballistic galvanometer - Measurement of figure of merit of B.G. - ~~Comparison of capacitors using BG~~..

UNIT-IV

Diode circuits and power Supplies: Junction diode characteristics - Half and full wave rectifiers - Expression for efficiency and ripple factor - Construction of low range power peak using diodes - Bridge rectifier - Filter circuits - Zener Diode - Characteristics - Regulated power supply using Zener diode - Clipper and Clamper using diodes.

Differentiator and integrator using resistor and capacitor.

UNIT-V

Transistor circuits: Characteristics of a transistor in CB, CE modes - Relatively merits Graphical analysis in CE configuration - Transistor as a amplifier - RC coupled

Single stage amplifier - Frequency response - Thevenin's and Norton's theorems - h parameters.

Basis logic gates AND, OR, NOT - Construction of basic logic gates using diodes and transistors. NAND and NOR Logic gates

Text Books

Electricity and Magnetism - *M. Narayanamoorthi and Others*, National PublishingCo., Chennai. Electricity and Magnetism - *R. Murugeshan*, S. Chand & Co. Ltd., New Delhi,Revised Edition, 2006.

Principles of Electronics - *V.K. Mehta*, S. Chand & Co., 4/e, 2001. Basic Electronics - *B.L. Theraja*, S. Chand & Co., 4/e, 2001.

Reference Books

Electricity and Magnetism - *Brijlal & Subrahmanyam*, Ratan Prakashan Mandir,Agra. Fundamentals of Electricity and Magnetism - *B.D. Duggal & C.L. Chhabra*, ShobanLal Nagin Chand & Co., Jallundur.

Physics, Vol. II - *Resnick, Halliday & Krane*, 5/e, John Wiley & Sons, Inc.,. Basic Electronics - *B. Grob*, McGraw - hill, 6/e, NY, 1989.

Elements of Electronics - *Bagde & Singh*, S. Chand

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BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING COURSE 9: ELECTRICAL AND ELECTRONIC INSTRUMENTATION

COUSE CODE :24ELEM41

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application/	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	UNIT-I	DC and AC indicating Instruments	2(one out of two)	2
2	UNIT-II	DC and AC bridges	2(one out of two)	2
3	UNIT-III	Oscilloscopes	2(one out of two)	2
4	UNIT-IV	Instrumentation Amplifiers and Signal Analysers	2(one out of two)	2
5	UNIT-V	Transducer and Display Devices	2(one out of two)	2

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COURSE 9: ELECTRICAL AND ELECTRONIC INSTRUMENTATION

COUSE CODE :24ELEM41

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_2_)

Time: 3 hours Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7. ---
8. –
9. –
10. --

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

10. (A).

(Or)

(b)

11.(A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM42: MICRO CONTROLLER SYSTEM

Theory Credits: 3 3 hrs/week

Objectives

The students will learn:

- To understand the concepts of microcontroller-based system.
- To enable design and programming of microcontroller-based system.
- To know about the interfacing Circuits.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Explain the evolution of microcontrollers, distinguish between microprocessors and microcontrollers, and demonstrate the use of development tools like assemblers, compilers, and simulators/debuggers.	Level 4
CO 2	Analyze the architecture and organization of the 8051 microcontroller, including its memory organization, register structure, port configuration, and interrupt system.	Level 4
CO 3	Utilize various addressing modes of the 8051 microcontroller and implement arithmetic, logical, and control instructions, including the generation and calculation of time delays using timers.	Level 4
CO 4	Develop and debug assembly language programs for the 8051 microcontroller to perform arithmetic operations and data organization tasks, such as addition, subtraction, multiplication, division, and data sorting.	Level 6
CO 5	Design and implement microcontroller-based interfacing projects, including peripheral devices like PPI 8255, DAC, LM35 temperature sensor, seven-segment displays, LCDs, and stepper motors.	Level 6

UNIT-I: (10Hrs)

Introduction, comparison of Microprocessor and micro controller, Evolution of microcontrollers from 4-bit to 32bit, Development tools for micro controllers, Assembler-Compiler-Simulator/Debugger.

UNIT -II: (10Hrs)

Microcontroller Architecture: Overview and block diagram of 8051, Architecture of 8051, program counter and memory organization, Data types and directives, PSW register, Register banks and stack, pin diagram of 8051, Port organization, Interrupts and timers.

UNIT-III:(10Hrs)

Addressing modes, instruction set of 8051: Addressing modes and accessing memory using various addressing modes, instruction set: Arithmetic, Logical, Simple bit, jump, loop and call instructions and their usage. Time delay generation and calculation, Timer/Counter Programming,

Unit -IV: (15Hrs)

Assemble language programming Examples: Addition, Multiplication, Subtraction, division, arranging a given set of numbers in largest/smallest order.

UNIT-V : (15Hrs)

Interfacing and Application of Microcontroller: Interfacing of – PPI 8255, DAC (0804), Temperature measurement (LM35), interfacing seven segment displays, displaying information on a LCD, control of a stepper Motor (Uni-Polar),

TEXT BOOKS:

1. The 8051 microcontroller and embedded systems using assembly and ckennet j. Ayalam, Dhananjay V. gadre, cengage publishers

2. The 8051 microcontrollers and Embedded systems - By Muhammad Ali
Mazidi and Janice Gillispie Mazidi – Pearson Education Asia, 4th Reprint, 2002.

REFERENCE BOOKS:

1. Microcontrollers Architecture Programming, Interfacing and System Design – Raj kamal.

2. The 8051 Microcontroller Architecture, Programming and Application - Kenneth J.Ajala , west publishing company (ST PAUL, NEW YORK, LOS ANGELES, SAN FRANCISCO).

3. Microcontroller theory and application-Ajay V. Deshmukh

CO-PO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM42P: MICRO CONTROLLER SYSTEM

Practical　　Credits: 1　　2hrs/week

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Develop assembly language programs to perform basic arithmetic operations such as addition, subtraction, multiplication, and division of 8-bit and 16-bit numbers using the 8051 microcontroller, both manually and through Keil software.	Level 6
CO 2	Write and execute programs to manipulate data within the 8051 microcontroller, including tasks like swapping nibbles, complementing bits, and finding the largest or smallest number in an array.	Level 4
CO 3	Demonstrate proficiency in using Keil software to simulate and debug microcontroller programs for arithmetic operations and data handling, ensuring accurate and efficient code execution	Level 4
CO 4	Design and implement interfacing projects using the 8051 microcontroller, such as controlling LEDs, buzzers, relays, and seven-segment displays, using both hardware and Keil software simulations	Level 6
CO 5	Apply knowledge of microcontroller interfacing and programming to develop solutions for real-world applications, demonstrating the ability to integrate and control peripheral devices with the 8051 microcontroller.	Level 4

LAB LIST:

Any six of the following experiments

1. Addition And Subtraction Of Two 8-Bit Numbers.
2. Multiplication And Division Of Two 8-Bit Numbers.
3. Largest number /smallest in an array.
4. Exchange Of Higher And Lower Nibbles In Accumulator.
5. Addition Of Two 8-Bit Numbers (Keil Software).
6. Addition Of Two 16-Bt Numbers (Keil Software)
7. Subtraction Of Two 8-Bit Numbers (Keil Software).

8. Subtraction Of Two 16-Bit Numbers (Keil Software).
9. Multiplication Of Two 8-Bit Numbers (Keil Software).
11. Program For Swapping And Compliment Of 8-Bit Numbers (Keil Software).
12. Program To Find The Largest Number In Given Array (Keil Software).
13. Program To Find The Smallest Number In Given Array (Keil Software).
14. Interfacing Led To 8051 Microcontroller (Keil Software).
15. Interfacing Buzzer To 8051 Microcontroller (Keil Software).
16. Interfacing Relay To 8051 Microcontroller (Keil Software).
17. Interfacing Seven Segments To 8051 Microcontroller (Keil Software).

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0891-2553262, https://www.drvskrishnagdc.edu.in

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM42: MICRO CONTROLLER SYSTEM

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24(ELE)M42: MICRO CONTROLLER SYSTEM

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

Unit I: Introduction to Microcontrollers

Essay Questions:

1. Discuss the evolution of microcontrollers from 4-bit to 32-bit architectures.
2. Compare and contrast microprocessors and microcontrollers.
3. Explain the role of development tools in microcontroller programming.

Short Questions:

1. What are the main differences between a microprocessor and a microcontroller?
2. List the key features that evolved in microcontrollers from 4-bit to 32-bit.
3. Why are simulators and debuggers important in microcontroller development?

Unit II: Microcontroller Architecture

Essay Questions:

1. Describe the architecture of the 8051 microcontroller in detail.
2. Explain the memory organization in the 8051 microcontroller and its significance.
3. Discuss the importance of interrupts and timers in microcontroller operation.

Short Questions:

1. What is the function of the PSW register in the 8051 microcontroller?
2. Describe the pin diagram of the 8051 microcontroller.
3. How is the stack organized in the 8051 microcontroller?

Unit III: Addressing Modes and Instruction Set

Essay Questions:

1. Analyze the different addressing modes available in the 8051 microcontroller.
2. Examine the instruction set of the 8051 microcontroller with examples.
3. Describe the process of generating time delays using the 8051 microcontroller.

Short Questions:

1. What are the different types of instructions in the 8051 instruction set?
2. How do you generate a time delay in the 8051 microcontroller?
3. What is the importance of addressing modes in microcontroller programming?

Unit IV: Assembly Language Programming Examples

Essay Questions:

1. Write and explain an assembly language program for the addition of two numbers using the 8051 microcontroller.
2. Discuss the process of arranging a given set of numbers in ascending or descending order using assembly language.
3. Explain how to perform multiplication and division operations using assembly language in the 8051 microcontroller.

Short Questions:

1. How do you write an assembly program for subtraction using the 8051 microcontroller?
2. What are the steps involved in multiplying two numbers in 8051 assembly language?
3. Explain the logic behind sorting numbers in assembly language.

Unit V: Interfacing and Application of Microcontrollers

Essay Questions:

1. **Describe the interfacing process of a 7-segment display with the 8051 microcontroller.**
2. **Analyze the process of controlling a stepper motor using the 8051 microcontroller.**
3. **Explain the application of the 8051 microcontroller in temperature measurement using the LM35 sensor.**

Short Questions:

1. **What is the role of the PPI 8255 when interfaced with the 8051 microcontroller?**
2. **How is a DAC (0804) interfaced with the 8051 microcontroller?**
3. **Explain the basic steps for interfacing an LCD with the 8051 microcontroller.**

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM42: MICRO CONTROLLER SYSTEM

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1. What are the main differences between a microprocessor and a microcontroller?
2. List the key features that evolved in microcontrollers from 4-bit to 32-bit
3. Describe the pin diagram of the 8051 microcontroller.
4.How is the stack organized in the 8051 microcontroller?
5. Analyze the different addressing modes available in the 8051 microcontroller.
6.Examine the instruction set of the 8051 microcontroller with examples
7. How do you write an assembly program for subtraction using the 8051 microcontroller?
8.What are the steps involved in multiplying two numbers in 8051 assembly language?
9. How is a DAC (0804) interfaced with the 8051 microcontroller?
10.Explain the basic steps for interfacing an LCD with the 8051 microcontroller.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (a) Discuss the evolution of microcontrollers from 4-bit to 32-bit architectures.

(OR)

(b) Compare and contrast microprocessors and microcontrollers.

12.(a) Describe the architecture of the 8051 microcontroller in detail.

(OR)

(b) Explain the memory organization in the 8051 microcontroller and its significance.

13.(a) Analyze the different addressing modes available in the 8051 microcontroller.

(OR)

(b) Describe the process of generating time delays using the 8051 microcontroller.

14.(a) Write and explain an assembly language program for the addition of two numbers using the 8051 microcontroller.

(OR)

(b) Discuss the process of arranging a given set of numbers in ascending or descending order using assembly language

15.a) Describe the interfacing process of a 7-segment display with the 8051 microcontroller.

(OR)

(b) Explain the application of the 8051 microcontroller in temperature measurement using the LM35 sensor.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M43

II Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-IV

COURSE 11: MICROPROCESSOR SYSTEMS

Theory Credits: 3 3 hrs/week

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	**Describe** the architecture and functional components of Intel 8085 and 8086 microprocessors, including CPU, ALU, register organization, and addressing modes.	**Level-5**
2.	**CO-2**	**Explain** the instruction set of Intel 8085 microprocessor, covering data transfer, logical operations, arithmetic computations, branching, and machine control instructions.	**Level-4**
3.	**CO-3**	**Develop** assembly language programs using Intel 8085 for basic operations such as addition, subtraction, multiplication, division, and tasks like finding the largest and smallest number in an array, and converting between BCD and ASCII formats.	**Level-5**
4.	**CO-4**	• **Design** and **implement** basic configurations of 8086 microprocessor in minimum and maximum modes, and manage interrupt priorities. Develop programs utilizing I/O interfaces including serial and parallel communication, programmable timers, keyboard, display, and DMA controller.	**Level-5**
5.	**CO-5**	**Evaluate** the architecture, organization, and programming model of ARM processors, focusing on 16/32 bit processors and ARM-based MCUs. Analyze the ARM instruction set and its application in embedded systems.	**Level-5**

UNIT -I:

CPU ARCHITECTURE *Introduction to Microprocessor, INTEL -8085(P)*

Architecture, CPU, ALU unit, Register organization, Address, data and control Buses. Pin configuration of 8085. Addressing modes 8086 Microprocessor: Architecture, Pin description. Instruction format, Instruction Execution timing, Addressing modes

UNIT -II:

8085 INSTRUCTION SET:

Data transfer Instruction, Logical Instructions, Arithmetic Instructions, Branch Instructions, Machine Control instructions.

UNIT -III:

ASSEMBLY LANGUAGE PROGRAMMING USING 8085, Programmes for Addition, Subtraction, Multiplication,Division, largest and smallest number in an array. BCD to ASCII and ASCII to BCD.

UNIT -IV:

BASIC 8086 CONFIGURATIONS – Minimum mode and Maximum Mode, Interrupt Priority Management I/O Interfaces: Serial Communication interfaces, Parallel Communication, Programmable Timers, Keyboard and display, DMA controller

UNIT -V: ARM PROCESSOR: Introduction to 16/32 bit processors, Arm architecture & organization, Arm based MCUs, Programming model, Instruction set.

TEXTBOOKS:

1. Microprocessor Architecture, Programming and Applications with the 8085 – Penram International Publishing, Mumbai.- Ramesh S. Gaonakar

2. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and Glenn SA Gibson
3. Microcontrollers Architecture Programming, Interfacing and System Design

– Raj Kamal Chapter: 15.1, 15.2, 15.3, 15.4.1 5. 8086 and

8088 Microprocessor by Tribel and avatar singh

REFERENCES:

1. Microprocessors and Interfacing – Douglas V.Hall
2. Microprocessor and Digital Systems – Douglas V. Hall
3. Advanced Microprocessors & Microcontrollers - B.P.Singh & Renu Singh – New Age
4. The Intel Microprocessors – Architecture, Programming and Interfacing – Bary B. Brey.
5. Arm Architecture reference manual –Arm ltd.

OUTCOMES:

- The student can gain good knowledge on microprocessor and implement in practical applications
- Design system using memory chips and peripheral chips for 16 bit 8086 microprocessor.
- Understand and devise techniques for faster execution of instructions, improve speed of operations and enhance performance of microprocessors.
- Understand multi core processor and its advantages

Course Code: 24(ELE)M43P

SEMESTER-IV

COURSE 11: MICROPROCESSOR SYSTEMS

Practical | Credits: 1 | 2 hrs/week

List of Experiment

Programs using Intel 8085 /8086

1. Addition and Subtraction (8 bit and 16-bit) 2. Multiplication and Divition (8-bit)
3. Largest number in an array.
4. Smallest number in an array.
5. BCD to ASCII and ASCII to BCD .
6. Program To Convert Two Bcd Numbers In To Hex
7. Program To Convert Hex Number In To Bcd Number.
8. Program To Find The Square Root Of A Given Number.
9. Interfacing Experiments Using 8086 Microprocessor (Demo):
1. Traffic Light Controller
2. Elevator,
3. 7-Segment Display

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS
[2023-24 Batch onwards]

Course Code: 24(ELE)M43

II Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-IV
COURSE 11: MICROPROCESSOR SYSTEMS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	2	2	2	2	3	3
CO 2	2	3	2	1	1	1	3	3	2	3
CO 3	3	2	2	1	2	2	3	2	2	2
CO 4	3	3	1	1	1	1	3	3	2	3
CO 5	3	3	1	2	2	1	2	2	3	2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	2	2	2	3
CO 2	3	3	2	2	3
CO 3	2	3	2	3	2
CO 4	3	3	3	2	3
CO 5	3	3	2	3	2

Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(ELE)M43

BLUE PRINT (:MICROPROCESSOR SYSTEMS)
IIB.Sc. (Hons.) ELECTRONICS- SEM-IV/Course : 11
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	CPU ARCHITECTURE	2	2	30
2.	II	8085 INSTRUCTION SET	2	2	30
3.	III	ASSEMBLY LANGUAGE PROGRAMMING USING 8085	2	2	30
4.	IV	BASIC 8086 CONFIGURATIONS	2	2	30
5.	V	ARM PROCESSOR	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M43

II Year B.Sc (Hons.)- ELECTRONICS
SEMESTER-IV COURSE 11: MICROPROCESSOR SYSTEMS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following [5 X 8 = 40]

1. a) Explain the architecture of INTEL 8085 microprocessor?
   [OR]
   b) Describe the addressing modes supported by the INTEL 8086 microprocessor?

2. a) Discuss the various categories of instructions in the 8085 microprocessor instruction set?
   [OR]
   b) Explain the timing diagram for the execution of an instruction in the 8085 microprocessor?

3. a) Write assembly language programs for multiplication, and division using the 8085?
   [OR]
   b) Explain the process of finding the largest and smallest number in an array by using 8085?

4. a) Explain the interrupt priority management system in the INTEL 8086 microprocessor?
   [OR]
   b) Discuss the significance of programmable timers in microprocessor-based systems?

5. a) Compare and contrast 16-bit and 32-bit ARM processors in terms of architecture?
   [OR]
   b) Discuss the instruction set architecture (ISA) of ARM processors?

SECTION – B

Answer any FIVE Questions of the following [5 X 4 = 20]

6. a) Define the components of the CPU architecture in a microprocessor?
7. a) Explain the pin configuration of INTEL 8085 microprocessor?
8. a) What are the different types of data transfer instructions in the 8085?
9. a) Explain the purpose and usage of branch instructions in the 8085?
10. a) Write the addition and subtraction operations in assembly language using the 8085?
11. a) What are BCD and ASCII representations?
12. a) Explain how interrupt handling is managed in the 8086 microprocessor?
13. a) What role do DMA controllers play in enhancing the efficiency of data transfer in 8086?

14. a) What distinguishes ARM processors from other microprocessor architectures?
15. a) How does ARM processor architecture support scalability in embedded systems?

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M43

II Year B.Sc (Hons.)- ELECTRONICS
SEMESTER-IV COURSE 11: MICROPROCESSOR SYSTEMS
QUESTION BANK

UNIT - I: CPU ARCHITECTURE

Essay Questions:

1. Explain the architecture of INTEL 8085 microprocessor. Discuss its CPU, ALU unit, Register organization, and the roles of Address, Data, and Control Buses.
2. Describe the addressing modes supported by the INTEL 8086 microprocessor. How do these modes influence the flexibility and efficiency of programming?
3. Compare and contrast the pin configuration and instruction execution timing between INTEL 8085 and INTEL 8086 microprocessors.

Short Questions:

1. Define the components of the CPU architecture in a microprocessor.
2. Explain the role and function of the Arithmetic Logic Unit (ALU) in a microprocessor.
3. What are the different types of addressing modes used in microprocessors?
4. Discuss the significance of Address, Data, and Control Buses in microprocessor communication.
5. List and briefly explain the pin configuration of INTEL 8085 microprocessor.
6. How does the instruction format of INTEL 8086 microprocessor influence its operation?

UNIT - II: 8085 INSTRUCTION SET

Essay Questions:

1. Discuss the various categories of instructions in the 8085 microprocessor instruction set. Provide examples and explain their significance in programming.
2. Explain the timing diagram for the execution of an instruction in the 8085 microprocessor. How does timing affect the performance of the processor?
3. How are machine control instructions used in the 8085 microprocessor? Provide examples and discuss their role in program control.

Short Questions:

1. What are the different types of data transfer instructions in the 8085 microprocessor?
2. Describe the logical instructions available in the 8085 microprocessor instruction set.
3. Provide examples of arithmetic instructions in the 8085 microprocessor and explain their operation.
4. Explain the purpose and usage of branch instructions in the 8085 microprocessor.
5. How do machine control instructions differ from data transfer and arithmetic instructions?
6. Discuss the role of the instruction set in determining the capabilities of a microprocessor.

UNIT - III: ASSEMBLY LANGUAGE PROGRAMMING USING 8085

Essay Questions:

1. Write assembly language programs for addition, subtraction, multiplication, and division using the 8085 microprocessor. Discuss the steps involved in programming each operation.
2. Explain the process of finding the largest and smallest number in an array using assembly language programming with the 8085 microprocessor.
3. Discuss the conversion processes between BCD (Binary Coded Decimal) and ASCII (American Standard Code for Information Interchange) using assembly language programming with the 8085 microprocessor.

Short Questions:

1. How are addition and subtraction operations implemented in assembly language using the 8085 microprocessor?
2. Describe the multiplication and division algorithms typically used in assembly language programming for the 8085 microprocessor.
3. Explain the method to find the largest and smallest number in an array using assembly language.
4. What are BCD and ASCII representations, and how do they differ in terms of data encoding?
5. Discuss the significance of BCD to ASCII and ASCII to BCD conversions in microprocessor applications.
6. How does assembly language programming differ from high-level language programming?

UNIT - IV: BASIC 8086 CONFIGURATIONS AND I/O INTERFACES

Essay Questions:

1. Differentiate between Minimum Mode and Maximum Mode configurations of the INTEL 8086 microprocessor. Discuss their respective advantages and applications.
2. Explain the interrupt priority management system in the INTEL 8086 microprocessor. How are interrupts prioritized and handled during program execution?
3. Discuss the role and functionality of various I/O interfaces such as serial communication interfaces, parallel communication, programmable timers, keyboard and display controllers, and DMA controllers in the context of microprocessor-based systems.

Short Questions:

1. What are the key differences between Minimum Mode and Maximum Mode configurations in the 8086 microprocessor?
2. Explain how interrupt handling is managed in the 8086 microprocessor.
3. Describe the purpose and operation of serial communication interfaces in microprocessor systems.
4. How does parallel communication interface with microprocessors differ from serial communication?
5. Discuss the significance of programmable timers in microprocessor-based systems.
6. What role do DMA controllers play in enhancing the efficiency of data transfer in microprocessor systems?

UNIT - V: ARM PROCESSOR

Essay Questions:

1. Compare and contrast 16-bit and 32-bit ARM processors in terms of architecture, organization, and application domains. Discuss their advantages and disadvantages.
2. Explain the architecture and organization of ARM-based MCUs (Microcontroller Units). How do they differ from traditional ARM processors?
3. Discuss the programming model and instruction set architecture (ISA) of ARM processors. How does ARM ISA support both high-level and low-level programming paradigms?

Short Questions:

1. What distinguishes ARM processors from other microprocessor architectures?
2. Describe the typical architecture of ARM-based MCUs and their targeted applications.
3. How does the ARM instruction set architecture facilitate efficient program execution?
4. Compare the advantages of 16-bit and 32-bit ARM processors in embedded system applications.
5. Discuss the impact of ARM architecture on the development of mobile computing devices.
6. How does ARM processor architecture support scalability and versatility in embedded systems?

Programme: B.Sc. Honours in Electronics (Major/ Minor)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM51/ 24ELEN51**

SEMESTER-V (III Year) COURSE 12: CELLULAR MOBILE COMMUNICATION

Theory Credits: 4 5 Hrs/Week

Course Objectives: The course on Cellular Mobile Communication aims

- To familiarize students with cellular network.
- Essential knowledge to be acquainted in the area of Mobile Communication.

Learning Outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand the basics of digital cellular system, cordless telephony and cell structure.	Level 2 (Understanding)
CO 2	Design GSM wireless protocol and markup language fundamentals.	Level 6 (Create)
CO 3	Understand the Basics of WLL and Bluetooth technology.	Level 2 (Understanding)
CO 4	Understand the Wireless application protocol.	Level 2 (Understanding)
CO 5	Design the Wireless local loop.	Level 6 (Create)

SYLLABUS

UNIT–I

Advanced mobile phone service - Global system for mobile communication - Digital cellular system - Cordless telephony - Third generation wireless systems, *Comparison of Common wireless system*.

UNIT–II

Cell structure - Hand off - roaming management - Hand off detection - Channel assignment techniques - Interference - ACI, CCI - Intersystem hand off and authentication - Network signalling - Cellular digital packet data.

UNIT–III

GSM - Network signalling, mobility management, short message service - International roaming, administration and operation.

UNIT–IV

Wireless application protocol - Architecture - Datagram - Transport layer securities - Transaction protocol - Session protocol application environment, wireless markup language, WML - Script wireless telephony applications.

UNIT–V

Introduction to Wi-Fi, Third generation mobile services - Wireless local loop - Bluetooth technology, *Security issues and Challenges in a Wireless network*.

Text Books

1. Mobile Communications - Jochen Schiller, 7/e, Pearson Education, 2003.
2. Principles of Wireless Networks - Kauch Pahalavan & Prahanet Krishnamoorthy, 2/e, Pearson Education, 2004.

Reference Books

1. Wireless and Mobile Networks Architecture - Yi-Bing Lin & Imrich Chlamtac, John Wiley, 2001.
2. Wireless and Mobile Communication - Theodore Rappaport, Pearson Education, 2001.

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	2	3	3
CO 2	3	1	1	1	1	2	3	2	3	3
CO 3	3	1	1	1	1	2	3	2	3	3
CO 4	3	1	1	1	1	2	2	2	3	3
CO 5	3	1	1	1	1	2	2	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major/ Minor)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM51P/ 24ELEN51P**

SEMESTER-V (III Year) COURSE 12: CELLULAR MOBILE COMMUNICATION Practical Course

Practical Credits: 1 2 Hrs/Week

COURSE OBJECTIVE:

- To familiarize the students with experimental techniques in Cellular mobile communication.
- To provide hands-on experience in conducting experiments related to Cellular mobile communication.

LEARNING OUTCOMES:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Gain a solid understanding of fundamental concepts in Cellular mobile communication.	Level 2 (Understanding)
CO 2	Acquire knowledge of experimental techniques and methodologies used in the field of Cellular mobile communication.	Level 2 (Understanding)
CO 3	Understand the principles and operation of laboratory equipment and instruments specific to Cellular mobile communication experiments.	Level 2 (Understanding)
CO 4	Develop proficiency in conducting experiments related to Cellular mobile communication. Acquire skills in data acquisition, analysis, and interpretation using appropriate software and techniques.	Level 2 (Understanding) Level 4 (Analysing) Level 6 (Create)
CO 5	Learn to design and perform experiments, including calibration, measurement, and control of variables.	Level 2 (Understanding) Level 3 (Applying) Level 6 (Create)

List of Experiments:

1. GSM Signal Reception and Decoding
2. Hand off Simulation in Cellular Networks
3. Implementation and Analysis of SMS in GSM Networks
4. Develop and test a simple mobile application using Wireless Markup Language (WML) and WML Script
5. Bluetooth-Based Wireless Data Transfer.

Programme: B.Sc. Honours in Electronics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM51/ 24ELEN51**
SEMESTER-V (III Year) COURSE 12: CELLULAR MOBILE COMMUNICATION

Theory Credits: 4 5 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM51/ 24ELEN51**
SEMESTER-V (III Year) COURSE 12: CELLULAR MOBILE COMMUNICATION

Theory Credits: 4 5 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Unit – I	2 (One out of two)	2
2	Unit – II	Unit – II	2 (One out of two)	2
3	Unit – III	Unit – III	2 (One out of two)	2
4	Unit – IV	Unit – IV	2 (One out of two)	2
5	Unit – V	Unit – V	2 (One out of two)	2

Programme: B.Sc. Honours in Electronics (Major/ Minor)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM51/ 24ELEN51**

SEMESTER-V (III Year) COURSE 12: CELLULAR MOBILE COMMUNICATION

Theory Credits: 4 5 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. What are the main features of Cordless Telephony, and how does it differ from mobile telephony?
2. Explain the basic architecture of the Global System for Mobile Communication (GSM).
3. What is the role of network signaling in cellular communication, and how does it impact overall network performance?
4. Describe the process of handoff detection in cellular networks.
5. What is the significance of Short Message Service (SMS) in GSM networks?
6. Explain the concept of network signaling in GSM and its importance in communication.
7. What is Wireless Markup Language (WML), and how is it used in wireless telephony applications?
8. Describe the role of Wireless Application Protocol (WAP) in mobile communication.
9. What is Wireless Local Loop (WLL), and how does it contribute to the telecommunications infrastructure?
10. Explain the basic working principle of Bluetooth technology.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Discuss the evolution of mobile phone services from Advanced Mobile Phone Service (AMPS) to Third Generation (3G) wireless systems?

OR

(b) Analyze the key differences between Global System for Mobile Communication (GSM) and Digital Cellular Systems.

12. (a) Examine the significance of hand off and roaming management in cellular networks?

OR

(b) Evaluate the different channel assignment techniques used in cellular networks?

13. (a) Discuss the role of mobility management in GSM networks. How does it facilitate seamless communication for users on the move?

OR

(b) Analyze the challenges and solutions associated with international roaming in GSM networks.

14. (a) Examine the architecture of Wireless Application Protocol (WAP) and its role in enabling mobile internet services. How does it differ from traditional internet protocols.

OR

(b) Analyze the security challenges in WAP, focusing on Datagram Transport Layer Security (DTLS) and Wireless Transport Layer Security (WTLS)?

15. (a) Discuss the technological advancements and challenges in the development of Third Generation (3G) mobile services.

OR

(b) Evaluate the impact of Bluetooth technology on wireless communication. How does it differ from other wireless technologies like Wi-Fi?

Question Bank
Short answer Questions

1. What are the main features of Cordless Telephony, and how does it differ from mobile telephony?
2. Explain the basic architecture of the Global System for Mobile Communication (GSM).
3. What is the role of network signaling in cellular communication, and how does it impact overall network performance?
4. Write a short note on Network signaling.
5. Explain about Wireless application protocol.
6. Describe the process of handoff detection in cellular networks.
7. What is the significance of Short Message Service (SMS) in GSM networks?
8. Explain the concept of network signaling in GSM and its importance in communication.
9. What is Wireless Markup Language (WML), and how is it used in wireless telephony applications?
10. Describe the role of Wireless Application Protocol (WAP) in mobile communication.
11. What is Wireless Local Loop (WLL), and how does it contribute to the telecommunications infrastructure?
12. Explain the basic working principle of Bluetooth technology.

Long answer Questions

1. Discuss the evolution of mobile phone services from Advanced Mobile Phone Service (AMPS) to Third Generation (3G) wireless systems?
2. Analyze the key differences between Global System for Mobile Communication (GSM) and Digital Cellular Systems.
3. Examine the significance of hand off and roaming management in cellular networks?
4. Evaluate the different channel assignment techniques used in cellular networks?
5. Discuss the role of mobility management in GSM networks. How does it facilitate seamless communication for users on the move?
6. Analyze the challenges and solutions associated with international roaming in GSM networks.
7. Examine the architecture of Wireless Application Protocol (WAP) and its role in enabling mobile internet services. How does it differ from traditional internet protocols.
8. Analyze the security challenges in WAP, focusing on Datagram Transport Layer Security (DTLS) and Wireless Transport Layer Security (WTLS)?
9. Discuss the technological advancements and challenges in the development of Third Generation (3G) mobile services.

10. Evaluate the impact of Bluetooth technology on wireless communication. How does it differ from other wireless technologies like Wi-Fi?

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
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0891-2553262, https://www.drvskrishnagdc.edu.in

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
III Year BSC Electronics
SEMESTER-V
COURSE CODE: 24ELEM52
COMPUTER NETWORK

Theory	Credits:4	5hrs/week

Objective: This course covers the architecture, protocols, and functions of network communication layers, including physical, data link, network, transport, session, presentation, and application layers, with a focus on transmission methods, error handling, and advanced network technologies.

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Classify various transmission media and assess their suitability for different physical layer applications.	Level 1
CO 2	Apply channel allocation methods like ALOHA, S-ALOHA, and Finite ALOHA to manage network traffic effectively.	Level 6
CO 3	Explain the functionality of LAN protocols IEEE 802.3, 802.4, 802.5, 802.6, and 802.11 in network communication.	Level 3
CO 4	Analyze the impact of different channel allocation strategies on network performance and reliability.	Level 4
CO 5	Design network systems incorporating appropriate transmission media and channel allocation methods to optimize communication.	Level 6

SYLLABUS

UNIT-I

Network structure Point to Point, Broadcast, Multicast - Horizontal and vertical distribution - Star, Mesh, tree, bus structures - OSI 7 layer model - Architecture - Functions of layers - Packet switches, circuit switching and message switching.

UNIT-II

Physical layer - Transmission media - Channel allocation methods - ALOHA, S-ALOHA, FINITE ALOHA - LAN Protocols IEEE802.3, 802.4, 802.5, 802.6 and 802.11.

UNIT-III

Data link layer - Framing - Error detection - Error correction - CRC - Stop and wait - Go band N - Sliding window Protocol - Selective repeat.

UNIT-IV

Network layer - Routing algorithms and congestion control algorithms - Repeaters, Bridges, Routers and Gateways, Internet working - Introduction to transport layer and session layer.

UNIT-V

Presentation layer - coding, compression and cryptography - Introduction to Application layer - High performance networks - ATM, Fast Ethernet, FDDI, DQDB, SONET and SDH.

Text Books

1. Computer Networks - *Andrew S. Tanenbaum*, 4/e, Pearson Education, 2005.
2. Data and Computer Communication - *W. Stallings*, 7/e, Pearson Education, 2006.

Reference Books

1. Introduction to Data Communications and Networking - *Behrouz & Forouzan*, 4/e, McGraw Hill Book Company, 2004.
2. Telecommunication Networks - Protocols Modeling and Analysis - *Misha Stewartz*, 2/e, Pearson Education, 2002.

CO-PO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

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Programme: B.Sc. Honours in Electronics(Major)

w.e.f. AY 2023-24
III Year BSC Electronics
SEMESTER-V
COURSE CODE: 24ELEM52
COMPUTER NETWORK

Max Marks-60 **Time-3Hrs.** **Credits:4**

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics(Major)

w.e.f. AY 2023-24

III Year BSC Electronics

SEMESTER-V

COURSE CODE: 24ELEM52

COMPUTER NETWORK

Max Marks-60 **Time-3Hrs.** **Credits:4**

Blue Print for Semester End Theory Examinations

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2 (two out of four)**	**1 (one out of two**
Understanding/ Comprehension	**27%**	**16**	**2 (two out of four)**	
Application	**20%**	**12**	**1 (one out of two)**	**1 (one out of two**
Analysis	**13%**	**8**		**2 (two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1 (one out of two**
Total	**100**	**60**	**5 (each question has internal choice)**	**5 outb of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	**8 marks**	**4 marks**
1	**I**	Network structure	**2 (one out of two)**	**2**
2	**II**	Physical layer - Transmission	**2 (one out of two**	**2**
3	**III**	Data link layer	**2 (one out of two)**	**2**
4	**IV**	Network layer - Routing algorithms and	**2 (one out of two)**	**2**
5	**V**	Presentation layer - coding, compression and	**2(one out of two)**	**2**
		TOTAL QUESTIONS	**5 (each question has internal choice)**	**5 out of given 10**

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
III Year BSC Electronics
SEMESTER-V
COURSE CODE: 24ELEM52
COMPUTER NETWORK
Max Marks-60 Time-3Hrs. Credits:4
(MODEL PAPER)

DURATION::3 hrs **MAX.MARKS :: 60**

SECTION-A

Answer any FIVE questions of the following (5 X 4 = 20M)

1. Briefly describe the main function of the OSI model's Transport Layer.
2. What is the primary advantage of packet switching over circuit switching?
3. Briefly describe the purpose of the IEEE 802.3 protocol.
4. What type of transmission media is most suitable for long-distance communication?
5. What is the primary purpose of framing in data communication?
6. Briefly explain how the CRC method detects errors in transmitted data.
7. What is the purpose of congestion control in networking?
8. Define internetworking in the context of the Network Layer.
9. What is the primary function of the Presentation Layer in the OSI model?
10. Briefly describe the difference between ATM and Fast Ethernet.

SECTION-B

Answer ALL the questions of the following (5 X 8 = 40 M)

11. (a)Discuss the differences between Point-to-Point, Broadcast, and Multicast network structures. How do these structures impact network performance and scalability?
    [OR]
    (b)Compare and contrast packet switching, circuit switching, and message switching. Discuss the scenarios in which each switching method is most effective.
12. (a) Explain the channel allocation methods, including ALOHA, Slotted ALOHA, and Finite ALOHA. How do these methods differ in terms of efficiency and reliability?
    [OR]
    (b)Analyze the IEEE 802 LAN protocols (802.3, 802.4, 802.5, 802.6, and 802.11). How do these protocols address different networking requirements, and what are their key features?

13. (a)Explain the mechanisms of error detection and correction in the Data Link Layer, focusing on Cyclic Redundancy Check (CRC) and Hamming code.

    [OR]

    (b)Compare the Stop-and-Wait, Go-Back-N, and Sliding Window protocols. How do these protocols manage data flow and ensure reliable communication?

14. (a)Explain the congestion control techniques employed in the Network Layer. How do these techniques prevent network overload and maintain performance?

    [OR]

    (b)Analyze the roles of repeaters, bridges, routers, and gateways in network communication. How do these devices facilitate internetworking across different types of networks?

15. (a) Discuss the role of the Presentation Layer in the OSI model, focusing on its functions in coding, compression, and cryptography. How does this layer ensure data security and efficiency?

    [OR]

    (b) Evaluate the use of Digital Circuit Switched Networks (DQDB) in high-speed networking. What are the advantages and limitations of using DQDB in various applications?

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
III Year BSC Electronics
SEMESTER-V
COURSE CODE: 24ELEM52
COMPUTER NETWORK

Max Marks-60 **Time-3Hrs.** **Credits:4**

Question Bank

Unit I: Network Structure

Essay Questions:

1. Discuss the differences between Point-to-Point, Broadcast, and Multicast network structures. How do these structures impact network performance and scalability?
2. Explain the various network topologies, such as Star, Mesh, Tree, and Bus structures. What are the advantages and disadvantages of each topology in different network scenarios?
3. Analyze the OSI 7-layer model. Describe the architecture and functions of each layer, and explain how they interact to facilitate network communication.
4. Compare and contrast packet switching, circuit switching, and message switching. Discuss the scenarios in which each switching method is most effective.

Short Answer Questions:

1. What are the key differences between a Star and Mesh network topology?
2. Briefly describe the main function of the OSI model's Transport Layer.
3. What is the primary advantage of packet switching over circuit switching?
4. Define multicast in the context of network communication.

Unit II: Physical Layer

Essay Questions:

1. Discuss the different types of transmission media used in networking. How do factors like bandwidth, attenuation, and noise affect the choice of transmission media?
2. Explain the channel allocation methods, including ALOHA, Slotted ALOHA, and Finite ALOHA. How do these methods differ in terms of efficiency and reliability?
3. Analyze the IEEE 802 LAN protocols (802.3, 802.4, 802.5, 802.6, and 802.11). How do these protocols address different networking requirements, and what are their key features?
4. Evaluate the role of the Physical Layer in the OSI model. How does it interact with other layers to ensure effective data transmission?

Short Answer Questions:

1. What is the main difference between ALOHA and Slotted ALOHA?
2. Briefly describe the purpose of the IEEE 802.3 protocol.

3. What type of transmission media is most suitable for long-distance communication?
4. Define channel allocation in the context of network communication.

Unit III: Data Link Layer

Essay Questions:

1. Discuss the concept of framing in the Data Link Layer. How does framing contribute to data integrity and error detection?
2. Explain the mechanisms of error detection and correction in the Data Link Layer, focusing on Cyclic Redundancy Check (CRC) and Hamming code.
3. Compare the Stop-and-Wait, Go-Back-N, and Sliding Window protocols. How do these protocols manage data flow and ensure reliable communication?
4. Analyze the Selective Repeat protocol. How does it differ from Go-Back-N, and in what scenarios is it more advantageous?

Short Answer Questions:

1. What is the primary purpose of framing in data communication?
2. Briefly explain how the CRC method detects errors in transmitted data.
3. How does the Sliding Window protocol improve upon the Stop-and-Wait protocol?
4. What is the key difference between Go-Back-N and Selective Repeat protocols?

Unit IV: Network Layer

Essay Questions:

1. Discuss the different routing algorithms used in the Network Layer. How do these algorithms impact network efficiency and reliability?
2. Explain the congestion control techniques employed in the Network Layer. How do these techniques prevent network overload and maintain performance?
3. Analyze the roles of repeaters, bridges, routers, and gateways in network communication. How do these devices facilitate internetworking across different types of networks?
4. Evaluate the interaction between the Network Layer and the Transport Layer in the OSI model. How do these layers work together to ensure end-to-end data delivery?

Short Answer Questions:

1. What is the primary function of a router in a network?
2. Briefly describe the difference between a bridge and a gateway.
3. What is the purpose of congestion control in networking?
4. Define internetworking in the context of the Network Layer.

Unit V: Presentation Layer and High-Performance Networks

Essay Questions:

1. Discuss the role of the Presentation Layer in the OSI model, focusing on its functions in coding, compression, and cryptography. How does this layer ensure data security and efficiency?
2. Explain the concept of high-performance networks and their importance in modern communication systems. How do technologies like ATM, Fast Ethernet, and FDDI contribute to network performance?

3. Analyze the significance of SONET and SDH in telecommunications. How do these technologies improve network reliability and data transfer rates?
4. Evaluate the use of Digital Circuit Switched Networks (DQDB) in high-speed networking. What are the advantages and limitations of using DQDB in various applications?

Short Answer Questions:

1. What is the primary function of the Presentation Layer in the OSI model?
2. Briefly describe the difference between ATM and Fast Ethernet.
3. How does FDDI improve network performance in high-speed networks?
4. What is the purpose of using cryptography in the Presentation Layer?

Dr. VS KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM

BLUE PRINT (COURSE CODE: 24ELEM53A)

Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-V
COURSE 14 A: INDUSTRIAL ELECTRONICS

MAX MARKS – 60 TIME – 3 HOURS
(CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-A) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-B) Each one 4 marks
1	I	Rectifiers and filters:	1	2
2	II	Power Supplies	1	2
3	III	Voltage Multipliers	1	2
4	IV	Controlled rectifiers	1	2
5	V	Heat effects	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120-60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

Programme: B.Sc. Honours in Electronics (Major) -2024-2025

SEMESTER-V

COURSE 14 A: INDUSTRIAL ELECTRONICS

Theory Credits: 3 3 hrs/week

Note-1: For Semester–V, for the domain subject Electronics, any one of the above three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (A, B, C allotment is random, not on any priority basis).

Note-2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.

Learning Outcomes:

Students after successful completion of the course will be able to understand electrical instruments, apply knowledge on various electrical meters, analyse the data acquired.

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understanding and Identify various facilities required to set up a basic Instrumentation Laboratory.	Level 2 (Understanding)
CO 2	Applying critical knowledge of various Electrical Instruments used in the Laboratory applications.	Level 3 (Applying)
CO 3	Understanding of using instruments like Rectifiers, Multimeters, Power supplies, Voltage Regulators etc. through hands on experience.	Level 2 (Understanding)
CO 4	Understand the Principle and operation of different Electronic Heating devices.	Level 2 (Understanding) Level 3 (Applying)
CO 5	applications of Rectifiers, Multimeters, Power supplies, Voltage Regulators etc.	Level 3 (Applying)

Syllabus

UNIT-I (20 hours)

Rectifiers and filters:

Introduction to Rectifiers, Definition and purpose of rectifiers, Overview of AC to DC conversion, Importance in power supplies and electronic circuits,
Rectifiers– Half wave, full wave and bridge rectifiers- Efficiency- Ripple factor- Regulation – Harmonic components in rectified output – Types of filters- Choke input (inductor) filter- Shunt capacitor filter- L section and section filters.

Voltage Regulators: Transistor Series voltage regulator - Transistor Shunt voltage regulator – Three terminal regulators (78XX and 79XX).

UNIT-II (10 hours)

Power Supplies: Introduction to Power Supplies, Definition and purpose, Overview of power supply systems, Types of power supplies (linear, switching, etc.), Applications in electronics and electrical systems.
Block diagram of regulated power supply – A simple regulated transistorized power supply (circuit and working) – Principle and working of switch mode power supply (SMPS).

UNIT-III (10 hours)

Voltage Multipliers: ***Introduction to Voltage Multipliers, Definition and purpose, Basic principles of voltage multiplication, Historical context and applications.***

Half wave voltage doubler, Full wave voltage doubler, Voltage Tripler circuit diagram and working mentioning of applications of voltage multipliers.

UNIT-IV (10 hours)

Controlled rectifiers: ***Introduction to Controlled Rectifiers, Definition and purpose, Difference between uncontrolled and controlled rectifiers, Overview of power control and regulation.***

SCR Half wave rectifier circuit, working with wave forms, mathematical analysis for resistive load - SCR Full wave rectifier circuit, working with wave forms, mathematical analysis for resistive load – SCR as inverter parallel and series circuits.

UNIT-V (10 hours)

Heat effects: Resistance, inductance and dielectric heating. Principle of operations and its applications. ***Power dissipation in resistors, capacitors, and inductors.Heat generation in semiconductors and integrated circuits.***

Reference Books:

1. Industrial Electronics, S.B. Biswas, Dhanapur Rai & Sons.
2. Industrial Electronics, G.K. Mithal, Khanna Publishers.
3. Electronic Devices and Circuits – G.K. Mithal.
4. Electronic Devices and Circuits-Millman and Halkias- Tata Mc Graw Hill (TMH)
5. Microelectronics- J. Millman and A. Grabel – TMH
6. Unified Electronics Volume II by J.P Agarwal and Amit Agarwal.

Programme: B.Sc. Honours in Electronics (Major) -2024-2025

SEMESTER-V

COURSE 14 A: INDUSTRIAL ELECTRONICS
(COURSE CODE: 24ELEM53AP)

Practical Credits: 1 2 hrs/week

(ANY SIX EXPERIMEMTS SHOULD BE DONE)

1. D.C Power supply and filters.
2. Transistor series regulator
3. Transistor as a shunt regulator
4. Voltage regulator using IC-7805and IC-7905.
5. Voltage doubler using diodes
6. Voltage Tripler using diodes
7. SCR VI characteristics.
8. SCR Series inverter
9. SCR parallel inverter.

COURSE OBJECTIVE:

The objective of the practical course on industrial electronics is to provide students with hands-on experience and practical skills in the operation, calibration, and application of electrical instruments.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	List out, identify and handle various equipment like D.C Power supply and filters, Transistor series regulator, Transistor as a shunt regulator, Voltage regulator using IC-7805and IC-7905,Voltage doubler using diodes, Voltage Tripler using diodes.	Level 2 (Understanding) Level 3 (Applying) Level 1 (Knowledge)
CO 2	Learn the procedures of operation of various electrical instruments.	Level 2 (Understanding)
CO 3	Demonstrate skills on testing filters, regulators, diodes and characteristics of inverters.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Acquire skills in observing and measuring the filters, regulators, diodes and characteristics of inverters.	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Perform some techniques related to testing the filters, regulators, diodes and characteristics of inverters. Understand the technique of operation filters, regulators, diodes and characteristics of inverters.	Level 3 (Applying) Level 4 (Analysing) Level 2 (Understanding)

SEMESTER-V
COURSE 14 A: INDUSTRIAL ELECTRONICS
(COURSE CODE: 24ELEM53A)

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A: Short Answer Questions

(Answer any 5 questions out of the 10. Each question carries 4 marks.)
4×5=20

1. What is the ripple factor in rectifier circuits, and how does it affect the output voltage?
2. Write the circuit diagram of a bridge rectifier and explain its working principle.
3. What are the key differences between a linear power supply and a switch mode power supply (SMPS)?
4. Explain the role of a transformer in a regulated power supply circuit.
5. What is a voltage multiplier and why is it used in electronic circuits?
6. Draw and describe the circuit of a half-wave voltage doubler.
7. What is the function of an SCR in a controlled rectifier circuit?
8. Draw the waveform of an SCR half-wave rectifier and explain the key phases of operation.
9. What is the principle of resistance heating and how is it utilized in various appliances?
10. Define dielectric heating and give an example of its application.

Section B: Essay Questions

(Answer all questions. Each question carries 8 marks.) 8×5=40

11. (A) Discuss the working principles of half-wave and full-wave rectifiers. Compare their efficiency, ripple factor, and regulation. Include the impact of harmonic components in the rectified output in your discussion.

OR

(B) Explain the different types of filters used in rectifier circuits. Describe the operation, advantages, and limitations of Choke Input (Inductor) Filter, Shunt Capacitor Filter, and L-section and π-section filters. Illustrate your answer with circuit diagrams and relevant equations.

12. (A) Explain the block diagram of a regulated power supply. Describe the function of each block in the regulation process and discuss how these blocks work together to provide a stable output voltage.

OR

(B) Detail the design and working of a simple transistorized regulated power supply. Include the circuit diagram, operational principles, and components used. Discuss the advantages of using a regulated power supply.

13. (A) Explain the working of a half-wave voltage doubler. Include the circuit diagram and mathematical analysis. Discuss its applications and limitations.

OR

(B) Describe the operation of a full-wave voltage doubler with the help of a circuit diagram. Explain its working principle and applications, and compare it with the half-wave voltage doubler.

14. (A) Describe the different configurations of SCRs used as inverters in both parallel and series circuits. Discuss their working principles, advantages, and typical applications.

OR

(B) Analyze the performance and operational characteristics of controlled rectifiers using SCRs. Discuss their advantages over traditional rectifiers.

15. (A) Discuss the principle of resistance heating and its applications. Explain how resistance heating is used in industrial and domestic settings, including the types of materials and devices involved.

OR

(B) Explain the principle of inductance heating and its applications. Describe the process and compare it with resistance heating in terms of efficiency and typical use cases.

Honours in Electronics (Major) -2024-2025
SEMESTER-V
COURSE 14 A: INDUSTRIAL ELECTRONICS
(COURSE CODE: 24ELEM53A)

UNIT-I: Rectifiers and Filters; Voltage Regulators

Essay-Type Questions:

1. Discuss the working principles of half-wave and full-wave rectifiers. Compare their efficiency, ripple factor, and regulation. Include the impact of harmonic components in the rectified output in your discussion.
2. Explain the different types of filters used in rectifier circuits. Describe the operation, advantages, and limitations of Choke Input (Inductor) Filter, Shunt Capacitor Filter, and L-section and π-section filters. Illustrate your answer with circuit diagrams and relevant equations.
3. Describe the functioning of Transistor Series and Shunt Voltage Regulators. Compare them with Three-Terminal Voltage Regulators (78XX and 79XX series). Include their operational principles, typical applications, and advantages/disadvantages of each type.

Short Answer Questions:

1. What is ripple factor in rectifier circuits, and how does it affect the output voltage?
2. Write the circuit diagram of a bridge rectifier and explain its working principle.
3. Define voltage regulation and explain how it is achieved in a voltage regulator circuit.

UNIT-II: Power Supplies

Essay-Type Questions:

1. Explain the block diagram of a regulated power supply. Describe the function of each block in the regulation process and discuss how these blocks work together to provide a stable output voltage.
2. Detail the design and working of a simple transistorized regulated power supply. Include the circuit diagram, operational principles, and components used. Discuss the advantages of using a regulated power supply.
3. Describe the principle and working of a Switch Mode Power Supply (SMPS). Explain the key components involved, such as the switching transistor, transformer, and control circuitry. Discuss the advantages of SMPS over traditional linear power supplies.

Short Answer Questions:

1. What are the key differences between a linear power supply and a switch mode power supply (SMPS)?
2. Explain the role of a transformer in a regulated power supply circuit.
3. What is feedback control in the context of power supplies, and why is it important?

UNIT-III: Voltage Multipliers

Essay-Type Questions:

1. Explain the working of a half-wave voltage doubler. Include the circuit diagram and mathematical analysis. Discuss its applications and limitations.
2. Describe the operation of a full-wave voltage doubler with the help of a circuit diagram. Explain its working principle and applications, and compare it with the half-wave voltage doubler.
3. Discuss the voltage tripler circuit, including its circuit diagram and working principle. Explain its typical applications and how it compares with voltage doubler circuits.

Short Answer Questions:

1. What is a voltage multiplier and why is it used in electronic circuits?
2. Draw and describe the circuit of a half-wave voltage doubler.
3. Mention two common applications of voltage multipliers in electronic devices.

UNIT-IV: Controlled Rectifiers

Essay-Type Questions:

1. Analyze the working of an SCR Half Wave Rectifier. Include circuit diagrams, waveform analysis, and mathematical calculations for a resistive load. Discuss its applications.
2. Explain the operation of an SCR Full Wave Rectifier. Provide circuit diagrams, waveform analysis, and mathematical calculations. Compare it with the SCR Half Wave Rectifier in terms of efficiency and applications.
3. Describe the different configurations of SCRs used as inverters in both parallel and series circuits. Discuss their working principles, advantages, and typical applications.

Short Answer Questions:

1. What is the function of an SCR in a controlled rectifier circuit?
2. Draw the waveform of an SCR half-wave rectifier and explain the key phases of operation.

3. What are the advantages of using SCRs in power control applications compared to traditional diodes?

UNIT-V: Heat Effects

Essay-Type Questions:

1. Discuss the principle of resistance heating and its applications. Explain how resistance heating is used in industrial and domestic settings, including the types of materials and devices involved.
2. Explain the principle of inductance heating and its applications. Describe the process and compare it with resistance heating in terms of efficiency and typical use cases.
3. Describe dielectric heating, including its operational principle and applications. Discuss how dielectric heating compares with other heating methods in terms of efficiency and specific applications.

Short Answer Questions:

1. What is the principle of resistance heating and how is it utilized in various appliances?
2. Define dielectric heating and give an example of its application.
3. How does inductance heating differ from resistance heating in terms of the heating mechanism and application?

Major Courses offered w.e.f. AY 2024-25

SEMESTER-V COUSE CODE :24ELEM53B
COURSE 14B: EMBEDDED SYSTEM DESIGN

Theory Credits: 3 3 hrs/week

VARIATION OF SYLLABUS FROM THE APCHE PRESCRIBED SYLLABUS

S.No.	Unit	Name of the Unit	Syllabus Added/Deleted	Percentage Variation
			Changes in APCHE syllabus are not proposed	

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2024-25

SEMESTER-V COUSE CODE :24ELEM53B
COURSE 14B: EMBEDDED SYSTEM DESIGN

Theory Credits: 3 3 hrs/week

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand different types of embedded systems and Design Technology .	Level 2
CO 2	Design of logic systems and RT Level custom single purpose processor	Level 6
CO 3	Application of debugging techniques and testing host machine	Level 3
CO 4	Analysis of width modulators, LCD controllers, Analog to digital converters and time clocks	Level 4
CO 5	Understanding advanced communication systems	Level 2

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2024-25

SEMESTER-V COUSE CODE :24ELEM53B
COURSE 14B: EMBEDDED SYSTEM DESIGN

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	-	1	2	1	1	2	2	2	3
CO 2	3	1	2	1	1	1	3	2	2	3
CO 3	3	2	2	1	--	1	3	2	2	3
CO 4	3	1	2	1	1	2	3	2	2	3
CO 5	3	2	1	2	1	1	3	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	--	3
CO 2	3	3	2	1	3
CO 3	3	3	2	--	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Major Courses offered w.e.f. AY 2024-25

SEMESTER-V COUSE CODE :24ELEM53B
COURSE 14B: EMBEDDED SYSTEM DESIGN

Theory	Credits: 4	5 hrs/week

Course Outcomes

1. Understand different types of embedded systems and Design Technology
2. Design of logic systems and RT Level custom single purpose processor
3. Application of debugging techniques and testing host machine
4. Analysis of width modulators, LCD controllers, Analog to digital converters and time clocks
5. Understanding advanced communication systems

UNIT 1: (15Hrs)

Introduction to Embedded Systems:
Embedded systems overview, Design Challenge, Processor Technology, IC Technology, and Design Technology.
UNIT 2: (15Hrs)
Custom Single Purpose Processor – Hardware Development: Introduction, Combinational logic ,Sequential logic, Custom Single Purpose Processor Design, RT-Level Custom Single- Purpose Processor.
UNIT 3: (15Hrs)
General Purpose Processor – Software Development: Introduction, Basic Architecture, Operation, Programmer's View, ASIPs, and Development Environment: Host and Target Machines, Linker / Locators for Embedded Software, Getting Embedded Software into the target system. Debugging Techniques: Testing on your Host Machine, and Instruction Set Simulators.UNIT 4: (10Hrs)

RTWA for Embedded Systems: Introduction, Timers, Counters and Watchdog Timers, UART, Pulse Width Modulators, LCD Controllers, Keypad Controllers, Stepper Motor Controllers, Analog – to – Digital Converters, and Real Time

Clocks.

UNIT 5: (10Hrs)

Advanced Communication Principles:Parallel Communication, Serial Communication, Wireless Communication, Serial Protocols: I^2C, CAN, FireWire, and USB. Parallel Protocols: PCI BUSand ARM BUS. Wireless Protocols: IrDA, Bluetooth, and IEEE 802.11.

TEXT BOOKS:

1.Embedded System Design – A Unified Hardware / Software Introduction
By Frank Vahid /Tony Givargis – WILEY EDITION.

2.Embedded Systems Architecture, Programming and Design – 2nd Edition
By Raj Kamal –Tata McGraw-Hill Education.

REFERENCES:

1.An Embedded Software Premier - David E- Siman, PEARSON

2.Education Embedded / real - time systems - DR. K.V.K.K. Prasad, dreamtech

3.The art of programming Embedded systems, Jack G. Ganssle, academic press

4.Intelligent Embedded systems, Louis L. Odette, Adison Wesly, 1991

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

SEMESTER-V COUSE CODE :24ELEM53B

COURSE 14B: EMBEDDED SYSTEM DESIGN

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application/	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	UNIT-I		2(one out of two)	2
2	UNIT-II		2(one out of two)	2
3	UNIT-III		2(one out of two)	2
4	UNIT-IV		2(one out of two)	2
5	UNIT-V		2(one out of two)	2

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SEMESTER-V COUSE CODE :24ELEM53B

COURSE 14B: EMBEDDED SYSTEM DESIGN

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_5_)

(Programme)_____________ Course title__________________. Course code_________

Time: 3 hours Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7. ---
8. –
9. –
10. --

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (a).

(Or)

(b)

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM54A: DIGITAL SYSTEM DESIGN

Theory Credits: 3 3 hrs/week

Objectives

The students will learn:

- The fundamentals of Boolean algebra and simplification of Boolean functions
- The combinational logic circuits and their design using HDL
- The sequential logic circuits and their design using HDL

Learning outcomes: After completion of the course students will be

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Able to apply Boolean algebra and logic gate principles to simplify and design digital circuits	Level 3
CO 2	Able to analyze and design combinational circuits, including arithmetic operations and code conversion	Level 4
CO 3	Able to design and implement digital systems using MSI devices such as decoders, encoders, multiplexers, and demultiplexers, and apply HDL to model combinational circuits.	Level 6
CO 4	Able to design and analyze synchronous sequential circuits, including flip-flops, counters, and shift registers, and create HDL models for sequential logic systems.	Level 4
CO 5	Able to design and analyze asynchronous sequential circuits, focusing on state reduction, race-free state assignment, and the identification and elimination of hazards.	Level 4

UNIT-I

Boolean Algebra and Logic Gates: Review of binary number systems - Binary arithmetic - Binary codes - Boolean Algebra and theorems - Boolean functions - Simplifications of Boolean functions using Karnaugh map and tabulation methods - Logic gates. Universal Gates and Their Implementation

UNIT-II

Combinational Logic: Combinational circuits - Analysis and design procedures - Circuits for arithmetic operations - Code conversions - Introduction to Hardware Description Language (HDL). Multiplication and Division Circuits

UNIT-III

Design with MSI Devices: Decoders and Encoders - Multiplexers and Demultiplexers - Memory and programming logic - HDL for combinational circuits.

UNIT-IV

Synchronous Sequential Logic: Sequential circuits - Flip-flops - Analysis and design procedures - State reduction and state assignments - Shift registers - Counters - HDL for sequential logic circuits, shift registers and counters.

UNIT-V

Asynchronous Sequential Logic: Analysis and design of asynchronous sequential circuits - Reduction of state and flow tables - Race free state assignment - Hazards.

Added topics under Autonomy: Universal Gates and Their Implementation, Multiplication and Division Circuits.

Text Books

1. Digital Logic and Computer Design - *M. Morris Mano,* Prentice Hall of India Private Limited.
2. A Verilog HDL Premier - *J. Baskar*, Pearson Education.

Reference Books

1.Analysis and Modeling of Digital Systems - *Zain Allabedin Navabee*, 2/e , McGraw Hill Publishing Co. Ltd., New Delhi.

2.An Engineering Approach to Digital Design - *Fletcher*, Prentice Hall of India Private Limited.
3.Modern Digital Electronics - *R.P. Jain*, 2/e, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

4.Digital Fundamentals - *T.L. Floyd*, 8/e, Pearson Education.

Co-Curricular Activities

(a) Mandatory: (*Training of students by teacher in field related skills: (lab:10 + field:05*)

1. For Teacher: Training of students by the teacher in the in the laboratory/field for not less than 15 hours on the field techniques/skills of understanding the operation,

Maintenance and utility of various electrical and electronic instruments both in the Laboratory as well as in daily life.

For Student: Students shall (individually)visit a local electrical and electronics shop or small firm to familiarize with the various electrical and electronic instruments available in the market and also to understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.(Or) Student shall visit a diagnostic centre and observe the ECG machine and the ECG pattern(Or) Student shall visit a diagnostic centre and observe the CT scan and MRI scan.(Or) Student shall visit a mobile smart phone repair shop and observe the different components on the PCB(Motherboard), different ICs (chips) used in the motherboard and trouble shooting of touch screen in smart phones.

Observations shall be recorded in a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to be submitted to the teacher.

2. Max marks for Fieldwork/Project work: 05.
3. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.
4. Unit tests (IE)

Suggested Co-Curricular Activities

1. Training of students by related industrial / technical experts. 2. Assignments (including technical assignments like identifying different measuring instruments and tools and their handling, operational techniques with safety and security.
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Making your own stethoscope at home.
5. Making seven segment display at home.
6. Preparation of videos on tools and techniques in various branches of instrumentation.
7. Collection of material/figures/photos related to products of Measuring Instruments, Display Modules and Biomedical Instruments and arrange them in a systematic way in a file.
8. Visits to Instrumentation Laboratories of local Universities or Industries like Cement, Chemical or Sugar Plants etc. or any nearby research organizations, private firms, etc.
9. Invited lectures and presentations on related topics by Technical /industrial experts

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM54A: DIGITAL SYSTEM DESIGN

Practical Credits: 1 2 hrs/week

List of Experiments

1. To verify the fundamental theorems of Boolean algebra using basic logic gates
2. To simplify given Boolean functions using the Karnaugh map (K-map) method
3. To design and implement a binary to Gray code converter using logic gates.
4. To design and implement a 4-to-1 multiplexer using MSI devices
5. To design and implement a 4-bit synchronous counter using flip-flops.
6. To analyze and design a simple asynchronous sequential circuit.

Learning outcomes: After completion of the course students will be

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	**Analyze and validate the theoretical principles of Boolean algebra through practical implementation and observation of logic gate operations.**	Level 4
CO 2	**Design and implement optimized digital circuits based on simplified Boolean expressions derived from K-map analysis**	Level 6
CO 3	**Apply knowledge of code conversion techniques in digital systems, validating the accuracy and functionality of the designed converter circuit.**	Level 3
CO 4	**Analyze the operation and application of multiplexers in digital design, with a focus on optimizing circuit performance.**	Level 4
CO 5	**Identify and address challenges in asynchronous circuit design, such as race conditions and hazards, to ensure stable and reliable operation**	Level 4

Question Bank

UNIT-I: BOOLEAN ALGEBRA AND LOGIC GATES

Essay Type Questions:

1. Explain the fundamental principles of Boolean Algebra and its theorems.
2. How are Boolean functions simplified using Karnaugh maps and tabulation methods? Provide examples to illustrate the process.
3. Discuss the various types of logic gates and their significance in digital circuits.

Short Answer Questions:

1. What is the importance of binary number systems in digital electronics?
2. Define and give examples of binary codes.
3. How do logic gates implement Boolean functions in digital circuits?

UNIT-II: COMBINATIONAL LOGIC

Essay Type Questions:

1. Describe the analysis and design procedures for combinational circuits.
2. Provide detailed steps and examples of circuits for arithmetic operations and code conversions.
3. Introduce Hardware Description Language (HDL). How is it used in the design and implementation of combinational circuits?

Short Answer Questions:

1. What are the primary differences between combinational and sequential circuits?
2. Explain the role of code conversion in digital systems.
3. What is the significance of HDL in modern digital circuit design?

UNIT-III: DESIGN WITH MSI DEVICES

Essay Type Questions:

1. Explain the function and design of decoders and encoders in digital systems.
2. How are these components used in conjunction with HDL for combinational circuits?
3. Discuss the roles of multiplexers, demultiplexers, and memory in digital circuits. How does programming logic integrate with these devices?

Short Answer Questions:

1. What is a multiplexer, and how does it differ from a demultiplexer?
2. Define the function of a decoder in digital electronics?
3. How does memory contribute to the functionality of digital systems?

UNIT-IV: SYNCHRONOUS SEQUENTIAL LOGIC

Essay Type Questions:

1. Discuss the design and analysis procedures for synchronous sequential circuits, including flip-flops and shift registers. How are state reduction and state assignments performed?
2. Explain the role of HDL in designing sequential logic circuits, including shift registers and counters. Provide examples of HDL code snippets.

Short Answer Questions:

1. What is the purpose of a flip-flop in sequential circuits?
2. How are shift registers utilized in digital systems?
3. Describe the process of state reduction in sequential circuit design.

UNIT-V: ASYNCHRONOUS SEQUENTIAL LOGIC

Essay Type Questions:

1. Explain the analysis and design of asynchronous sequential circuits. Discuss the steps involved in reducing state and flow tables and achieving race-free state assignments.
2. Describe the concept of hazards in asynchronous sequential circuits. How are they identified and mitigated in circuit design?

Short Answer Questions:

1. What are the differences between synchronous and asynchronous sequential circuits?
2. Define race conditions in the context of asynchronous circuits.
3. How are state tables used in the design of asynchronous sequential circuits?

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 23ELEM54A: DIGITAL SYSTEM DESIGN

Theory | Credits: 3 | 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 23(ELE)M54A: DIGITAL SYSTEM DESIGN

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

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Programme: B.Sc. Honours in Electronics (Major)
COURSE CODE 23ELEM54A: DIGITAL SYSTEM DESIGN

Max Marks: 60

Model Paper

Section A
Answer any five questions from the following (4M$\times 5 = 20M$)

1. What is the importance of binary number systems in digital electronics?
2. How do logic gates implement Boolean functions in digital circuits?
3. What are the primary differences between combinational and sequential circuits?
4. Explain the role of code conversion in digital systems.
5. Define the function of a decoder in digital electronics?
6. How does memory contribute to the functionality of digital systems?
7. How are shift registers utilized in digital systems?
8. Describe the process of state reduction in sequential circuit design.
9. What are the differences between synchronous and asynchronous sequential circuits?
10. Define race conditions in the context of asynchronous circuits.

Section B
Answer all the questions (8M$\times 5 = 40M$)

11. (a) Explain the fundamental principles of Boolean Algebra and its theorems.
(OR)
(b) How are Boolean functions simplified using Karnaugh maps and tabulation methods? Provide examples to illustrate the process.

12.(a) Describe the analysis and design procedures for combinational circuits.
(OR)
(b) Provide detailed steps and examples of circuits for arithmetic operations and code conversions.

13.(a) Explain the function and design of decoders and encoders in digital systems.

(OR)

(b) How are these components used in conjunction with HDL for combinational circuits?

14.(a) Discuss the design and analysis procedures for synchronous sequential circuits, including flip-flops and shift registers. How are state reduction and state assignments performed?

(OR)

(b) Explain the role of HDL in designing sequential logic circuits, including shift registers and counters. Provide examples of HDL code snippets.

15.a) Explain the analysis and design of asynchronous sequential circuits. Discuss the steps involved in reducing state and flow tables and achieving race-free state assignments.

(OR)

(b) Describe the concept of hazards in asynchronous sequential circuits. How are they identified and mitigated in circuit design?

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

III Year B.Sc (Hons.)-ELECTRONICS

Course Code: 24(ELE)M54B

SEMESTER-V

COURSE 15 B: CONSUMER ELECTRONICS

Theory Credits: 3 3 hrs/week

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	To study Microwave ovens – block diagram - working - types – wiring and safety instructions. – care and cleaning	Level-4
2.	CO-2	To study washing machines – block diagram - working - types – wiring and safety instructions. – care and cleaning	Level-3
3.	CO-3	To study Air conditioners and refrigerators – block diagram - working - types – wiring and safety instructions. – care and cleaning	Level-5
4.	CO-4	To study Home/Office digital devices – block diagram - working - types – wiring and safety instructions. – care and cleaning	Level-4
5.	CO-5	To study Digital access devices like – block diagram - working - types – wiring and safety instructions. – care and cleaning.	Level-5

UNIT – I

MICROWAVE OVENS – **Introduction to Electromagnetic spectrum** Microwaves (Range used in Microwave ovens) – Microwave oven block diagram and **description of various parts** – LCD timer with alarm – Single-Chip Controllers – types of Microwave oven – Wiring and Safety instructions – care and Cleaning.

UNIT – II

WASHING MACHINES – **Block diagram of washing machine,** Electronic controller for washing machines – Washing machine hardware and software – Types of washing machines – Fuzzy logic washing machines Features of washing machines.

UNIT – III

AIR CONDITIONERS AND REFRIGERATORS - Air Conditioning – **Block diagram and** Components of air conditioning systems – All water air conditioning systems – All air conditioning systems – Unitary and central air conditioning systems – Split air conditioners and **Refrigerator block diagram and functioning mechanism**.

UNIT – IV

HOME/OFFICE DIGITAL DEVICES – Facsimile machine **block diagram and its functioning**– Xerographic copier – calculators – Structure of a calculator – **Block diagram of calculator**, Internal organization of a calculator– Servicing electronic calculators – Digital clocks – Block diagram of a digital clock.

UNIT – V

DIGITAL ACCESS DEVICES – Digital computer, **Block diagram of digital computer** – Internet access – online ticket reservation – functions and networks – barcode scanner and decoder – Electronic Fund Transfer
– Automated Teller Machines (ATMs) – Set-Top boxes – Digital cable TV – Video on demand.

TEXTBOKS:

1. S.P. Bali, Consumer Electronics – Pearson Education, New Delhi,2005.
2. R.G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Learning outcomes:

- The Student can gain good knowledge on microwave ovens and implement in practical applications.
- The Student can gain good knowledge on Washing Machines and implement in practical applications.
- The Student can gain good knowledge on Air conditioners and Refrigerators and implement in practical applications.
- The Student can gain good knowledge on Digital access devices and implement in practical applications.
- Ability to measure strain, displacement, velocity, angular velocity , temperature, pressure Vacuum, and Flow.
-

SEMESTER-V

Course Code: 24(ELE)M54BP

COURSE 15 B: CONSUMER ELECTRONICS

Practical Credits: 1 2 hrs/week

(At least two Activities should be done)

1. Study of PA systems for various situations – Public gathering , closed theatre/ Auditorium, Conference room, Prepare Bill of Material(Costing)
2. Installation of Audio/Video systems – site preparation , electrical requirements, cables and connectors
3. Market Survey of products (at least one from each module)
4. Identification of block and tracing the system.

Assembly and Disassembly of system using Toolkit

5. Assembly and Disassembly of system and printer.

NOTE: one activity as directed in practical course is equivalent to 4 experiments

Text Book

1. Biomedical Instrumentation - *M. Arumugham*, 2/e, Anuradha Agencies Publishers

Reference Books

1. Clinical Engineering - *Jacobster & Webster*, PHI.
2. Applied Biomedical Instrumentation - *Geddes & Baker*, John Wiley & Sons.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

III Year B.Sc (Hons.)-ELECTRONICS

Course Code: 24(ELE)M54B

SEMESTER-V

COURSE 15 B: CONSUMER ELECTRONICS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	1	1	2	2	2	2	2
CO 2	2	3	2	1	2	1	3	3	2	3
CO 3	3	2	2	2	1	1	3	2	3	3
CO 4	3	3	1	2	2	2	2	2	3	3
CO 5	3	3	1	1	1	1	3	3	2	2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	2	2	2	2
CO 3	3	3	3	3	3
CO 4	3	3	2	3	3
CO 5	2	3	2	2	2

Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 23(ELE)M54B

BLUE PRINT (:CONSUMER ELECTRONICS)
III B.Sc. (Hons.) ELECTRONICS- SEM-V/Course : 15B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	MICROWAVE OVENS	2	2	30
2.	II	WASHING MACHINES	2	2	30
3.	III	AIR CONDITIONERS AND REFRIGERATORS	2	2	30
4.	IV	HOME/OFFICE DIGITAL DEVICES	2	2	30
5.	V	DIGITAL ACCESS DEVICES	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
III Year B.Sc (Hons.)- ELECTRONICS
Course Code: 24(ELE)M54B

SEMESTER-V COURSE 15B: CONSUMER ELECTRONICS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Describe the functioning of various parts of Microwave oven with block diagram?
   [OR]
   b) Write about the various types of Microwave ovens with wiring and safety instructions?

2. a) Describe hardware and software functionalities of Washing machine?
   [OR]
   b) Describe different features of Washing machines?
3. a) Write about functioning of various components of air conditioning system?
   [OR]
   b) Describe the functioning of split air conditioner?

4. a) Write about the Facsimile machine block diagram and its functioning**?**
   [OR]
   b) Write about the block diagram of calculator and its internal organization?

5. a) Write about block diagram of digital computer and internet access?
   [OR]
   b) Write about barcode scanner and decoder?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) Write about LCD timer with alarm?
7. a) Write about single-chip Controllers?
8. a) Write about Electronic controller for washing machines?
9. a) Give a brief note on fuzzy logic washing machines?
10. a) Discuss briefly on all water air conditioning systems?
11. a) Briefly write about unitary and central air conditioning systems?

12. a) Discuss briefly about Xerographic copier?
13. a) Write about steps in servicing of electronic calculators?
14. a) Discuss about online ticket reservation?
15. a) Write about Automated Teller Machines (ATMs)?

B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
III Year B.Sc (Hons.)- ELECTRONICS
Course Code: 24(ELE)M54B

SEMESTER-V COURSE 15B: CONSUMER ELECTRONICS
QUESTION BANK

UNIT I: MICROWAVE OVENS

Essay Type Questions:

1. Explain the operating principle of microwave ovens. Discuss the role of the electromagnetic spectrum in microwave cooking.
2. Describe the block diagram of a microwave oven. Discuss the functions and significance of each component.
3. Compare and contrast single-chip controllers used in microwave ovens. How do they contribute to the efficiency and functionality of the appliance?

Short Type Questions:

1. What safety precautions should be followed while using a microwave oven?
2. Explain the importance of the LCD timer with alarm in a microwave oven.
3. Discuss the maintenance tips and cleaning procedures for microwave ovens.

UNIT II: WASHING MACHINES

Essay Type Questions:

1. Describe the block diagram of a washing machine. Explain the functions of its major components.
2. Discuss the evolution of washing machine technology, focusing on the role of electronic controllers and fuzzy logic.
3. Compare different types of washing machines available today. Highlight the advantages and disadvantages of each type.

Short Type Questions:

1. What are the features of a fuzzy logic washing machine? How does it improve washing efficiency?
2. Explain the hardware and software aspects involved in modern washing machines.
3. How does an electronic controller enhance the performance of a washing machine?

UNIT III: AIR CONDITIONERS AND REFRIGERATORS

Essay Type Questions:

1. Compare and contrast unitary and central air conditioning systems.
2. Explain the block diagram of a split air conditioner. Discuss its functioning mechanism.
3. Describe the components of a refrigerator. How do they work together to maintain cooling?

Short Type Questions:

1. What are the components of an air conditioning system? Explain their roles.
2. Discuss the concept of an all-water air conditioning system. What are its advantages?
3. Explain the working principle of a refrigerator cooling system.

UNIT IV: HOME/OFFICE DIGITAL DEVICES

Essay Type Questions:

1. Describe the block diagram and functioning of a facsimile machine.
2. Explain the structure and functioning of a digital calculator.
3. Discuss the evolution of digital clocks. How do they differ from traditional mechanical clocks?

Short Type Questions:

1. What are the key components of a facsimile machine? Explain their functions.
2. Describe the internal organization of a digital calculator.
3. What are the common servicing procedures for electronic calculators?

UNIT V: DIGITAL ACCESS DEVICES

Essay Type Questions:

1. Explain the block diagram of a digital computer. Discuss its various components and their functions.
2. Discuss the significance of internet access in modern digital devices. How has it revolutionized services like online ticket reservation?

3. Describe the operation of Automated Teller Machines (ATMs). How do they ensure security during transactions?

Short Type Questions:

1. What is the function of a barcode scanner and decoder in retail environments?
2. Explain the operation of Set-Top boxes in digital cable TV systems.
3. What is Video on Demand (VOD)? How does it differ from traditional TV broadcasting?

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM71A**

SEMESTER-VII (IV Year) COURSE 16A: MEDICAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

Course Objectives: After studying this paper, the students will be able to handle most of the electronic instrumentation in the medical field.

Learning Outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand terminologies related to ECG, EEG, EMG and ERG.	Level 2 (Understanding)
CO 2	Measurement of heart beat rate - Measurement of pulse rate - Measurement of temperature.	Level 5 (Evaluating)
CO 3	Understand the Basic Amplifier configurations.	Level 2 (Understanding)
CO 4	Discuss the High Energy Radiation Applications.	Level 6 (Create)
CO 5	Discuss the High Frequency Applications.	Level 6 (Create)

SYLLABUS

UNIT-I

Basic Amplifier configurations, Bio-Amplifiers: Bio potentials - Bio-electricity - Necessity for special types of amplifiers for biological signal amplifications - Different types of Bio-OP - Amps.

UNIT-II

Bio-Potential Recording: ECG - EEG - EMG - ERG - Specific types of electrodes used - Different lead systems - their waveforms.

UNIT-III

Measurement of Biological Parameters: Measurement of respiration rate - Measurement of heart beat rate - *Measurement of pulse rate* - Measurement of temperature - Measurement of blood pressure - Patient monitoring set up - *Use of Microprocessor in patent monitoring*- Blood flow meters EM and Plethysmography technique,

UNIT-IV

High Energy Radiation Applications: Applications of X-ray and isotopes for diagnostics and therapeutic applications - Application of Lasers in biological medium.

UNIT-V

High Frequency Applications: Diathermy effect - Short, wave diathermy - Ultrasonic diathermy - Microwave diathermy.

Text Books

1. Biomedical Instrumentation - M. Arumugam, 2/e, Anuradha Agencies Publishers.

Reference Books

1. Clinical Engineering - Jacobster & Webster, PHI.
2. Applied Biomedical Instrumentation - Geddes & Baker, John Wiley & Sons.

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	2	3	3
CO 2	3	1	1	1	1	2	3	2	3	3
CO 3	3	1	1	1	1	2	3	2	3	3
CO 4	3	1	1	1	1	2	2	3	3	3
CO 5	3	1	1	1	1	2	2	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM71AP**

SEMESTER-VII (IV Year) COURSE 16A: MEDICAL ELECTRONICS Practical Course

Practical | Credits: 1 | 2 Hrs/Week

COURSE OBJECTIVE:

To develop practical skills in the use of laboratory equipment and experimental techniques for measuring properties using Biomedical devices in Medical electronics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for measuring various properties using Biomedical devices.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 2	Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.	Level 3 (Applying)
CO 3	Accurate recording and analysis of data: Students should be able to accurately record and analyse experimental data, including understanding the significance of error analysis and statistical methods.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Understanding of fundamental physical principles in Biomedical devices.	Level 2 (Understanding) Level 3 (Applying)

List of Experiments:

1. Bio-Amplifiers.
2. Bio-OP – Amps.
3. ECG (Electrocardiogram).
4. EEG (Electroencephalogram).
5. Measurement of heart beat rate.
6. Measurement of temperature.
7. Measurement of blood pressure.

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM71A**

SEMESTER-VII (IV Year) COURSE 16A: MEDICAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM71A**
SEMESTER-VII (IV Year) COURSE 16A: MEDICAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Bio-Amplifiers	2 (One out of two)	2
2	Unit – II	Bio-Potential Recording	2 (One out of two)	2
3	Unit – III	Measurement of Biological Parameters	2 (One out of two)	2
4	Unit – IV	High Energy Radiation Applications	2 (One out of two)	2
5	Unit – V	High Frequency Applications	2 (One out of two)	2

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM71A**
SEMESTER-VII (IV Year) COURSE 16A: MEDICAL ELECTRONICS

Theory Credits: 3 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. What are the primary reasons for using specialized amplifiers in biological signal amplification?
2. List and briefly describe two types of Bio-Operational Amplifiers commonly used in medical devices.
3. What are the key differences between ECG and EEG in terms of electrode placement and the type of bio-potential they measure?
4. Briefly describe the role of electrodes in the recording of bio-potentials.
5. What are the key factors that influence the accuracy of blood pressure measurements in a clinical environment?
6. Briefly explain how Plethysmography is used to measure blood flow.
7. What are the primary therapeutic applications of X-rays in medicine?
8. Briefly describe the role of isotopes in medical diagnostics.
9. What is diathermy, and how is it used in medical treatments?
10. Briefly describe the difference between short wave diathermy and ultrasonic diathermy.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Explain the concept of bioelectricity and discuss why special types of amplifiers are required for biological signal amplifications. Provide examples of different types of Bio-Op Amps and their applications in medical devices.

OR

(b) Describe the various types of Bio-Op Amps used in the amplification of biological signals. Discuss the advantages and limitations of each type in the context of clinical applications.

12. (a) Discuss the principles and techniques involved in recording bio-potentials such as ECG, EEG, EMG, and ERG. How do the specific types of electrodes and lead systems impact the accuracy of these recordings?

OR

(b) Explain the different lead systems used in ECG recording. Compare and contrast their waveforms and applications in clinical diagnostics.

13. (a) Describe the various techniques used to measure biological parameters such as respiration rate, heart rate, temperature, and blood pressure. How are these measurements integrated into a patient monitoring setup?

OR

(b) Discuss the principles of blood flow measurement using Electromagnetic (EM) and Plethysmography techniques. Compare the accuracy and applicability of these methods in clinical settings.

14. (a) Analyze the diagnostic and therapeutic applications of X-rays and isotopes in medicine. Discuss the safety concerns and regulatory guidelines associated with their use.

OR

(b) Explain how lasers are applied in biological mediums for both diagnostic and therapeutic purposes. Provide examples of specific medical procedures that utilize lasers.

15. (a) Discuss the different types of diathermy (short wave, ultrasonic, and microwave) and their applications in medical treatment. How does each type affect biological tissues?

OR

(b) Explain the principles of microwave diathermy and its advantages over other forms of diathermy in therapeutic applications.

Question Bank
Short answer Questions

1. What are the primary reasons for using specialized amplifiers in biological signal amplification?
2. List and briefly describe two types of Bio-Operational Amplifiers commonly used in medical devices.
3. What are the key differences between ECG and EEG in terms of electrode placement and the type of bio-potential they measure?
4. Briefly describe the role of electrodes in the recording of bio-potentials.
5. What are the key factors that influence the accuracy of blood pressure measurements in a clinical environment?
6. Briefly explain how Plethysmography is used to measure blood flow.
7. What are the primary therapeutic applications of X-rays in medicine?
8. Briefly describe the role of isotopes in medical diagnostics.
9. What is diathermy, and how is it used in medical treatments?
10. Briefly describe the difference between short wave diathermy and ultrasonic diathermy.
11. What are the different types of Bio-OP – Amps
12. Discuss about EEG (electroencephalogram) test.
13. Write a short note on Plethysmography technique.
14. What are the application of Lasers in biological medium.
15. Discuss on Microwave diathermy.

Long answer Questions

1. Explain the concept of bioelectricity and discuss why special types of amplifiers are required for biological signal amplifications. Provide examples of different types of Bio-Op Amps and their applications in medical devices.
2. Describe the various types of Bio-Operational Amplifiers (Bio-Op Amps) used in the amplification of biological signals. Discuss the advantages and limitations of each type in the context of clinical applications.
3. Discuss the principles and techniques involved in recording bio-potentials such as ECG, EEG, EMG, and ERG. How do the specific types of electrodes and lead systems impact the accuracy of these recordings?
4. Explain the different lead systems used in ECG recording. Compare and contrast their waveforms and applications in clinical diagnostics.

5. Describe the various techniques used to measure biological parameters such as respiration rate, heart rate, temperature, and blood pressure. How are these measurements integrated into a patient monitoring setup?
6. Discuss the principles of blood flow measurement using Electromagnetic (EM) and Plethysmography techniques. Compare the accuracy and applicability of these methods in clinical settings.
7. Analyze the diagnostic and therapeutic applications of X-rays and isotopes in medicine. Discuss the safety concerns and regulatory guidelines associated with their use.
8. Explain how lasers are applied in biological mediums for both diagnostic and therapeutic purposes. Provide examples of specific medical procedures that utilize lasers.
9. Discuss the different types of diathermy (short wave, ultrasonic, and microwave) and their applications in medical treatment. How does each type affect biological tissues?
10. Explain the principles of microwave diathermy and its advantages over other forms of diathermy in therapeutic applications.

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

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Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24

IV Year BSC Electronics

SEMESTER- VII COURSE CODE: 24ELEM71B

ADVANCED COMMUNICATION SYSTEMS

Theory Credits: 3 3 hrs/week

LEARNING OBJECTIVES:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Analyze the elements of communication systems, classify signals, and evaluate channel capacity by reviewing analog and pulse modulation techniques.	Level 4
CO 2	Demonstrate understanding of digital modulation techniques and assess their performance, while applying sampling theories and quantization methods to digitize analog signals.	Level 2
CO 3	Compare and apply various multiplexing and multiple access techniques, including FDMA, TDMA, and CDMA, to optimize communication in local and wide-area networks.	Level 1
CO 4	Implement source coding techniques, such as Huffman coding, and apply error control codes to ensure accurate digital data transmission	Level 2
CO 5	Evaluate the evolution of wireless communication from 1G to 4G systems, analyze signal fading mechanisms, and explore the advantages of multiple antenna configurations in modern networks.	Level 5

SYLLABUS

Unit – I

Introduction: Elements of a communication system, classification of signals, information and channel capacity. Review of analog modulation and pulse modulation techniques.

Unit – II

Digital modulation techniques: Fundamentals of binary ASK, PSK, DPSK and FSK modulation schemes, comparison of digital modulation schemes, M – ary signaling schemes, synchronization methods.

Digital transmission of analog signals: Sampling, sampling theorem, signal distortion in sampling, Nyquist rate, aliasing, quantization of analog signals, the PCM system, delta modulation schemes.

Unit –III

Multiplexing and multiple access: FDM/FDMA/ multiple access, TDM/ multiple access, comparison of FDMA and TDMA, code division multiple access, space division and polarization multiple access, access algorithms ALOHA. Multiple access techniques for local area networks.

Unit – IV

Source coding for digital data: Source coding theorem, Huffman coding, channel coding theorem, matched filter, matched filter receiver. Error control codes: Linear block codes, binary cyclic codes, convolution codes.

Unit – V

Wireless communication: Introduction, 1st and 2nd generation cellular systems. Cellular communication from 1G to 3G and 4G systems, future wireless networks.

Signal fading: Introduction, principals of signal fading, propagation and path loss models.

Introduction to multiple antenna techniques: Concepts in multi-antenna configurations – SISO, SIMO, MISO, MIMO, advantages, multiple transmit and receive antennas, spatial multiplexing, multi user MIMO.

References Books:

1. Digital communication Electronic communication systems – fundamentals to advanced: Wayne Tomasi,
2. Pearson Education, 5th edition, 2009
3. Wireless communications and networking- Vijay K Garg, Elseiver, 2007.
4. MIMO – OFDM wireless communication with MATLAB, Yong Soo Cho, John Wiley and Sons, IEEE press, 2010.
5. Digital and Analog communication systems- Sam Shanmugam,Wiley Student Edition, 2008 reprint.
6. Data communication- William Schweber, McGraw-Hill, 1988.
7. .Digital communications- Simon Haykin, Wiley, 1988.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Electronics(Major)
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IV Year BSC Electronics
SEMESTER- VII COURSE CODE: 24ELEM71B
ADVANCED COMMUNICATION SYSTEMS

Max Marks-60 **Time-3Hrs.** **Credits:3**

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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ADVANCED COMMUNICATION SYSTEMS

Max Marks-60 **Time-3Hrs** **Credits:3**

Blue Print for Semester End Theory Examinations

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33%	20	2 (two out of four)	1 (one out of two
Understanding/ Comprehension	27%	16	2 (two out of four)	
Application	20%	12	1 (one out of two)	1 (one out of two
Analysis	13%	8		2 (two out of four)
Synthesis/ Evaluate	7%	4		1 (one out of two
Total	100	60	5 (each question has internal choice)	5 out of 10 questions

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	8 marks	4 marks
1	**I**	Introduction: Elements of a communication system	**2 (one out of two)**	**2**
2	**II**	Digital modulation techniques	**2 (one out of two)**	**2**
3	**III**	Multiplexing and multiple access	**2 (one out of two)**	**2**
4	**IV**	Source coding for digital data	**2 (one out of two)**	**2**
5	**V**	Wireless communication	**2 (one out of two)**	**2**
		TOTAL QUESTIONS	**5 (each question has internal choice)**	**5 out of given 10**

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ADVANCED COMMUNICATION SYSTEMS

Max Marks-60 **Time-3Hrs.** **Credits:3**

(MODEL PAPER)

DURATION::3 hrs **MAX.MARKS :: 60**

SECTION-A

Answer any FIVE questions of the following **(5 X 4 = 20 M)**

1. What are the primary elements of a communication system?
2. Define channel capacity and its significance in communication systems.
3. Define Nyquist rate and its importance in sampling.
4. Briefly describe the process of quantization in the PCM system.
5. Define Time Division Multiple Access (TDMA).
6. Briefly explain the concept of Space Division Multiple Access (SDMA).
7. Define linear block codes and provide an example.
8. Briefly describe the channel coding theorem.
9. Briefly explain the advantages of MIMO over SISO systems.
10. What is spatial multiplexing in the context of wireless communication?

SECTION-B

Answer ALL the questions Of the following **(5 X 8 = 40 M)**

11. (a)Explain the elements of a communication system and discuss the role of each element in ensuring effective communication.

[OR]

(b)Compare and contrast analog modulation techniques with pulse modulation techniques, providing examples of each.

12. (a)Explain the process of sampling and its importance in the digital transmission of analog signals. What are the potential issues that can arise during sampling?

[OR]

(b)Discuss the concept of M-ary signaling schemes and their applications in modern communication systems.

13. (a)Discuss the differences between Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA). How do these techniques manage bandwidth in communication systems?

[OR]

(b)Discuss the ALOHA protocol and its significance in the development of multiple access techniques for local area networks.

14. (a)Explain Huffman coding and its application in reducing the redundancy of transmitted data.

[OR]

(b)Analyze the importance of error control codes in communication systems. How do linear block codes differ from binary cyclic codes?

15. (a)Trace the evolution of cellular communication systems from 1G to 4G. What were the key technological advancements in each generation?

[OR]

(b)Evaluate the role of spatial multiplexing and multi-user MIMO in enhancing the capacity and efficiency of wireless networks.

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ADVANCED COMMUNICATION SYSTEMS

Max Marks-60 **Time-3Hrs.** **Credits:3**

Question Bank

Unit I: Introduction to Communication Systems

Essay Questions:

1. Explain the elements of a communication system and discuss the role of each element in ensuring effective communication.
2. Compare and contrast analog modulation techniques with pulse modulation techniques, providing examples of each.
3. Discuss the concept of channel capacity in communication systems. How does it relate to signal classification and information theory?
4. Analyze the impact of different signal classifications on the performance and efficiency of a communication system.

Short Answer Questions:

1. What are the primary elements of a communication system?
2. Define channel capacity and its significance in communication systems.
3. Briefly explain the concept of pulse modulation.
4. How do analog and digital signals differ in terms of modulation techniques?

Unit II: Digital Modulation and Transmission of Analog Signals

Essay Questions:

1. Compare and contrast binary ASK, PSK, DPSK, and FSK modulation schemes. Discuss the advantages and disadvantages of each.
2. Explain the process of sampling and its importance in the digital transmission of analog signals. What are the potential issues that can arise during sampling?

3. Discuss the concept of M-ary signaling schemes and their applications in modern communication systems.
4. Evaluate the role of synchronization methods in digital modulation techniques and their impact on system performance.

Short Answer Questions:

1. What is binary phase-shift keying (BPSK)?
2. Define Nyquist rate and its importance in sampling.
3. Briefly describe the process of quantization in the PCM system.
4. What is aliasing, and how can it affect the accuracy of signal reconstruction?

Unit III: Multiplexing and Multiple Access Techniques

Essay Questions:

1. Discuss the differences between Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA). How do these techniques manage bandwidth in communication systems?
2. Explain Code Division Multiple Access (CDMA) and its advantages over FDMA and TDMA. Provide real-world examples of its application.
3. Analyze the role of multiplexing techniques in improving the efficiency of communication systems. How does multiplexing relate to multiple access methods?
4. Discuss the ALOHA protocol and its significance in the development of multiple access techniques for local area networks.

Short Answer Questions:

1. What is Frequency Division Multiplexing (FDM)?
2. Define Time Division Multiple Access (TDMA).
3. Briefly explain the concept of Space Division Multiple Access (SDMA).
4. What are the main differences between FDMA and TDMA?

Unit IV: Source Coding and Error Control Codes

Essay Questions:

1. Discuss the Source Coding Theorem and its implications for data compression in digital communication systems.
2. Explain Huffman coding and its application in reducing the redundancy of transmitted data.

3. Analyze the importance of error control codes in communication systems. How do linear block codes differ from binary cyclic codes?
4. Evaluate the role of convolution codes in enhancing the reliability of data transmission. Discuss the process of decoding convolutional codes using the Viterbi algorithm.

Short Answer Questions:

1. What is a matched filter and its role in digital communication?
2. Define linear block codes and provide an example.
3. Briefly describe the channel coding theorem.
4. What is the purpose of convolution codes in error correction?

Unit V: Wireless Communication and Signal Fading

Essay Questions:

1. Trace the evolution of cellular communication systems from 1G to 4G. What were the key technological advancements in each generation?
2. Discuss the principles of signal fading and its impact on wireless communication. How do propagation and path loss models help in understanding signal fading?
3. Explain the concept of multiple antenna techniques and their advantages in modern wireless communication systems. How do SISO, SIMO, MISO, and MIMO configurations differ?
4. Evaluate the role of spatial multiplexing and multi-user MIMO in enhancing the capacity and efficiency of wireless networks.

Short Answer Questions:

1. What are the main characteristics of 1G cellular systems?
2. Define signal fading and its primary causes.
3. Briefly explain the advantages of MIMO over SISO systems.
4. What is spatial multiplexing in the context of wireless communication?

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BLUE PRINT
Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VII
COURSE 17 A: PRINCIPLES AND UTILISATION OF ELECTRONIC DOMESTIC APPLIANCES

MAX MARKS – 60 TIME – 3 HOURS
(CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-A) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-B) Each one 4 marks
1	I	MICROWAVE OVENS	1	2
2	II	WASHING MACHINES	1	2
3	III	AIR CONDITIONERS AND REFRIGERATORS	1	2
4	IV	HOME / OFFICE DIGITAL DEVICES	1	2
5	V	DIGITAL ACCESS DEVICES	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120-60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

(COURSE CODE: 24ELEM72A)

SEMESTER-VII

COURSE 17 A: PRINCIPLES AND UTILISATION OF ELECTRONIC DOMESTIC APPLIANCES

Theory Credits: 4 5 hrs/week

Course Objective:

The course principles and utilisation of electronic domestic appliances aims to provide students with a fundamental understanding of the theoretical principles underlying principles and utilisation of electronic domestic appliances.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understanding working function of micro wave oven. Applying principles.	Level 1 (knowledge) Level 2 (Understanding) Level 3 (Applying)
CO 2	Understanding working function of washing mechine. Applying principles.	Level 2 (Understanding) Level 3 (Applying)
CO 3	Understanding working function of Air conditioner and refrigerator. Applying principles.	Level 2 (Understanding) Level 3 (Applying)
CO 4	Understanding working function of digital device. Applying principles.	Level 2 (Understanding) Level 3 (Applying)
CO 5	Understanding working function of digital access device Applying principles.	Level 2 (Understanding) Level 3 (Applying)

(COURSE CODE: 24ELEM72A)

SEMESTER-VII

COURSE 17 A: PRINCIPLES AND UTILISATION OF ELECTRONIC DOMESTIC APPLIANCES

Theory Credits: 4
5 hrs/week

UNIT-I: MICROWAVE OVENS :Microwaves - Properties and generation - Microwave oven block diagram, ***Components of a Microwave Oven, Magnetron, Waveguide, Turntable, Control panel.***- LCD timer with alarm - Controllers - Wiring and Safety instructions - Care and Cleaning.

UNIT-II: WASHING MACHINES, ***Basic Components, Drum: Agitator (Top-Loading) or Drum Action (Front-Loading): Water Inlet Valve: Pump: Motor,***Electronic controller for washing machines - Washing machine hardware and software - Types of washing machines - Fuzzy logic washing machines - Features of washing machines.

UNIT-III: AIR CONDITIONERS AND REFRIGERATORS

Air Conditioning - Components of air conditioning systems – ***working principle of AC,*** All water air conditioning systems - All air conditioning systems - Unitary and central air conditioning systems - Split air conditioners. ***Working principle of refrigerator, difference between air conditioner and refrigerator.***

UNIT-IV: HOME / OFFICE DIGITAL DEVICES

Facsimile machine - Xerographic copier - Calculators - Structure of a calculator - Internal Organization of a calculators - Servicing electronic calculators - Digital clocks, ***types of digital clocks,*** - Block diagram of a digital clock.

UNIT-V: DIGITAL ACCESS DEVICES

Digital computer - Internet access - Online ticket reservation - Functions and networks - Barcode Scanner and decoder - Electronic Fund Transfer - Automated Teller Machines (ATMs) - Set-Top boxes - Digital cable TV - Video on demand. ***E-Reader, Smart TVs and Streaming Devices.***

BOOKS FOR STUDY

1. Consumer Electronic - S.P. Bali, Pearson Education, New Delhi, 2005.

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(COURSE CODE: 24ELEM72A)

Programme: B.Sc. Honours in Electronics (Major) -2024-2025

SEMESTER-VII

COURSE 17 A: PRINCIPLES AND UTILISATION OF ELECTRONIC DOMESTIC APPLIANCES

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A: Short Answer Questions

Answer any 5 questions out of the 10 given. Each question carries 4 marks. 4×5=20

1. **What are the key properties of microwaves that make them suitable for cooking in a microwave oven?**
2. **Explain the role of the electronic controller in a washing machine.**
3. **What are the main components of an air conditioning system?**
4. **Briefly describe the internal organization of a basic calculator.**
5. **What is the primary function of a facsimile machine?**
6. **What is fuzzy logic in the context of washing machines, and how does it benefit the user?**
7. **Name two types of washing machines and describe one key feature of each.**
8. **Explain the difference between unitary and central air conditioning systems.**
9. **List the main components of a digital clock according to its block diagram.**
10. **What is the primary purpose of a barcode scanner and decoder?**

Section B: Essay Questions

Answer all questions. Each question carries 8 marks.
8×5=40

11. **(A) Discuss the generation of microwaves in a microwave oven. Include the principles of microwave generation and the main components involved. Explain how the properties of microwaves contribute to their efficiency in cooking.**

OR

(B) Describe the block diagram of a microwave oven and explain the function of each component. How do controllers and LCD timers with alarms contribute to the operation and convenience of microwave ovens?

12. **(A) Examine the role of electronic controllers in modern washing machines. Discuss how these controllers enhance the functionality and efficiency of washing machines.**

OR

(B) Compare and contrast the different types of washing machines, including top-loading, front-loading, and combination models. How does fuzzy logic improve the performance of washing machines?

13. **(A) Describe the various components of an air conditioning system. How do these components work together to regulate temperature and humidity?**

OR

(B) Differentiate between all-water and all-air air conditioning systems. Discuss the advantages and disadvantages of each system in terms of efficiency and application.

14. **(A) Explain the function and importance of a facsimile machine in modern communication. How does it compare to other digital communication devices in terms of efficiency and usage?**

OR

(B) Discuss the block diagram of a digital clock and explain how it keeps time accurately. What are the key components involved in its operation?

15. **(A) Analyze the role of digital computers in modern Internet access and online services. How do they support functions like online ticket reservation and electronic fund transfers?**

OR

(B) Discuss the technology and functionality of barcode scanners and decoders. How do they enhance efficiency in retail and inventory management?

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SEMESTER-VII

COURSE 17 A:

PRINCIPLES AND UTILISATION OF ELECTRONIC DOMESTIC APPLIANCES

(COURSE CODE: 24ELEM72A)

QUESTION BANK

Unit-I: Microwave Ovens

Essay Questions:

1. **Discuss the generation of microwaves in a microwave oven. Include the principles of microwave generation and the main components involved. Explain how the properties of microwaves contribute to their efficiency in cooking.**
2. **Describe the block diagram of a microwave oven and explain the function of each component. How do controllers and LCD timers with alarms contribute to the operation and convenience of microwave ovens?**
3. **Explain the safety instructions necessary for operating a microwave oven and the care and cleaning procedures that ensure its longevity and optimal performance. Why are these practices important for user safety and appliance maintenance?**

Short Answer Questions:

1. **What are the key properties of microwaves that make them suitable for cooking in a microwave oven?**
2. **List and briefly describe the main components of a microwave oven.**
3. **What are the primary safety precautions one should take when using a microwave oven?**

Unit-II: Washing Machines

Essay Questions:

1. **Examine the role of electronic controllers in modern washing machines. Discuss how these controllers enhance the functionality and efficiency of washing machines.**
2. **Compare and contrast the different types of washing machines, including top-loading, front-loading, and combination models. How does fuzzy logic improve the performance of washing machines?**

3. **Discuss the hardware and software components involved in washing machines. How do they interact to provide a seamless washing experience? Highlight the features that distinguish advanced washing machines from basic models.**

Short Answer Questions:

1. **What is fuzzy logic in the context of washing machines, and how does it benefit the user?**
2. **Name two types of washing machines and describe one key feature of each.**
3. **What role does the electronic controller play in a washing machine?**

Unit-III: Air Conditioners and Refrigerators **Essay Questions:**

1. **Describe the various components of an air conditioning system. How do these components work together to regulate temperature and humidity?**
2. **Differentiate between all-water and all-air air conditioning systems. Discuss the advantages and disadvantages of each system in terms of efficiency and application.**
3. **Compare unitary air conditioning systems with central air conditioning systems. What are the key differences in their design, operation, and suitability for different settings?**

Short Answer Questions:

1. **What are the main components of an air conditioning system?**
2. **Explain the difference between unitary and central air conditioning systems.**
3. **What is an all-water air conditioning system, and where might it be most effectively used?**

Unit-IV: Home/Office Digital Devices **Essay Questions:**

1. **Explain the function and importance of a facsimile machine in modern communication. How does it compare to other digital communication devices in terms of efficiency and usage?**
2. **Describe the internal organization of a calculator and how it performs arithmetic operations. How does the structure of a calculator contribute to its functionality and accuracy?**

3. **Discuss the block diagram of a digital clock and explain how it keeps time accurately. What are the key components involved in its operation?**

Short Answer Questions:

1. **What is the primary function of a facsimile machine?**
2. **Briefly describe the internal organization of a basic calculator.**
3. **List the main components of a digital clock according to its block diagram.**

Unit-V: Digital Access Devices

Essay Questions:

1. **Analyze the role of digital computers in modern Internet access and online services. How do they support functions like online ticket reservation and electronic fund transfers?**
2. **Discuss the technology and functionality of barcode scanners and decoders. How do they enhance efficiency in retail and inventory management?**
3. **Explain the operation and advantages of Automated Teller Machines (ATMs) and set-top boxes. How do these devices contribute to financial transactions and digital entertainment?**

Short Answer Questions:

1. **What is the primary purpose of a barcode scanner and decoder?**
2. **How does an Automated Teller Machine (ATM) facilitate electronic transactions?**
3. **Name two functions of set-top boxes in digital television systems.**

Major Courses offered w.e.f. AY 2024-25

SEMESTER-V COUSE CODE :24ELEM72B
COURSE 17B: DIGITAL AND DATA COMMUNICATION SYSTEMS

Theory Credits: 4 5 hrs/week

Objectives:
At the end of this course students will be able to visualize how analog signals are converted to digital signals for voice and data transmission; the concept of multiplexing to fulfill the demand of high speed digital transmission across the globe; the various methods of generation of digital signals (ASK,FSK,PSK,QAM) according to the application requirements; implement optimization techniques, data coding, channel requirements, signal to noise ratio, bandwidth, error finding within the received information and information theory.

Outcomes:
1.With advent of areas such as GSM, GPS, Bluetooth, RFID, DTMF, Mobile, Ethernet, RF,XBEE, Networking, Data Acquisition, Smart city and Smart Card, Internet of things the knowledge of the subject is an essential need.
2.Today multiplexing have become an extremely important asset to telecommunication processes and has greatly improved the way that we transmit and receive independent signals over AM and FM radio, telephone lines, and optical fibers.
3.Digital communication has become ubiquitous for success in the workplace. It helps in networking, demonstrates efficiency, stable foundation for documentation etc.
4.The most important part in transmission is noise immunity. So after understanding the above topics the students will be able to implement optimization techniques and will have a better understanding of data coding, channel requirements, signal to noise ratio, bandwidth, error finding within the received information

Unit I:

Digital Transmission: Sampling and quantization, Low pass sampling – Aliasing, Signal Reconstruction, Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding of speech signal. PCM, DPCM, DM, ADM Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ – Manchester, ISI – Nyquist criterion for distortionless transmission Multiplexing: Many to one/one to Many, Frequency division Multiplexing, Time division Multiplexing, Multiplexing applications, introduction to multiple access techniques

Unit II:

Digital Modulation Scheme: Random Processes and Spectral Analysis: Concept of Probability, Random variable, Random Process, Classification of Random Processes, Power spectral density , Method of generation and detection of coherent & non-coherent binary ASK, FSK & PSK, DPSK quadrature modulation/demodulation techniques.(QPSK and MSK),M-ary Digital carrier Modulation/demodulation, QAM

Unit III:

Performance Analysis Of Digital Communication System: General Binary Signaling, Coherent Receivers for Digital Carrier Modulations, General Expression for Error Probability of optimum receivers.

Information Theory: Measure of Information, Source Encoding, Entropy, Channel capacity, Error Correcting codes: Hamming code, linear block codes, cyclic codes, Huffman coding, Shannon-Fano coding, code tree & Trellis diagram.

Unit IV:

Introduction To Data Communication and Networking: Data Communication, network architecture, Networks, Protocols and Standards, data link layer Standards Organizations. Line Configuration, Topology, Transmission Modes Types of transmission media: Guided Media, Unguided Media, Transmission Impairments, Circuit switching

Unit V:

Introduction to Wireless Networks: Evolution of Wireless Networks, Applications, Challenges,

Overview of various Wireless Networks.

Wireless transmission: Frequencies for radio transmission, signals, antennas, Signal propagation.Multiplexing (Space Division Multiplexing, Frequency Division Multiplexing, TimeDivision Multiplexing, Code Division Multiplexing, Orthogonal Frequency Division Multiplexing),

Reference Books:

1. B.P.Lathi,"Modern Digital and Analog Communication Systems", Oxford University PressPublication
2. H. Taub, D.L. Schilling, G. Saha,"Principles of Communications", McGraw-Hill InternationalPublication
3. SimonHaykin,"Communication Systems”, Wiley India Publication.
4. H.P.HSU and D.Mitra,"Analog and Digital Communications", Tata McGraw-Hill publication.

Major Courses offered w.e.f. AY 2024-25

SEMESTER-V COUSE CODE :24ELEP72B
COURSE 17B: DIGITAL AND DATA COMMUNICATION SYSTEMS

Practical Credits: 1 2 hrs/week

List Of Experiments

1. To analyze a PCM system and interpret the modulated and demodulated waveforms for asampling frequency
2. To analyze a Delta modulation-demodulation and observe effect of slope overload
3. To analyze a FSK modulation system and interpret the modulated and demodulated waveforms
4. To analyze a PSK modulation system and interpret the modulated and demodulated waveforms
5. To demonstrate Time Division Multiplexing and De-multiplexing process using Pulseamplitude modulation signals
6. To simulate Binary Amplitude shift keying technique using MATLAB software
7. To simulate Binary Frequency shift keying technique using MATLAB software
8. To simulate Binary Phase shift keying technique using MATLAB software
9. To simulate Quadrature Phase shift keying technique using MATLAB software

10. To simulate Differential Phase shift keying technique using MAT

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

SEMESTER-V COUSE CODE :24ELEM72B
COURSE 17B: DIGITAL AND DATA COMMUNICATION SYSTEMS

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application/	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	UNIT-I		2(one out of two)	2
2	UNIT-II		2(one out of two)	2
3	UNIT-III		2(one out of two)	2
4	UNIT-IV		2(one out of two)	2
5	UNIT-V		2(one out of two)	2

SEMESTER-V COUSE CODE :24ELEM72B

COURSE 17B: DIGITAL AND DATA COMMUNICATION SYSTEMS

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (__)

(Programme)______________ Course title___________________. Course code__________

Time: 3 hours Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7. ---
8. –
9. –
10. --

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (a).

(Or)

(b)

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Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM73A: RF Networks

Theory Credits: 3 3 hrs/week

Objectives

- The students will learn:
- To model high frequency circuit using scattering matrixes
- To acquire knowledge on the RF filter design
- To design microwave amplifier
- To get familiar with design of RF oscillator
- To learn about the high frequency antennas

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Apply scattering parameters in RF circuit and systems	Level 3 (Apply)
CO 2	Develop filters for high frequency applications	Level 6 (creation)
CO 3	Design amplifiers for RF transceivers	Level 6 (creation)
CO 4	Understand the RF oscillator design techniques	Level 2 (Understand)
CO 5	Develop antennas for high frequency applications	Level 6 (creation)

UNIT I
NETWORKS AND MATRICES

Scattering and chain scattering matrices, Generalized scattering matrix, Analysis of two port networks, Interconnection of networks. Positive real concepts, scattering matrix, representation of microwave components (directional coupler, circulators, hybrids and isolators).

UNIT II
HIGH FREQUENCY CIRCUIT DESIGN

Tuned Circuits, Filter design- Butterworth filter, Chebyshev filter, impedance matching. High frequency amplifier, BJT and FET amplifier, Broadband Amplifiers RF Oscillators, Colpitts, Hartley Oscillators, PLL. High Frequency Integrated Circuits.

UNIT III

MICROWAVE AMPLIFIER DESIGN

Types of amplifiers, Power gain equations. Introduction to narrow band amplifiers basic concepts, Maximum gain design, Low noise design. High power design, Negative resistance, reflection amplifiers – various kinds – stability considerations, Microwave transistor amplifier design – input and output matching networks – constant noise figure circuits.

UNIT IV

MICROWAVE TRANSISTOR OSCILLATOR DESIGN

One port and two port negative resistance oscillators. Oscillator configurations, Oscillator design using large signal measurements, Introduction to Microwave CAD packages, Microwave integrated circuits, MIC design for lumped elements

UNIT V

RF AND MICROWAVE ANTENNAS

Radiation from surface current and line current distribution, Basic Antenna parameters, Feeding structure-Patch Antenna, Ring Antenna, Micro strip dipole, Micro strip arrays, Traveling wave Antenna, Antenna System for Mobile Radio-Antenna Measurements and Instrumentation. Propagation characteristics of RF and Microwave signals, Introduction to EBG structures.

REFERENCES:

1. Matthew M.Radmanesh, "RF and Microwave Design Essentials", Author House, Bloomington, 2007.
2. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design – Theory and Applications", Pearson, 2nd Edition, 2012.
3. E.da Silva, "High Frequency and Microwave Engineering", Butterworth Heinmann Publications, Oxford, 2001.
4. David.M.Pozar, "Microwave Engineering", John Wiley and Sons, 4th Edition, 2012.
5. Kraus.J.D, Marhefka.R.J. Khan.A.S. "Antennas and Wave Propagation", Tata Mc Graw Hill, New Delhi, 5th Edition, 2017

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

SEMESTER-VII

COURSE CODE 24ELEM73AP: RF Networks

Practical Credits: 1 2 hrs/week

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Develop the ability to measure and analyze transmission line parameters, including inductance, capacitance, reflection coefficient, and VSWR, using a network analyzer.	Level 6
CO 2	Apply knowledge of microwave engineering to design and characterize microstrip transmission lines, including $\lambda/2$, $\lambda/4$, and $\lambda/8$ lines, ensuring optimal signal transmission	Level 3
CO 3	Design and evaluate RF filters and impedance matching networks, demonstrating proficiency in optimizing RF circuit performance for various applications.	Level 6
CO 4	Gain practical experience in measuring and interpreting RF signals and their spectra, using advanced instrumentation to analyze and troubleshoot RF systems	Level 2
CO 5	Design, simulate, and characterize key RF components such as antennas, low-noise amplifiers (LNAs), mixers, and voltage-controlled oscillators (VCOs), with a focus on real-world applications in communication systems	Level 6

LIST OF EXPERIMENTS

1. Measurement of transmission line parameters using network analyzer

(a) Inductor (b) Capacitor

2.Measurement of transmission line parameters using network analyzer

(a) Reflection coefficient (b) VSWR

3.Design of Microstrip transmission line

(a) $\lambda/2$ line (b) $\lambda/4$ line (c) $\lambda/8$ line

4.Design and characterization of RF filters

5.Design of impedance matching network

6.Measurement of RF signals and their spectrum

7.Design and characterization of antennas

8.Design and characterization of LNA

9.Design and characterization of Mixer 10. Design and characterization of VCO

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Programme: B.Sc. Honours in Electronics (Major)
SEMESTER-VII
COURSE CODE 24ELEM73A: RF Networks

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-VII

COURSE CODE 24ELEM73A: RF Networks

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

Question Bank

UNIT I: NETWORKS AND MATRICES

Essay Questions:

1. Discuss the concept of scattering matrices and their significance in the analysis of microwave networks..
2. Explain the principles and applications of positive real functions in network theory. How are these concepts applied in the design and analysis of two-port microwave networks?
3. Analyze the interconnection of networks using chain scattering matrices. Discuss how these matrices simplify the analysis of complex microwave networks.

Short Answer Questions:

1. Define the scattering matrix and describe its key properties.
2. What is the significance of a positive real function in network analysis?
3. Explain the concept of the generalized scattering matrix and its application in microwave network analysis.

UNIT II: HIGH FREQUENCY CIRCUIT DESIGN

Essay Questions:

1. Compare and contrast Butterworth and Chebyshev filters in terms of design and performance characteristics. How are these filters used in high-frequency circuit design?
2. Discuss the design and operation of high-frequency amplifiers using BJT and FET. What are the challenges associated with broadband amplifier design?
3. Explain the working principles of RF oscillators, focusing on Colpitts and Hartley configurations.

Short Answer Questions:

1. What is impedance matching, and why is it critical in high-frequency circuit design?
2. Briefly describe the working principle of a Colpitts oscillator.
3. What are the key characteristics of a Chebyshev filter?

UNIT III: MICROWAVE AMPLIFIER DESIGN

Essay Questions:

1. Discuss the design considerations for narrow-band microwave amplifiers, including maximum gain and low noise design.
2. Explain the concept of negative resistance in reflection amplifiers. Discuss the various types of reflection amplifiers and their stability considerations.
3. Analyze the role of input and output matching networks in microwave transistor amplifier design.

Short Answer Questions:

1. What is the importance of power gain equations in amplifier design?
2. Define negative resistance and explain its relevance in amplifier design.
3. What are constant noise figure circuits, and how are they used in microwave amplifier design?

UNIT IV: MICROWAVE TRANSISTOR OSCILLATOR DESIGN

Essay Questions:

1. Discuss the design of one-port and two-port negative resistance oscillators. How do large signal measurements influence the design process?
2. Explain the role of Microwave CAD packages in the design of microwave integrated circuits (MICs
3. Analyze the challenges associated with the design of microwave transistor oscillators

Short Answer Questions:

1. What is the difference between one-port and two-port negative resistance oscillators?
2. Briefly describe the importance of large signal measurements in oscillator design.
3. What are microwave integrated circuits (MICs), and how are they used in modern electronics?

UNIT V: RF AND MICROWAVE ANTENNAS

Essay Questions:

1. Discuss the radiation mechanisms of surface current and line current distribution in RF and microwave antennas.
2. Explain the design and application of microstrip antennas, including patch, ring, and dipole configurations.
3. Analyze the propagation characteristics of RF and microwave signals in various environments.

Short Answer Questions:

1. Define basic antenna parameters and explain their significance in antenna design.
2. What is a microstrip array, and how is it used in antenna systems?
3. Briefly describe the concept of EBG structures and their application in antenna design.

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Programme: B.Sc. Honours in Electronics (Major)
SEMESTER-VII
COURSE CODE 24ELEM73A: RF Networks

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1. Define the scattering matrix and describe its key properties.
2. What is the significance of a positive real function in network analysis?
3. Briefly describe the working principle of a Colpitts oscillator.
4. What are the key characteristics of a Chebyshev filter?
5. What is the importance of power gain equations in amplifier design?
6. Define negative resistance and explain its relevance in amplifier design
7. What is the difference between one-port and two-port negative resistance oscillators?
8. Briefly describe the importance of large signal measurements in oscillator design.
9. What is a microstrip array, and how is it used in antenna systems?
10. Briefly describe the concept of EBG structures and their application in antenna design

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (a) Discuss the concept of scattering matrices and their significance in the analysis of microwave networks..

(OR)

(b) Analyze the interconnection of networks using chain scattering matrices. Discuss how these matrices simplify the analysis of complex microwave networks.

12.(a) Compare and contrast Butterworth and Chebyshev filters in terms of design and performance characteristics. How are these filters used in high-frequency circuit design?

(OR)

(b) Discuss the design and operation of high-frequency amplifiers using BJT and FET. What are the challenges associated with broadband amplifier design?

13.(a) Explain the concept of negative resistance in reflection amplifiers. Discuss the various types of reflection amplifiers and their stability considerations

(OR)

(b) Analyze the role of input and output matching networks in microwave transistor amplifier design

14.(a) Discuss the design of one-port and two-port negative resistance oscillators. How do large signal measurements influence the design process?

(OR)

(b) Explain the role of Microwave CAD packages in the design of microwave integrated circuits (MICs)

15.a) Discuss the radiation mechanisms of surface current and line current distribution in RF and microwave antennas

(OR)

(b) Analyze the propagation characteristics of RF and microwave signals in various environments.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M73B

IV Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-VII

COURSE 18 B: WIRELESS SENSOR NETWORK DESIGN

Theory Credits: 3 3hrs/week

OBJECTIVES :

- To understand the fundamentals of wireless sensor network
- To gain knowledge on the MAC and Routing Protocols of WSN
- To get exposed to 6LOWPAN technology
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.
- To gain knowledge about operating system related to WSN and 6LOWPAN

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	**Explain** the principles and challenges of Wireless Sensor Networks (WSNs), including node architecture, network design principles, and the role of gateways. Analyze the physical layer considerations and transceiver design in short-range radio communication standards such as IEEE 802.15.4, Zigbee, and Bluetooth.	**Level-3**
2.	**CO-2**	**Compare** and **contrast** MAC protocols in WSNs, including fundamental concepts, low duty cycle protocols, contention-based, and schedule-based protocols like SMAC, BMAC, and TRAMA. Evaluate routing protocols such as SPIN, Directed Diffusion, LEACH, PEGASIS, and their suitability based on network requirements.	**Level-4**
3.	**CO-3**	**Design** and **implement** 6LoWPAN architectures, including protocol stack configurations, adaptation layers, addressing schemes, and routing strategies like Mesh-Under and Route-Over. Evaluate header compression techniques (stateless and context-based) and mechanisms for fragmentation and reassembly. Analyze mobility protocols such as Mobile IPv6, Proxy MIPv6, and NEMO routing.	**Level-5**
4.	**CO-4**	**Develop** applications for WSNs considering design issues and protocol paradigms such as end-to-end communication, real-time streaming, publish/subscribe models, and web service protocols. Implement common protocols like MQTT-S, ZigBee CAP, SNMP, and explore real-time transport and session management in specific industry contexts.	**Level-5**
5.	**CO-5**	**Utilize** tools like TinyOS and Contiki for WSN development, including programming in NesC, configuring interfaces and modules, and simulating networks using TOSSIM and Cooja simulator.	**Level-4**

UNIT I

INTRODUCTION

Principle of Wireless Sensor Network -Introduction to wireless sensor networks-Challenges,

Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards- IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT II

MAC AND ROUTING PROTOCOLS

MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC,TRAMA, Routing protocols – Requirements, Classification -SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT III

6LOWPAN

6LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers – Addressing, Routing - Mesh-Under - Route-Over, Header Compression - Stateless header compression - Context- based header compression, Fragmentation and Reassembly , Mobility – types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO –Routing – MANET, ROLL, Border routing.

UNIT IV

APPLICATIONS

Design Issues, Protocol Paradigms -End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols -Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP),Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry- Specific protocols.

UNIT V

TOOLS

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming

REFERENCE BOOKS:

1. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley Publication, 2006.
2. Anna Forster, "Introduction to Wireless Sensor Networks", Wiley, 2017.
3. Zach Shelby Sensinode and Carsten Bormann, " 6LoWPAN: The Wireless Embedded
   Internet" John Wiley and Sons, Ltd, Publication, 2009.
4. Philip Levis, "TinyOS Programming", 2006 – www.tinyos.net.
5. The Contiki Operating System. http://www.sics.se/contiki.

Course Code: 24(ELE)M73BP

SEMESTER-VII

COURSE 18 B: WIRELESS SENSOR NETWORK DESIGN

Practical Credits: 1 2hrs/week

LIST OF EXPERIMENTS

1. Routing protocol of WSN
2. Characteristics Analysis of ZIGBEE
3. Characteristics Analysis of Bluetooth
4. MAC protocol of WSN
5. Study of 6LOWPAN OS and Simulator
6. RPL analysis
7. Topology Analysis of 6LOWPAN
8. RFID based application using zigbee/Bluetooth/6lowpan
9. Proximity based application using zigbee/Bluetooth/6lowpan
10. MINI PROJECT

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M73B

IV Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-VII

COURSE 18 B: WIRELESS SENSOR NETWORK DESIGN

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	1	1	1	2	2	2	3
CO 2	2	3	2	1	1	2	3	3	2	3
CO 3	3	2	1	2	1	1	3	2	3	2
CO 4	3	3	2	2	2	2	2	2	2	3
CO 5	3	3	2	1	2	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	2	2	2	2
CO 3	2	3	3	3	3
CO 4	3	3	2	2	3
CO 5	2	3	3	2	2

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Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(ELE)M73B

BLUE PRINT (:WIRELESS SENSOR NETWORK DESIGN)
IIB.Sc. (Hons.) ELECTRONICS- SEM-VII/Course : 18B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	PRINCIPLE OF WIRELESS SENSOR NETWORK	2	2	30
2.	II	MAC AND ROUTING PROTOCOLS	2	2	30
3.	III	6LOWPAN	2	2	30
4.	IV	APPLICATIONS	2	2	30
5.	V	TOOLS	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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Dr. V S KRISHNA GOVERNMENT DEGREE COLLEGE (A) VISAKHAPATNAM
B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M73B
II Year B.Sc (Hons.)- ELECTRONICS, SEMESTER-VII
COURSE 18B: WIRELESS SENSOR NETWORK DESIGN

Time: 3 hrs. **Maxmarks:60**

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Explain the principles of Wireless Sensor Networks (WSNs)?[[OR]

   b) Describe the architecture of nodes and networks in Wireless Sensor Networks (WSNs)?

2. a) Explain contention-based and schedule-based MAC protocols used in WSNs?
   [OR]
   b) Describe the requirements and classifications of routing protocols in WSNs?
3. a) Explain the architecture of 6LoWPAN ?[OR]
   b) Discuss the different link layer technologies used in 6LoWPAN?

4. a) Discuss the design issues and protocol paradigms in applications of Wireless Sensor?
   [OR]
   b) Explain the role of WSN protocols in industry-specific applications?

5. a) Explain the architecture, interfaces, modules, and configuration concepts in TinyOS?
   [OR]

   b) Discuss programming techniques using NesC?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) What are the key challenges in Wireless Sensor Networks (WSNs)
7. a) What is the role of a gateway in Wireless Sensor Networks (WSNs)?
8. a) What is the role of Medium Access Control (MAC) protocols in WSNs?
9. a) Describe the operation of SMAC (Sensor MAC) protocol in detail?
10. a) Describe the protocol stack of 6LoWPAN?
11. a) How does 6LoWPAN support mobility?
12. a) Describe the end-to-end communication paradigm in WSNs?
13. a) Discuss the advantages and applications of MQTT-S in WSNs?
14. a) Discuss the role of interfaces and modules in TinyOS programming?
15. a) Compare the programming models of TinyOS and Contiki OS?

B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]

Course Code: 24(ELE)M73B

II Year B.Sc (Hons.)- ELECTRONICS, SEMESTER-VII

COURSE 18B: WIRELESS SENSOR NETWORK DESIGN

QUESTION BANK

UNIT I: INTRODUCTION TO WIRELESS SENSOR NETWORKS

Essay Questions:

1. Explain the principles of Wireless Sensor Networks (WSNs). Discuss the challenges faced in designing and deploying WSNs compared to ad hoc networks.
2. Describe the architecture of nodes and networks in Wireless Sensor Networks (WSNs). Discuss the design principles and service interfaces used in WSNs.
3. Compare and contrast short-range radio communication standards IEEE 802.15.4, Zigbee, and Bluetooth. Discuss their applications and suitability in different WSN scenarios.

Short Questions:

1. What are the key challenges in Wireless Sensor Networks (WSNs)? How do they differ from challenges in ad hoc networks?
2. Describe the node architecture in a WSN. What are the essential components of a typical sensor node?
3. Explain the concept of network architecture in Wireless Sensor Networks (WSNs). How does it facilitate efficient data communication?
4. Discuss the design principles that guide the development of Wireless Sensor Networks (WSNs).
5. Compare IEEE 802.15.4, Zigbee, and Bluetooth in terms of their physical layer and transceiver design considerations.
6. What is the role of a gateway in Wireless Sensor Networks (WSNs)? How does it connect WSNs to external networks?

UNIT II: MAC AND ROUTING PROTOCOLS

Essay Questions:

1. Discuss the fundamentals of Medium Access Control (MAC) protocols in Wireless Sensor Networks (WSNs). Compare and contrast low duty cycle protocols with wakeup concepts.
2. Explain contention-based and schedule-based MAC protocols used in WSNs (e.g., SMAC, BMAC, TRAMA). Discuss their advantages and disadvantages.
3. Describe the requirements and classifications of routing protocols in WSNs. Discuss examples such as SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, and PEGASIS.

Short Questions:

1. What is the role of Medium Access Control (MAC) protocols in Wireless Sensor Networks (WSNs)? Why are they necessary?
2. Explain the concept of low duty cycle protocols in WSNs. How do they conserve energy?
3. Compare contention-based and schedule-based MAC protocols in terms of their operation and efficiency.
4. Describe the operation of SMAC (Sensor MAC) protocol in detail. What are its advantages in WSNs?
5. Discuss the characteristics and applications of BMAC (Burst Media Access Control) protocol.
6. What are the key features of schedule-based MAC protocols like TRAMA?

UNIT III: 6LOWPAN

Essay Questions:

1. Explain the architecture of 6LoWPAN (IPv6 over Low-Power Wireless Personal Area Networks). Describe its protocol stack and adaptation layer.
2. Discuss the different link layer technologies used in 6LoWPAN. Explain addressing schemes, routing techniques (Mesh-Under and Route-Over), and header compression methods.
3. Describe the mobility aspects in 6LoWPAN networks. Discuss Mobile IPv6, Proxy Mobile IPv6, and Network Mobility (NEMO). Explain their roles in supporting mobile devices in WSNs.

Short Questions:

1. What is 6LoWPAN? How does it enable IPv6 communication over low-power wireless networks?
2. Describe the protocol stack of 6LoWPAN. What are the functions of the adaptation layer?
3. Explain the Mesh-Under and Route-Over routing techniques used in 6LoWPAN networks.
4. Discuss the stateless and context-based header compression techniques employed in 6LoWPAN.
5. What are the challenges associated with fragmentation and reassembly in 6LoWPAN networks?
6. How does 6LoWPAN support mobility? Discuss the roles of Mobile IPv6, Proxy Mobile IPv6, and NEMO in WSNs.

UNIT IV: APPLICATIONS

Essay Questions:

1. Discuss the design issues and protocol paradigms in applications of Wireless Sensor Networks (WSNs). Explain end-to-end communication, real-time streaming, sessions, and publish/subscribe paradigms.
2. Describe common protocols used in WSN applications, such as MQTT-S, ZigBee CAP, SNMP, and protocols for real-time transport and sessions. Discuss their features and applications.
3. Explain the role of WSN protocols in industry-specific applications. Discuss examples of protocols used in various industries and their impact on efficiency and reliability.

Short Questions:

1. What are the design considerations for applications of Wireless Sensor Networks (WSNs)? How do they differ from traditional networks?
2. Describe the end-to-end communication paradigm in WSNs. How does it ensure reliable data transmission?
3. Explain the concept of real-time streaming and sessions in WSN applications. Why are they important?
4. Discuss the advantages and applications of MQTT-S (MQ Telemetry Transport for Sensor Networks) in WSNs.
5. What is ZigBee CAP (Compact Application Protocol)? How is it used in ZigBee networks?
6. Explain the role of SNMP (Simple Network Management Protocol) in monitoring and managing WSNs.

UNIT V: TOOLS

Essay Questions:

1. Introduce TinyOS and NesC programming language. Explain the architecture, interfaces, modules, and configuration concepts in TinyOS. Discuss programming techniques using NesC.
2. Describe Contiki OS. Discuss its structure, communication stack, and simulation environment (Cooja simulator). Explain how Contiki OS facilitates the development and simulation of WSN applications.
3. Compare TinyOS and Contiki OS in terms of their features, development environment, and suitability for different types of WSN applications.

Short Questions:

1. What is TinyOS? Describe its architecture and key components.
2. Explain the NesC programming language. How is it used in developing applications for TinyOS?
3. Discuss the role of interfaces and modules in TinyOS programming.
4. Describe the simulation environment provided by the Cooja simulator in Contiki OS.
5. How does Contiki OS support communication in WSNs? Discuss its communication stack.
6. Compare the programming models of TinyOS and Contiki OS. Which aspects make them suitable for WSN applications?

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM74A**
SEMESTER-VII (IV Year) COURSE 19A: SENSORS

Theory Credits: 3 3 Hrs/Week

Course Objectives: The course on Sensors aims

- To familiarize students with basic terminologies of the Sensors.
- Essential knowledge to be acquainted in the field of Sensors.

Learning Outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand terminologies related to Sensors.	Level 2 (Understanding)
CO 2	Acquainted with various applications and futuristic Sensor's technology.	Level 2 (Understanding) Level 3 (Applying)
CO 3	Differentiate Biomedical Sensors.	Level 4 (Analysing)
CO 4	Understand the characteristics of Optical Sensors Holography.	Level 2 (Understanding)
CO 5	Design of signal conditioning devices for sensors.	Level 6 (Create)

SYLLABUS

UNIT–I

Chemical Sensors Physical Sensors, Surface Micro Machined Capacitive Pressure sensor, integrated flow sensor, *Piezo-electric sensors*, *Motion sensors*, Chemical and Biochemical Sensors, Conductivity sensor, Hydrogen Sensitive MOSFET, Tri-Oxide Sensors, Schottky diode type sensor, Solid Electrolyte, Electrochemical Sensors. Sensor Matrix for Two-Dimensional measurement of concentrations.

UNIT–II

Optical Sensors Holography, Echolocation and bio-holography, Sensors used in space and environmental applications. Application in meteorology, Natural resources application sensor used in Instrumentation methods.

UNIT–III

Biomedical Sensors, Biological Sensors in Human Body, O*ptical, Acoustic, Piezoelectric, and Calorimetric biosensors*, Different types of Transducer system, Physiological Monitoring, chemo receptors, Hot and Cold receptors, Sensors for smell, sound, vision, taste.

UNIT–IV

Aerospace Sensor Gyroscope laser and fibre optic gyroscopes, Accelerometers. Laser, Aerospace application of laser, Resolvers, Altimeters, Angle of attack sensors, servos.

UNIT–V

Advanced Sensor Design Sensor design, sensor characteristics, Design of signal conditioning devices for sensors. Design of 2 and 4 wire transmitters with 4, 20 Ma output. Pressure Sensor using Si-Si bonding, Catheter pressure sensors, TIP pressure sensors, High pressure sensors, Silicon accelerometers

References

1. Sensors Hand Book - Sabaree Soloman, McGraw Hill ,1998
2. Medical Instrumentation Application and Design - J.G. Webster Houghton Mifilin Co.
3. Introduction to Medical Equipment Technology - Carr and Brown, Addison Wesley, 1999.
4. Optical Fibre Sensors, Volume 1 & 2 - Culshaw B and Dakin J (Eds), Artech House, Norwood, 1989.
5. Guided Weapon Control Systems - P. Garnell, Pergamon Press, 1980.

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	2	3	3
CO 2	3	1	1	1	1	2	3	2	3	3
CO 3	3	1	1	1	1	2	3	2	3	3
CO 4	3	1	1	1	1	2	3	2	3	3
CO 5	3	1	1	1	1	2	3	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM74AP**

SEMESTER-VII (IV Year) COURSE 19A: SENSORS Practical Course

Practical Credits: 1 2 Hrs/Week

COURSE OBJECTIVE:

To develop practical skills in the use of laboratory equipment and experimental techniques for measuring different properties of Sensors.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for measuring different properties of Sensors.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 2	Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.	Level 3 (Applying)
CO 3	Accurate recording and analysis of data: Students should be able to accurately record and analyse experimental data, including understanding the significance of error analysis and statistical methods.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Understanding of fundamental principles of Sensors.	Level 2 (Understanding) Level 3 (Applying)

List of Experiments:

1. Voltage and Current Detection Circuitry.
2. Temperature and Pressure Detection Circuitry.
3. Water flow and Level detection Circuitry.
4. Light sensor.
5. Humidity sensor.
6. Measurement of Power and Energy.
7. Measurement of Resistance by bridge.
8. Analog temperature.
9. Digital temperature and humidity sensor.
10. Ultrasonic sensor.

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM74A**
SEMESTER-VII (IV Year) COURSE 19A: SENSORS

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM74A**

SEMESTER-VII (IV Year) COURSE 19A: SENSORS

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Chemical Sensors	2 (One out of two)	2
2	Unit – II	Optical Sensors	2 (One out of two)	2
3	Unit – III	Biomedical Sensors	2 (One out of two)	2
4	Unit – IV	Aerospace Sensor	2 (One out of two)	2
5	Unit – V	Advanced Sensor Design	2 (One out of two)	2

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM74A**
SEMESTER-VII (IV Year) COURSE 19A: SENSORS

Theory | Credits: 3 | 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs | Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. What is the working principle of a Hydrogen Sensitive MOSFET, and where is it commonly used?
2. Describe the concept of a Sensor Matrix for Two-Dimensional measurement of concentrations.
3. What are the key differences between Echolocation and Bio-holography in the context of sensor technology?
4. Identify and briefly describe a sensor used in natural resource applications.
5. How do hot and cold receptors function as biological sensors?
6. Briefly describe the mechanism of sensors used for detecting sound in the human body.
7. What are the primary functions of accelerometers in aerospace applications?
8. Describe the role of servos in the operation of aerospace sensors.
9. What are the characteristics of a 2-wire transmitter with a 4-20 mA output?
10. Briefly explain the function of catheter pressure sensors in medical applications.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Discuss the working principle and applications of Surface Micro Machined Capacitive Pressure Sensors. How do these sensors differ from traditional pressure sensors?

(OR)

(b) Explain the role of Schottky diode type sensors in chemical sensing. Discuss their sensitivity, selectivity, and the types of chemical reactions they can detect.

12. (a) Explain the principles of Holography and its application in optical sensors. How does holography improve sensor performance in environmental monitoring?

(OR)

(b) Discuss the use of optical sensors in meteorology. How do these sensors contribute to weather prediction and climate studies?

13. (a) Analyze the role of chemo receptors in the human body. How do they contribute to physiological monitoring and medical diagnostics?

(OR)

(b) Discuss the various types of transducer systems used in biomedical sensors. Provide examples of their applications in monitoring different physiological parameters.

14. (a) Explain the working principle of fiber optic gyroscopes and their significance in aerospace applications. Compare them with traditional gyroscopes.

(OR)

(b) Discuss the role of laser technology in aerospace sensors. How are lasers used in altimeters and angle of attack sensors?

15. (a) Discuss the challenges and considerations in designing signal conditioning devices for sensors. Provide examples of how these devices enhance sensor performance.

(OR)

(b) Explain the design and operation of Si-Si bonded pressure sensors. How are they utilized in high-pressure environments?

Question Bank

Short answer Questions

1. What is the working principle of a Hydrogen Sensitive MOSFET, and where is it commonly used?
2. Describe the concept of a Sensor Matrix for Two-Dimensional measurement of concentrations.
3. What are the key differences between Echolocation and Bio-holography in the context of sensor technology?
4. Identify and briefly describe a sensor used in natural resource applications.
5. How do hot and cold receptors function as biological sensors?
6. Briefly describe the mechanism of sensors used for detecting sound in the human body.
7. What are the primary functions of accelerometers in aerospace applications?
8. Describe the role of servos in the operation of aerospace sensors.
9. What are the characteristics of a 2-wire transmitter with a 4-20 mA output?
10. Briefly explain the function of catheter pressure sensors in medical applications.
11. Distinguish between the Chemical Sensors and Physical Sensors.
12. Discuss about Optical Sensors and Holography.
13. What are the Different types of Transducer systems.
14. Write a short note on the High-pressure sensors.
15. Discuss about the Silicon accelerometers.

Long answer Questions

1. Discuss the working principle and applications of Surface Micro Machined Capacitive Pressure Sensors. How do these sensors differ from traditional pressure sensors?
2. Explain the role of Schottky diode type sensors in chemical sensing. Discuss their sensitivity, selectivity, and the types of chemical reactions they can detect.
3. Explain the principles of Holography and its application in optical sensors. How does holography improve sensor performance in environmental monitoring?
4. Discuss the use of optical sensors in meteorology. How do these sensors contribute to weather prediction and climate studies?
5. Analyze the role of chemo receptors in the human body. How do they contribute to physiological monitoring and medical diagnostics?

6. Discuss the various types of transducer systems used in biomedical sensors. Provide examples of their applications in monitoring different physiological parameters.
7. Explain the working principle of fiber optic gyroscopes and their significance in aerospace applications. Compare them with traditional gyroscopes.
8. Discuss the role of laser technology in aerospace sensors. How are lasers used in altimeters and angle of attack sensors?
9. Discuss the challenges and considerations in designing signal conditioning devices for sensors. Provide examples of how these devices enhance sensor performance.
10. Explain the design and operation of Si-Si bonded pressure sensors. How are they utilized in high-pressure environments?

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VII COURSE CODE: 24ELEM74B
BIOMEDICAL INSTRUMENTATION

Theory Credits:3 3hrs/week

Objectives:

- Biomedical Instrumentation and Signal Processing
- It applies quantitative, analytical, software and hardware methods which help in better understanding of basic biological processes and to develop innovative techniques for the diagnosis, treatment and prevention of diseases.

Learning Outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Explain the different physiological systems of human	Level 1
CO 2	Summarize various electrical and non electrical parameters measuring devices. .	Level 1
CO 3	Illustrate non electrical parameters measurement methods	Level 2
CO 4	Classify the various recording methods used in medical field Infer the graphical and imaging applications in biomedical system.	Level 3
CO 5	Summarize the life assisting and therapeutic devices	Level 2

SYLLABUS

Unit I: **Basic Principles of Biomedical Electronics**

Bioelectrical signals, distribution of electrical potentials in different parts of the body, their magnitude and relationship to the physical status, processing of bio-electronic signals, different transducers for data acquisition; man-instrument system, biometrics

Unit II: Recording Systems

General consideration of electronic recording: preamplifier, main amplifier and driver amplifier; considerations of noise; display systems: Oscilloscopes- long persistence, memory facility, multi-channel displays, flat panel displays, touch screens

Unit III: Patient Safety and imaging techniques

Electronic shock hazards in biomedical instrumentation, Leakage current; grounding techniques; patient monitoring systems: foetus monitoring system and ICU; Need for imaging human body, imaging techniques: NMR, MRI, ultrasonic, X-ray tomography, endoscope, flexible bronchoscope and gastro scope

Unit IV: Biomedical Instruments

Electro-encephalography (EEG), Electrocardiography (ECG), Electromyography (EMG), hemo- dialysis machine, traction, cardiac pacemakers, cardiac defibrillators; use of telemetry in diagnosis, Lasers in biomedical field

Unit V:

EMC Applications: Digital circuit power distribution, Digital circuit radiations, Conducted emissions, RF and transient immunity, electrostatic discharge, PCB layout and design, EMC measurements. Standards, reliability, automated test equipment.

Reference Books:

1. Handbook of Biomedical Instrumentation –R. S. Khandpur, TMH, New Delhi
2. Biomedical Instrumentation – Leslie Cromwell, PHI Publication, New Delhi
3. Biomedical Engineering System – Leslie Cromwell, PHI Publication, New Delhi
4. Biomedical Phenomenon – Robert Plonsay, John Wiley & Sons
5. Computers in medicine – R. D. Lele, TMH, New Delhi
6. Introduction to Biomedical Equipment Technology: J. J. Carr and J. M. Brown, Pearson Education Asia Publication, Singapore
7. W. C. Bossshart , ―PCB Design and Technology‖ Tata McGraw Hill, 1987.
8. Clyde F. Coombs, ―Electronic Instrument Handbook‖, McGraw Hill, Third Edition, 2005.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

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CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
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NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VII COURSE CODE: 24ELEM74B
BIOMEDICAL INSTRUMENTATION

Max Marks-60 **Time-3Hrs.** **Credits:3**

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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BIOMEDICAL INSTRUMENTATION

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2(two out of four)**	**1(one out of two**
Understanding/ Comprehension	**27%**	**16**	**2(two out of four)**	
Application	**20%**	**12**	**1(one out of two)**	**1(one out of two**
Analysis	**13%**	**8**		**2(two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1(one out of two**
Total	**100**	**60**	**5(each question has internal choice)**	**5 outb of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	8 marks	4 marks
1	**I**	Basic Principles of Biomedical Electronics	**2(one out of two)**	**2**
2	**II**	Recording Systems	**2(one out of two**	**2**
3	**III**	Patient Safety and imagingtechniques	**2(one out of two**	**2**
4	**IV**	BiomedicalInstruments	**2(one out of two**	**2**
5	**V**	EMC Applications	**2(one out of two**	**2**
		TOTAL QUESTIONS	**5(each question has internal choice)**	**5 out of given 10**

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Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VII COURSE CODE: 24ELEM74B
BIOMEDICAL INSTRUMENTATION

Model Question Paper

DURATION::3 hrs **MAX.MARKS : 60**

SECTION-A

Answer any FIVE questions of the following (5 X 4 = 20 M)

1. What are bioelectrical signals, and why are they important in biomedical electronics?
2. Briefly describe the relationship between bioelectrical signals and the physical status of the human body.
3. What is the role of a preamplifier in an electronic recording system?
4. How does noise affect the performance of biomedical recording systems?
5. Briefly describe the purpose of a cardiac pacemaker.
6. What are the common applications of lasers in biomedical engineering?
7. What is the primary function of an ECG machine?
8. How does a hemodialysis machine assist patients with kidney failure?
9. Define electrostatic discharge (ESD) and its impact on medical devices.
10. How does proper PCB layout contribute to EMC in biomedical applications?

SECTION-B

Answer ALL the questions Of the following (5 X 8 = 40 M)

11. (a) Discuss the nature and significance of bioelectrical signals in the human body. How do these signals reflect the physical status of an individual?

[OR]

(b) Explain the distribution of electrical potentials in different parts of the body. How are these potentials measured and processed for biomedical applications?

12. (a) Discuss the impact of noise on electronic recording systems in biomedical applications. How can noise be minimized to ensure accurate data recording?

[OR]

(b) **Analyze the various types of display systems used in biomedical electronics, such as oscilloscopes with long persistence, memory facility, and multi-channel displays**.

13. (a) Discuss the potential electronic shock hazards associated with biomedical instrumentation. What techniques can be employed to mitigate these risks?

[OR]

(b)Explain the importance of grounding techniques in ensuring patient safety in biomedical systems. How does improper grounding lead to leakage current and other hazards?

14. (a) Explain the operation of a hemodialysis machine. How does it support patients with kidney failure, and what are the key considerations in its design?

[OR]

(b) Analyze the role of cardiac pacemakers and cardiac defibrillators in managing heart conditions. How do these devices function, and what are their life-saving benefits?

15. (a) Analyze the role of PCB layout and design in ensuring electromagnetic compatibility (EMC) in biomedical devices. How do proper design techniques contribute to the reliability of these devices?

[OR]

(b) Evaluate the standards and regulations governing EMC in biomedical electronics. How do these standards ensure the safety and reliability of medical devices in clinical environments?

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VII COURSE CODE: 24ELEM74B
BIOMEDICAL INSTRUMENTATION

Question Bank

Unit I: Basic Principles of Biomedical Electronics

Essay Questions:

1. Discuss the nature and significance of bioelectrical signals in the human body. How do these signals reflect the physical status of an individual?
2. Explain the distribution of electrical potentials in different parts of the body. How are these potentials measured and processed for biomedical applications?
3. Describe the role of transducers in biomedical electronics. What are the different types of transducers used for data acquisition, and how do they function?
4. Analyze the concept of the man-instrument system in biomedical engineering. How does this system integrate with biometrics to enhance healthcare?

Short Answer Questions:

1. What are bioelectrical signals, and why are they important in biomedical electronics?
2. Briefly describe the relationship between bioelectrical signals and the physical status of the human body.
3. What is the function of a transducer in biomedical signal processing?
4. Define biometrics in the context of biomedical electronics.

Unit II: Recording Systems

Essay Questions:

1. Explain the general considerations involved in electronic recording systems, focusing on the role of preamplifiers, main amplifiers, and driver amplifiers in signal processing.

2. Discuss the impact of noise on electronic recording systems in biomedical applications. How can noise be minimized to ensure accurate data recording?
3. Analyze the various types of display systems used in biomedical electronics, such as oscilloscopes with long persistence, memory facility, and multi-channel displays.
4. Evaluate the advantages and challenges of using flat panel displays and touch screens in biomedical instrumentation.

Short Answer Questions:

1. What is the role of a preamplifier in an electronic recording system?
2. How does noise affect the performance of biomedical recording systems?
3. Briefly explain the function of an oscilloscope in biomedical electronics.
4. What are the benefits of using multi-channel displays in biomedical applications?

Unit III: Patient Safety and Imaging Techniques

Essay Questions:

1. Discuss the potential electronic shock hazards associated with biomedical instrumentation. What techniques can be employed to mitigate these risks?
2. Explain the importance of grounding techniques in ensuring patient safety in biomedical systems. How does improper grounding lead to leakage current and other hazards?
3. Describe the various imaging techniques used in biomedical applications, such as NMR, MRI, ultrasonic imaging, and X-ray tomography. What are their respective advantages and limitations?
4. Analyze the role of patient monitoring systems, including foetus monitoring and ICU systems, in modern healthcare. How do these systems contribute to patient safety and treatment efficacy?

Short Answer Questions:

1. What is leakage current, and how can it be prevented in biomedical instrumentation?
2. Briefly describe the significance of grounding in patient safety.
3. What are the key differences between MRI and X-ray tomography?
4. How is ultrasonic imaging used in biomedical applications?

Unit IV: Biomedical Instruments

Essay Questions:

1. Discuss the working principles and clinical applications of Electroencephalography (EEG), Electrocardiography (ECG), and Electromyography (EMG). How do these instruments contribute to medical diagnostics?
2. Explain the operation of a hemodialysis machine. How does it support patients with kidney failure, and what are the key considerations in its design?
3. Analyze the role of cardiac pacemakers and cardiac defibrillators in managing heart conditions. How do these devices function, and what are their life-saving benefits?
4. Evaluate the use of lasers in the biomedical field, particularly in surgical procedures and diagnostic applications. What are the advantages and potential risks of using lasers in medicine?

Short Answer Questions:

1. What is the primary function of an ECG machine?
2. How does a hemodialysis machine assist patients with kidney failure?
3. Briefly describe the purpose of a cardiac pacemaker.
4. What are the common applications of lasers in biomedical engineering?

Unit V: EMC Applications

Essay Questions:

1. Discuss the challenges of digital circuit power distribution in biomedical electronics. How do radiations and conducted emissions impact the performance of medical devices?
2. Explain the importance of RF and transient immunity in biomedical instruments. How can electrostatic discharge affect sensitive medical equipment, and what measures can be taken to protect against it?
3. Analyze the role of PCB layout and design in ensuring electromagnetic compatibility (EMC) in biomedical devices. How do proper design techniques contribute to the reliability of these devices?
4. Evaluate the standards and regulations governing EMC in biomedical electronics. How do these standards ensure the safety and reliability of medical devices in clinical environments?

Short Answer Questions:

1. What is conducted emission, and how does it affect digital circuits in biomedical electronics?
2. Define electrostatic discharge (ESD) and its impact on medical devices.
3. How does proper PCB layout contribute to EMC in biomedical applications?
4. What is the significance of automated test equipment in ensuring the reliability of biomedical devices?

(COURSE CODE: 24ELEM75A)

BLUE PRINT

Programme: B.Sc. Honours in Electronics (Major) -2024-2025

SEMESTER-VII COURSE 20 A: DIGITAL SIGNAL PROCESSING

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-A) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-B) Each one 4 marks
1	I	classifications of signals	1	2
2	II	Discrete-time system	1	2
3	III	The Discrete Fourier Transform	1	2
4	IV	Fast Fourier Transform	1	2
5	V	Design and Digital Filters	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\textit{Percentage of choice} = \frac{120-60}{120} \times 100 = 50\%$$

SEMESTER-VII

COURSE 20 A: DIGITAL SIGNAL PROCESSING

(COURSE CODE: 24ELEM75A)

Theory   Credits: 3   3 hours/week

Course Objective:

The course on digital signal processing aims to provide students with a fundamental understanding of the theoretical principles underlying digital signal processing.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understanding Signal Types and System Characteristics	Level 1 (knowledge) Level 2 (Understanding)
CO 2	Analysis and Implementation of Discrete-Time LTI Systems:	Level 2 (Understanding) Level 4 (Analysing)
CO 3	Application of Z-Transform and its Properties:	Level 2 (Understanding) Level 3 (Applying)
CO 4	Understanding and applying of Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT):	Level 2 (Understanding) Level 4 (Analysing)
CO 5	Understanding and applying Design and Implementation of Digital Filters:	Level 2 (Understanding) Level 3 (Applying)

SEMESTER-VII

COURSE 20 A: DIGITAL SIGNAL PROCESSING (COURSE CODE: 24ELEM75A)

Theory Credits: 3

SYLLABUS

UNIT – I

Definitions and classifications of signals (periodic, aperiodic, etc.)

Discrete Time Signals and System: Discrete Time Signals (Elementary examples, classification: periodic and a periodic Signals energy and Power signals, Even and Odd Signals). Discrete Time System : Block diagram representation of discrete time systems, classification of discrete time systems time variant and time – invariant, linear and nonlinear, casual and anti- casual, stable and unstable.

UNIT-II

Discrete-time system properties (linearity, time invariance, causality, stability)
Linear Time-Invariant (LTI) systems and their properties.

Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and Non-recursive discrete time system. Constant coefficient differences equations and their solutions, impulse response of LTI system, structures of LTI systems Recursive and Non- recursive realization of FIR system.

The Z transform: The Z-transform and one-sided Z-transform, properties of Z-transform, inverse of the Z-transform, Solution of difference equations.

UNIT-III

The Discrete Fourier Transform: The DFT and IDFT, relationship, DFT with Z-transform, the DFT as a linear transformation Relationship of DFT with Z-transform, ***Definition and properties of the Z-transform, Region of convergence, Inverse Z-transform System function and stability analysis.*** Properties of DFT: periodicity, linearity, summery and time reversal of a sequence. Circular convolution, and correlation by DFT method, Overlap add and save filtering by DFT method.

UNIT-IV

Fast Fourier Transform : Operation counts by direct copulation of DFT, Radix – 2 FFT algorithm- Decimation –in-time (DIT) and Decimation – in frequency (DIF) algorithm, Efficient computation DFT of Two real sequences , Efficient Computation of DFT of a 2 N-pt. real sequences. ***The Need for FFT.***

UNIT – V

Design and Digital Filters: ***Filter Design Basics, FIR Filter Design, Characteristics.***

Casually and its implication, Design of linear phase FIR filters using different windows. Design of IIR filters – Impulse Invariance Method and Bilinear transformation method. Application of Adaptive Filters: System Identification or System Modelling, Adaptive Channel Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm.

References: 1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D.G. Manolakis, 3rd Edition, Pearson. ***2.*** DSP by Ramesh babu . ***3.*** Digital Signal Processing by S. Salivahanan, TMH ***4.*** Digital Signal Processing – schaums Outlines series . ***5.***. DSP by Oppen Ham & Shaffer

SEMESTER-VII

COURSE 20 A: DIGITAL SIGNAL PROCESSING

(COURSE CODE: 24ELEM75AP)

Practical   Credits: 1   2hours/week

List of Experiments:

1. Different types of signal generation using MATLAB
2. Linear convolution of sequences (without using the inbuilt function 'conv' available in MATLAB)
3. Circular convolution of two sequences, Comparison of result with that of Linear convolution
4. Finding auto correlation of a sequence
4 .Finding cross correlation of two sequences
6. Finding power spectral density of a sequence
7. Finding the convolution of periodic sequence using DFT and IDFT
8. Implementation of FFT (Fast Fourier Transform) algorithm
(i) Decimation in Time (DIT)
(ii) Decimation in Frequency (DIF)
9. Design of FIR filter(low pass, high pass and band pass) using windowing technique(hamming window, rectangular window and Kaiser window)
10. Design of IIR filter (Design of Butterworth and Chebyshev filter)
11. Convolution of long duration sequences using overlap add, overlap save mete

SEMESTER-VII

COURSE 20 A: DIGITAL SIGNAL PROCESSING

(COURSE CODE: 24ELEM75AP)

Practical Credits: 1 2hours/week

COURSE OBJECTIVE:

The objective of the practical course digital signal processing is to provide students with hands-on experience and practical skills in the operation, calibration, and application of electrical instruments.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understanding Different types of signal generation using MATLAB Apply the knowledge on MATLAB	Level 2 (Understanding) Level 3 (Applying) Level 1 (Knowledge)
CO 2	Understanding and Finding auto correlation of a sequence	Level 2 (Understanding)
CO 3	Understanding Finding power spectral density of a sequence Applying the convolution of periodic sequence using DFT and IDFT Analysing by Design of FIR filter	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Understanding Implementation of FFT	Level 2 (Understanding)
CO 5	Applying and analysing Design of IIR filter	Level 3 (Applying) Level 4 (Analysing) Level 2 (Understanding)

Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VII
COURSE 20 A: DIGITAL SIGNAL PROCESSING
(COURSE CODE: 24ELEM75A)

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A: Short Answer Questions

Answer any 5 out of the 10 questions. Each question carries 4 marks. 5×4=20

1. Define and provide an example of an energy signal.
2. What is the difference between a periodic and an aperiodic discrete time signal?
3. Explain the term "time-invariant system" with an example.
4. What is a linear time-invariant (LTI) system?
5. Describe the concept of convolution sum in discrete-time systems.
6. Explain the difference between recursive and non-recursive systems.
7. What is the one-sided Z-transform?
8. Define circular convolution and its significance in signal processing.
9. Briefly describe the Decimation-In-Time (DIT) FFT algorithm.
10. What is the significance of the LMS algorithm in adaptive filtering?

Section B: Essay Questions

Answer all questions. Each question carries 8 marks. 8×4=40

11. **(A)** Describe and differentiate between energy and power signals. Illustrate your answer with appropriate examples.

(OR)

(B) Explain the classification of discrete-time systems. Provide detailed descriptions of time-variant vs. time-invariant and linear vs. nonlinear systems.

12. **(A)** Discuss the convolution sum and its importance in analysing discrete-time linear time-invariant (LTI) systems. Derive the convolution sum formula and provide an example.

(OR)

(B) Explain the concept of constant coefficient difference equations. How are these used in the characterization of recursive and non-recursive discrete-time systems?

13. **(A)** Describe the Discrete Fourier Transform (DFT) and its inverse (IDFT). Discuss their computational significance and relationship.

(OR)

(B) Explain the properties of the Discrete Fourier Transform, including periodicity, linearity, summery, and time reversal. Provide examples to illustrate each property.

14. **(A)** Discuss the Radix-2 FFT algorithm, including the Decimation-In-Time (DIT) and Decimation-In-Frequency (DIF) algorithms. Compare their operational efficiency.

(OR)

(B) Describe the efficient computation of the DFT for two real sequences and for a 2^N-point real sequence. Why this process is more efficient compared to direct computation?

15. **(A)** Explain the design of linear phase FIR filters using different windowing techniques. Compare the performance of different window methods.

(OR)

(B) Discuss the Impulse Invariance Method and the Bilinear Transformation Method for designing IIR filters. Outline the advantages and limitations of each method.

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Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VII

COURSE 20 A:

DIGITAL SIGNAL PROCESSING COURSE CODE: 24ELEM75A)

QUESTION BANK

UNIT – I: Discrete Time Signals and Systems

Essay-Type Questions:

1. **Describe and differentiate between periodic and aperiodic discrete time signals. Provide examples of each and discuss their implications in signal processing.**
2. **Explain the concepts of energy and power signals. How can you determine whether a given discrete time signal is energy or power? Illustrate with appropriate examples and equations.**
3. **Discuss the classification of discrete time systems. Provide detailed explanations for time-variant vs. time-invariant, linear vs. nonlinear, causal vs. anti-causal, and stable vs. unstable systems. Include block diagram representations where necessary.**

Short Answer Questions:

1. **What are even and odd discrete time signals? Provide mathematical definitions and examples.**
2. **Define a discrete time system. What is the importance of block diagram representation in analyzing discrete time systems?**
3. **What is the significance of stability in discrete time systems? How can stability be tested?**

UNIT – II: Analysis and Response of Discrete-Time Linear LTI Systems Essay-Type Questions

1. **Explain the convolution sum and its importance in analyzing discrete-time linear time-invariant (LTI) systems. Derive the convolution sum formula and provide a detailed example.**
2. **Discuss the concept of recursive and non-recursive discrete time systems. Explain how constant coefficient difference equations are used to characterize these systems and illustrate with examples.**
3. **What is the Z-transform and how is it used in the analysis of discrete-time systems? Discuss its properties and how the Z-transform can be used to solve difference equations.**

Short Answer Questions:

1. **What is the impulse response of an LTI system, and why is it crucial in system analysis?**

2. **Differentiate between recursive and non-recursive systems. Provide an example of each.**
3. **Explain the one-sided Z-transform and its significance in discrete-time signal processing.**

UNIT – III: The Discrete Fourier Transform (DFT)

Essay-Type Questions

1. **Discuss the Discrete Fourier Transform (DFT) and its inverse (IDFT). Describe the relationship between DFT and IDFT and their computational significance.**
2. **Explain the properties of the Discrete Fourier Transform, including periodicity, linearity, summery, and time reversal. Provide examples to illustrate each property.**
3. **Describe the process and importance of circular convolution. How does it differ from linear convolution, and how is it used in the DFT method for filtering?**

Short Answer Questions:

1. **What is the relationship between the DFT and the Z-transform?**
2. **Define circular convolution. How can it be computed using the DFT?**
3. **What are the applications of correlation using the DFT method?**

UNIT – IV: Fast Fourier Transform (FFT)

Essay-Type Questions

1. **Explain the Radix-2 FFT algorithm, including the Decimation-In-Time (DIT) and Decimation-In-Frequency (DIF) algorithms. Discuss their operational differences and computational efficiency.**
2. **Discuss the concept of operation counts in the direct computation of DFT. How does the FFT algorithm improve computational efficiency?**
3. **Describe the efficient computation of the DFT for two real sequences and for a 2^N-point real sequence. Why this process is more efficient compared to direct computation?**

Short Answer Questions:

1. **What is the Radix-2 FFT algorithm? Briefly describe its operation.**
2. **How does the Decimation-In-Time (DIT) algorithm differ from the Decimation-In-Frequency (DIF) algorithm?**
3. **Why is the FFT algorithm considered efficient compared to the direct computation of DFT?**

UNIT – V: Design of Digital Filters and Adaptive Filters

Essay-Type Questions

1. **Discuss the design of linear phase FIR filters using different windowing techniques. Compare and contrast the different window methods and their effects on filter performance.**
2. **Explain the Impulse Invariance Method and Bilinear Transformation Method for designing IIR filters. Discuss the advantages and limitations of each method.**
3. **Describe the application of adaptive filters in system identification and adaptive channel equalization. How do adaptive filters work, and what are the key algorithms used in their implementation?**

Short Answer Questions:

1. **What is the LMS Algorithm and how does it relate to adaptive filters?**
2. **Define the concept of system identification in the context of adaptive filters.**
3. **Explain the term "minimum mean square error criterion" in the LMS algorithm.**

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-VIII

COURSE CODE 24ELEM81A: MICROPROCESSORS AND MICROCONTROLLERS

Theory | Credits: 3 | 3 hrs/week

Objectives

- To understand basic architecture of 8085 microprocessor
- To understand the instruction set and write programs in assembly language
- To interface 8085 microprocessors with common peripheral devices
- To understand the differences in architecture and applications between Microprocessors and Microcontrollers
- To understand basic architecture, instruction set and simple interfacing of PIC16F887 Microcontroller.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Analyze the basic architecture, classification, and operational parameters of microprocessors to understand their role and functionality in computing systems	Level 4
CO 2	Apply the instruction set and addressing modes of the 8086 microprocessor to develop and optimize assembly language programs for specific computational tasks.	Level 3
CO 3	Evaluate the stack operations, interrupt structures, and timing mechanisms of 8085 and 8086 microprocessors to effectively manage subroutines and interrupt-driven processes.	Level 5
CO 4	Integrate peripheral devices and microcontrollers with microprocessors by understanding their architectures, features, and interfacing techniques, with a focus on 8255, 8253, 8259, and microcontroller systems	Level 6
CO 5	Design and implement interfacing programs using the PIC16F887 microcontroller, focusing on its core features, memory organization, and peripherals, through C language or assembly language programming.	Level 6

Unit-1

Introduction to Microprocessor: Introduction, Basic block diagram, Speed, Word size, Memory capacity, Classification of microprocessors.

8085Microprocessor, 8086 Microprocessor: Features, Architecture -block diagram, General purpose registers, register pairs, flags, stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin description of microprocessor 8085 and 8086.

Unit-2

8086 Instructions: Operation code, Operand & Mnemonics. Instruction set of 8086, instruction classification, addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions. Assembly language programming examples.

Unit-3

Stack operations, subroutine, call and return instructions. Delay loops, use of counters, timing diagrams-instruction cycle, machine cycle, T- states, time delay, Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts Comparison of 8085 Microprocessor with 8086 Microprocessor (Internal Architecture, Data Addressing Mode)

Unit-4 Peripheral Devices: 8255-Programmable Peripheral Interface, 8253- Programmable interval Timer, 8259- Priority Interrupt Controller, Microcontrollers: Introduction, different types of microcontrollers, embedded microcontrollers, processor architectures. Harvard vs. Princeton, CISC vs. RISC architectures, microcontroller memory types, microcontroller features, clocking, I/O pins, interrupts, timers, peripherals.

Unit-5

Introduction to PIC16F887 Microcontroller: Core features, Architecture, pin diagram, memory organization- Program and data memory organization, I/O Ports, addressing modes, instruction set. Interfacing to PIC16F887: LED, Switches, Solid State Relay, Seven Segment Display, DC Motor, Interfacing program examples using C language/ Assembly Language.

Reference Books

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar – Wiley Eastern Limited- IV Edition.
2. Fundamentals of Microprocessor & Microcomputer: B. Ram—Danpat Rai Publications.
3. Microchip PIC16F87X datasheet
4. PIC Microcontrollers, Milan Verle, , mikro Elektronika, 1st edition (2008)
5. Muhammad Ali Mazidi, ―Microprocessors and Microcontrollers‖, Pearson, 2006
6. B. Brey, The Intel Microprocessors- Architecture, Programming and Interfacing, Pearson Education (2003)

CO-PO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

SEMESTER-VIII

COURSE CODE 24ELEM81AP:

MICROPROCESSORS AND MICROCONTROLLERS

Practical Credits: 1 2 hrs/week

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	**Develop** proficiency in implementing assembly language programs to perform data transfer, arithmetic operations, and complex calculations such as multibyte addition, subtraction, multiplication, and division	Level 5
CO 2	**Apply** algorithmic logic to solve computational problems such as searching within a list, generating the Fibonacci series, and determining the minimum and maximum among a set of numbers.	Level 3
CO 3	**Demonstrate** the ability to perform hardware interfacing using programmable peripheral devices like the 8255, 8253, and 8259, and verify their functionality through practical experiments	Level 5
CO 4	**Analyze** and solve mathematical problems by writing programs that compute the square root, find the greatest common divisor (GCD) of two numbers, and sort a series of numbers in ascending or descending order.	Level 4
CO 5	**Evaluate** and verify the logical operations and truth tables of basic logic gates through practical programming and interfacing tasks, reinforcing foundational knowledge in digital electronics. .	Level 5

LIST OF EXPERIMENTS

Microprocessor and Microcontrollers Lab

1. Program to transfer a block of data.
2. Program for multibyte addition
3. Program for multibyte subtraction
4. Program to multiply two 8-bit numbers.
5. Program to divide a 16 bit number by 8 bit number.
6. Program to search a given number in a given list.
7. Program to generate terms of Fibonacci series.
8. Program to find minimum and maximum among N numbers
9. Program to find the square root of an integer.
10. Program to find GCD of two numbers.
11. Program to sort numbers in ascending/descending order.
12. Program to verify the truth table of logic gates.
13. Interfacing using 8255 14. Interfacing using 8253
15. Interfacing using 8259

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Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-VIII

COURSE CODE 24ELEM81A: MICROPROCESSORS AND MICROCONTROLLERS

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-VIII

COURSE CODE 24ELEM81A MICROPROCESSORS AND MICROCONTROLLERS

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

Question bank

Unit 1: Introduction to Microprocessor

Essay Questions:

1. **Discuss the evolution of microprocessors, highlighting the significance of speed, word size, and memory capacity in their development.**
2. **Compare and contrast the architecture and key features of the 8085 and 8086 microprocessors.**
3. **Explain the generation of control signals in the 8085 and 8086 microprocessors, focusing on the role of multiplexed address and data buses..**

Short Answer Questions:

1. **Define word size and explain its significance in the context of microprocessor performance.**
2. **List and briefly describe the types of buses found in the 8085 and 8086 microprocessors.**
3. **What are the key differences between the stack pointer and program counter in the 8086 microprocessor?**

Unit 2: 8086 Instructions

Essay Questions:

1. **Analyze the instruction set of the 8086 microprocessor, discussing the classification of instructions and the importance of addressing modes.**
2. **Examine the role of assembly language programming in microprocessor operations, using the 8086 as a case study..**
3. **Describe the process of instruction execution in the 8086 microprocessor, from fetching the operation code to the execution of machine control instructions.**

Short Answer Questions:

1. **What is the purpose of the operation code (opcode) in the 8086 microprocessor?**
2. **List three different types of data transfer instructions in the 8086 microprocessor and briefly explain each.**
3. **Describe the significance of branch instructions in assembly language programming.**

Unit 3: Stack Operations and Interrupts

Essay Questions:

1. **Explain the stack operations in the 8086 microprocessor, detailing the use of call and returninstructions.**

2. **Discuss the interrupt structure of the 8085 microprocessor, comparing vectored and non-vectored interrupts.**
3. **Compare the internal architecture and data addressing modes of the 8085 and 8086 microprocessors.**

Short Answer Questions:

1. **What is the function of the stack in a microprocessor, and how is it utilized in subroutines?**
2. **Define latency time and response time in the context of microprocessor interrupts.**

3. **How does the 8085 microprocessor process vectored interrupts differently from non-vectored interrupts?**

Unit 4: Peripheral Devices

Essay Questions:

1. **Discuss the role and functioning of the 8255 Programmable Peripheral Interface (PPI) in microprocessor systems..**
2. **Compare the Harvard and Princeton architectures, focusing on their implementation in microcontrollers.**
3. **Describe the different types of microcontroller memory and their significance in microcontrolleroperations.**

Short Answer Questions:

1. **What is the purpose of the 8259 Priority Interrupt Controller in microprocessor systems?**
2. **Briefly describe the differences between CISC and RISC architectures in microcontrollers.**
3. **List the key features of embedded microcontrollers and their applications in modern electronics.**

Unit 5: Introduction to PIC16F887 Microcontroller

Essay Questions:

1. **Analyze the core features and architecture of the PIC16F887 microcontroller, emphasizing its memory organization and I/O ports..**
2. **Discuss the importance of addressing modes in the PIC16F887 microcontroller and how they are utilized in programming..**
3. **Explain the process of interfacing the PIC16F887 microcontroller with external devices such as LEDs, switches, and DC motors**.

Short Answer Questions:

1. **What are the main differences between program memory and data memory in the PIC16F887 microcontroller?**
2. **Describe the function of the instruction set in the PIC16F887 microcontroller.**
3. **How are LEDs interfaced with the PIC16F887 microcontroller? Provide a brief overview.**

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Programme: B.Sc. Honours in Electronics (Major)

SEMESTER-VIII

COURSE CODE 24ELEM81A MICROPROCESSORS AND MICROCONTROLLERS

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. Define word size and explain its significance in the context of microprocessor performance.
2. List and briefly describe the types of buses found in the 8085 and 8086 microprocessors.
3. List three different types of data transfer instructions in the 8086 microprocessor and briefly explain each.
4. Describe the significance of branch instructions in assembly language programming.
5. What is the function of the stack in a microprocessor, and how is it utilized in subroutines?
6. Define latency time and response time in the context of microprocessor interrupts.
7. Briefly describe the differences between CISC and RISC architectures in microcontrollers.
8. List the key features of embedded microcontrollers and their applications in modern electronics.
9. Describe the function of the instruction set in the PIC16F887 microcontroller.
10. How are LEDs interfaced with the PIC16F887 microcontroller? Provide a brief overview

Section B

Answer all the questions (8M$\times$ $5 = 40M$)

11.(a) Discuss the evolution of microprocessors, highlighting the significance of speed, word size, and memory capacity in their development.

(OR)

(b) Explain the generation of control signals in the 8085 and 8086 microprocessors, focusing on the role of multiplexed address and data buses

12.(a) Analyze the instruction set of the 8086 microprocessor, discussing the classification of instructions and the importance of addressing modes.

(OR)

(b) Examine the role of assembly language programming in microprocessor operations, using the 8086 as a case study

13.(a) Explain the stack operations in the 8086 microprocessor, detailing the use of call and returninstructions.

(OR)

(b) Compare the internal architecture and data addressing modes of the 8085 and 8086 microprocessors.

14.(a) Discuss the role and functioning of the 8255 Programmable Peripheral Interface (PPI) in microprocessor systems

(OR)

(b) Describe the different types of microcontroller memory and their significance in microcontrolleroperations.

15.a) Analyze the core features and architecture of the PIC16F887 microcontroller, emphasizing its memory organization and I/O ports..

(OR)

(b) Explain the process of interfacing the PIC16F887 microcontroller with external devices such as LEDs, switches, and DC motors.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M81B

IV Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-VIII

COURSE 21 B: ELECTROMAGNETICS

Theory Credits: 3 3 hrs/week

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Understand the basic mathematical concepts related to electromagnetic vector fields.	Level-4
2.	CO-2	Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.	Level-3
3.	CO-3	Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.	Level-4
4.	CO-4	Understand the concepts related to Faraday's law, induced emf and Maxwell's equations.	Level-4
5.	CO-5	Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.	Level-5

COURSE OBJECTIVES :

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
3. To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations.

To impart knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

Unit-1:

VECTOR ANALYSIS: Scalars and Vectors, Vector Algebra, Rectangular (Cartesian) Coordinate System, Vector Components and Unit Vector, Vector Field, Products, Cylindrical Coordinates, Spherical Coordinates, Differential Length, Area and Volume, Line, Surface and Volume integrals, Del Operator, Gradient of a Scalar, Divergence and Curl of a Vector, the Laplacian.

UNIT-2

ELECTROSTATIC FIELDS:

Electric Field, Field due to Discrete and Continuous Charge Distributions, Electric Flux Density, Gauss's Law and Applications, Divergence Theorem and Maxwell's First Equation. Electric dipole. Electric Fields in Conductors, Current and Current Density, Continuity of Current, Metallic Conductor Properties and Boundary Conditions, Method of Images. Dielectric materials, Polarization, Dielectric Constant, Isotropic and Anisotropic dielectrics, Boundary conditions.

UNIT- 3

POISSON'S EQUATION AND LAPLACE'S EQUATION:

Derivation of Poisson's and Laplace's equation, Uniqueness Theorem, Examples of Solution of Laplace's Equation: Cartesian, Cylindrical and Spherical Coordinates.

Magneto statics: Maxwell's Equation, Magnetic Flux and Magnetic Flux Density, Scalar and Vector Magnetic Potentials. Magnetization in Materials and Permeability, Anisotropic materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits. Forces and Torques.

UNIT-4

TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS:

Faraday's Law of Electromagnetic Induction, Stationary Circuit in Time-Varying Magnetic Field, Transformer and Motional EMF, Displacement Current, Maxwell's Equations in differential and integral form and Constitutive Relations. Potential Functions, Lorentz gauge and the Wave Equation for Potentials, Concept of Retarded Potentials. Electromagnetic-boundary conditions. Time-Harmonic Electromagnetic Fields and use of Phasors.

UNIT-5

ELECTROMAGNETIC WAVE PROPAGATION:

Wave Equation in a source free isotropic homogeneous media, Uniform Plane Waves in Lossless and Lossy unbounded homogeneous media, Wave Polarization, Phase and Group velocity,Flow of Electromagnetic Power and Poynting Vector. Uniform Plane wave incident on a plane conductor boundary, concept of reflection and standing wave. Guided electromagnetic wave propagation: Waves along Uniform Guiding Structures, TEM, TE and TM waves.

SUGGESTED BOOKS:

1. Murray. R. Spiegel, Vector Analysis, Schaum series, Tata McGraw Hill (2006)
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
3. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
4. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
5. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
6. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
7. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education (2012)
8. Electromagnetic Wave and Radiating System, Jordan and Balmain, Prentice Hall (1979)

SEMESTER-VIII

Course Code: 24(ELE)M81BP

COURSE 21 B: ELECTROMAGNETICS

Practical Credits: 1 2 hrs/week

Electromagnetics Lab (using Scilab/ any other similar freeware)

60 Lectures

1. Understanding and Plotting Vectors.
2. Transformation of vectors into various coordinate systems.
3. 2D and 3D Graphical plotting with change of view and rotation.
4. Representation of the Gradient of a scalar field, Divergence and Curl of Vector Fields.
5. Plots of Electric field and Electric Potential due to charge distributions.
6. Plots of Magnetic Flux Density due to current carrying wire.
7. Programs and Contour Plots to illustrate Method of Images
8. Solutions of Poisson and Laplace Equations – contour plots of charge and potential distributions
9. Introduction to Computational Electromagnetics: Simple Boundary Value Problems by Finite Difference/Finite Element Methods.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS PATTERN

[2023-24 Batch onwards]

Course Code: 24(ELE)M81B

IV Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-VIII

COURSE 21 B: ELECTROMAGNETICS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	3	2	1	1	2	3	2	2	3
CO 2	3	2	2	1	1	1	3	2	3	3
CO 3	3	2	1	2	1	1	3	3	3	3
CO 4	3	2	2	2	2	1	2	3	2	2
CO 5	2	3	2	2	1	2	2	2	2	2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	2	2	2	3
CO 2	3	3	3	2	2
CO 3	2	3	2	3	3
CO 4	3	2	2	3	3
CO 5	3	3	3	2	2

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Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(ELE)M81B

BLUE PRINT (:ELECTROMAGNETICS)
IV B.Sc. (Hons.) ELECTRONICS- SEM-VIII/Course : 21B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	VECTOR ANALYSIS	2	2	30
2.	II	ELECTROSTATIC FIELDS	2	2	30
3.	III	POISSON'S EQUATION AND LAPLACE'S EQUATION	2	2	30
4.	IV	TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS	2	2	30
5.	V	ELECTROMAGNETIC WAVE PROPAGATION	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M81B

IV Year B.Sc (Hons.)- ELECTRONICS
SEMESTER-VIII COURSE 21B: ELECTROMAGNETICS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Write about Spherical Coordinates system in case of vectors?
[OR]
b) Discuss about Divergence and Curl of a Vector?

2. a) State and prove Gauss's Law in electrostatics?
[OR]
b) Write about Metallic Conductor Properties and Boundary Conditions?

3. a) Derive Poisson's and Laplace's equations?
[OR]
b) Write about the inductor and derive self-inductance of an inductor?

4. a) Derive Faraday's Law of Electromagnetic Induction?
[OR]
b) Derive Maxwell's Equations in differential and integral form?

5. a) Derive Electromagnetic wave Equation in a source free isotropic homogeneous media?
[OR]
b) Write about Electromagnetic Power and derive the Poynting Vector?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) Define Scalars and vectors with good examples?
7. a) Show that gradient of a scalar is a vector?
8. a) Derive Maxwell's first equations?
9. a) Derive continuity equation?
10. a) Deduce Laplace's equation?
11. a) Write about magnetization in Materials and Permeability?
12. a) Derive equation for Motional EMF?
13. a) Derive Lorentz gauge equation?
14. a) Briefly discuss about Phase and Group velocity?
15. a) Write about TEM, TE and TM waves ?

B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M81B

IV Year B.Sc (Hons.)- ELECTRONICS
SEMESTER-VIII COURSE 21B: ELECTROMAGNETICS

QUESTION BANK

UNIT 1: VECTOR ANALYSIS

Essay Type Questions:

1. Explain the concept of vector analysis. Discuss the importance of vectors in physics and engineering applications.
2. Describe the applications of vector calculus in different coordinate systems (Rectangular, Cylindrical, Spherical). Provide examples to illustrate their usage.
3. Discuss the significance of the del operator (∇) in vector calculus. Explain its applications in computing gradient, divergence, and curl.

Short Type Questions:

1. Differentiate between scalars and vectors. Provide examples of each.
2. Define the terms: gradient, divergence, and curl of a vector field. Explain their physical interpretations.
3. Explain the concept of line, surface, and volume integrals in vector calculus.

UNIT 2: ELECTROSTATIC FIELDS

Essay Type Questions:

1. Discuss the fundamental concepts of electrostatic fields. Explain Gauss's law and its applications with relevant examples.
2. Describe the behavior of electric fields in conductors. Explain the concept of electric potential and boundary conditions in electrostatics.
3. Explain the polarization of dielectric materials. How does dielectric constant affect the behavior of these materials in electric fields?

Short Type Questions:

1. Define electric flux density and electric dipole moment. How are they related to electric field intensity?
2. Discuss the method of images in electrostatics. Provide an example where this method is applied.
3. Explain the concept of current density and continuity of current in the context of metallic conductors.

UNIT 3: POISSON'S EQUATION AND LAPLACE'S EQUATION

Essay Type Questions:

1. Derive Poisson's equation and Laplace's equation. Explain their significance in electrostatics and other fields.
2. Solve Laplace's equation in Cartesian, cylindrical, and spherical coordinates. Provide examples illustrating these solutions.
3. Discuss the uniqueness theorem in the context of solutions to Laplace's equation. How does it ensure the uniqueness of solutions?

Short Type Questions:

1. Explain Maxwell's equations in the context of magnetostatics. How are they derived from the laws of electromagnetism?
2. Define magnetic flux density and magnetic vector potential. How are they related to each other?
3. Discuss the concept of magnetization in materials. What role does permeability play in magnetostatics?

UNIT 4: TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS

Essay Type Questions:

1. Discuss Faraday's law of electromagnetic induction. Explain its implications for time-varying magnetic fields and induced electromotive forces (EMFs).
2. Describe Maxwell's equations in both differential and integral forms. How are they used to describe the behavior of electromagnetic fields?
3. Explain the concept of displacement current. How does it complete Maxwell's equations and contribute to the understanding of electromagnetic waves?

Short Type Questions:

1. What are the constitutive relations in Maxwell's equations? How do they relate to the properties of materials?
2. Discuss the concept of potential functions in electromagnetism. How are they related to the electric and magnetic fields?
3. Explain the concept of time-harmonic electromagnetic fields. How are phasors used to analyze such fields?

UNIT 5: ELECTROMAGNETIC WAVE PROPAGATION

Essay Type Questions:

1. Describe the wave equation in a source-free isotropic homogeneous medium. Discuss the propagation of uniform plane waves in lossless and lossy media.
2. Explain the concept of wave polarization. How does it affect the propagation characteristics of electromagnetic waves?
3. Discuss the concept of guided electromagnetic wave propagation. Compare and contrast TEM, TE, and TM modes in waveguides.

Short Type Questions:

1. Define phase velocity and group velocity of electromagnetic waves. How are they related to each other?
2. Explain the concept of the Poynting vector. How is it used to describe the flow of electromagnetic power?
3. Describe the phenomenon of reflection and standing waves when a uniform plane wave encounters a plane conductor boundary.

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM82A**

SEMESTER-VIII (IV Year) COURSE 22A: ANTENNA AND WAVES PROPAGATION

Theory Credits: 3 3 Hrs/Week

Course Objectives: The course on Antenna and Waves Propagation aims

- Students will be introduced to antennas, their principle of operation.
- Antenna analysis and their applications.
- Introduce the student to wave propagation over ground, through troposphere and ionosphere; diversity principles.
- Propagation effects in microwave systems, satellite, space, and radar links.
- Transmission Lines, Antenna and Wave Propagation.

Learning Outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Define various antenna parameters.	Level 1 (Remember)
CO 2	Analyze radiation patterns of antennas.	Level 4 (Analysing)
CO 3	Evaluate antennas for given specifications.	Level 5 (Evaluate)
CO 4	Illustrate techniques for antenna parameter measurements.	Level 2 (Understanding)
CO 5	Understand the various applications of antennas.	Level 2 (Understanding)

SYLLABUS

UNIT-1

Electromagnetic Wave Propagation: Propagation in Good Conductors, Skin Effect, Reflection of uniform Plane Waves at normal incidence, Plane Wave reflection at Oblique Incidence, Wave propagation in dispersive media, concept of phase velocity and group velocity.

UNIT-2

Transmission Lines: Typical Transmission lines- Co-axial, Two Wire, Microstrip, Coplanar and Slot Lines, Transmission Line Parameters, Transmission Line Equations, Wave propagation in Transmission lines, low loss, lossless line, Distortion less line, Input Impedance, Standing Wave Ratio, Power. and lossy lines, Shorted Line, Open-Circuited Line, Matched Line, Smith Chart, Transmission Line Applications.

UNIT-3

Waveguides and Waveguide Devices: Wave propagation in waveguides, Parallel plate waveguides, TEM, TM and TE modes, rectangular waveguides, circular waveguides, Power transmission and attenuation, rectangular cavity resonators, directional couplers, isolator, circulator.

UNIT-4

Radiation of electromagnetic waves: Concept of retarded potentials, Antenna Parameters: Radiation Mechanism, Current Distribution on a Thin Wire Antenna, Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance Antenna Radiation Efficiency, Effective Length and Equivalent Areas, Maximum Directivity and Maximum Effective Area, Friis Transmission Equation and Radar Range Equation, *Antenna temperature and signal to noise ratio.*

UNIT-5

Comparison between an antenna & transmission line, Types of Antenna: Hertzian dipole, Half wave dipole, Quarter-wave dipole, Yagi-Uda, microstrip, Parabolic antenna, Helical antenna, Antenna array.

Suggested books:

1. M. N. O. Sadiku, Principles of Electromagnetics, Oxford University Press (2001).
2. Karl E. Lonngren, Sava V. Savov, Randy J. Jost, Fundamentals of Electromagnetics with MATLAB, PHI.
3. W. H. Hayt and J.A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006).
4. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001).
5. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006).
6. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006).
7. G. S. N. Raju, Antennas and Propagation, Pearson Education (2001).

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	3	2	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	2	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM82AP**
SEMESTER-VIII (IV Year) COURSE 22A: ANTENNA AND WAVES PROPAGATION
Practical Course

Practical Credits: 1 2 Hrs/Week

COURSE OBJECTIVE:
To develop practical skills in the use of laboratory equipment and experimental techniques for measuring characteristics in Antenna and Waves propagation.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques to measure various characteristics in Antenna and Waves propagation.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 2	Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.	Level 3 (Applying)
CO 3	Accurate recording and analysis of data: Students should be able to accurately record and analyse experimental data, including understanding the significance of error analysis and statistical methods.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Understanding of fundamental principles in Antenna and Waves propagation.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

Antenna and Waves Propagation Lab:

1. Program to determine the phasor of forward propagating field.
2. Program to determine the instantaneous field of a plane wave.
3. Program to find the Phase constant, Phase velocity, Electric Field Intensity and Intrinsic ratio.
4. Program to find skin depth, loss tangent and phase velocity.
5. Program to determine the total voltage as a function of time and position in a loss less transmission line.
6. Program to find the characteristic impedance, the phase constant and the phase velocity.
7. Program to find the output power and attenuation coefficient.
8. Program to find the power dissipated in the lossless transmission line.
9. Program to find the total loss in lossy lines.
10. Program to find the load impedance of a slotted line.
11. Program to find the input impedance for a line terminated with pure capacitive impedance.
12. Program to determine the operating range of frequency for TE10 mode of air-filled rectangular waveguide.
13. Program to determine Directivity, Bandwidth, Beamwidth of an antenna.
14. Program to determine diameter of parabolic reflector.
15. Program to find out minimum distance between primary and secondary antenna.

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM82A**

SEMESTER-VIII (IV Year) COURSE 22A: ANTENNA AND WAVES PROPAGATION

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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SEMESTER-VIII (IV Year) COURSE 22A: ANTENNA AND WAVES PROPAGATION

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Electromagnetic Wave Propagation	2 (One out of two)	2
2	Unit – II	Transmission Lines	2 (One out of two)	2
3	Unit – III	Waveguides and Waveguide Devices	2 (One out of two)	2
4	Unit – IV	Radiation of electromagnetic waves	2 (One out of two)	2
5	Unit – V	Types of Antenna	2 (One out of two)	2

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SEMESTER-VIII (IV Year) COURSE 22A: ANTENNA AND WAVES PROPAGATION

Theory Credits: 3 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. Define phase velocity and group velocity. How do they differ in dispersive media?
2. What is meant by wave propagation in dispersive media, and how does it affect signal transmission?What are the key features of a DC servo motor, and how is it used in robotics?
3. Explain the significance of the Smith Chart in analyzing transmission lines. How is it used to determine input impedance and standing wave ratio?
4. What are the conditions for a transmission line to be considered distortionless? How does this affect signal integrity?Describe the main components of a Robot Vision System (RVS) and their functions.
5. What is the significance of cavity resonators in waveguide systems? Describe their application in practical communication systems.
6. Compare TEM, TM, and TE modes of wave propagation in parallel plate waveguides.What is the difference between forward kinematics and inverse kinematics in robotics?
7. What is the Friis Transmission Equation, and how is it used in analyzing the link budget of a communication system?
8. Define and differentiate between radiation power density and radiation intensity. How are these quantities related to antenna directivity?
9. What are the key features of a parabolic antenna, and why is it widely used in satellite communication?
10. Briefly describe the structure and radiation mechanism of a helical antenna. What are its typical applications?

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Explain the phenomenon of skin effect in good conductors. Discuss its significance in the propagation of electromagnetic waves and its impact on the design of transmission lines and antennas.

    (OR)

    (b) Discuss the reflection of uniform plane waves at both normal and oblique incidences. Explain the differences in the reflection coefficients and the conditions under which total internal reflection occurs.

12. (a) Compare and contrast the different types of transmission lines: Co-axial, Two Wire, Microstrip, Coplanar, and Slot Lines. Discuss their applications and the advantages and disadvantages of each.

    (OR)

    (b) Derive the transmission line equations and explain how they are used to analyze wave propagation in lossless and lossy transmission lines.

13. (a) Describe the propagation of electromagnetic waves in rectangular waveguides. Explain the difference between TE and TM modes and how they are excited in waveguides.

    (OR)

    (b) Discuss the design and operation of directional couplers, isolators, and circulators. How are these devices used in microwave communication systems?

14. (a) Explain the concept of retarded potentials and their role in the radiation of electromagnetic waves. How do retarded potentials help in understanding the behavior of radiating antennas?

    (OR)

    (b) Analyze the various antenna parameters such as radiation pattern, directivity, gain, and efficiency. How do these parameters affect the performance of an antenna?

15. (a) Compare and contrast the operational principles and applications of the Hertzian dipole, half-wave dipole, and quarter-wave dipole antennas. Discuss their radiation patterns and typical use cases.

    (OR)

    (b) Discuss the design and functionality of Yagi-Uda and microstrip antennas. How are these antennas used in modern communication systems, and what are their advantages?

Question Bank
Short answer Questions

1. Define phase velocity and group velocity. How do they differ in dispersive media?
2. What is meant by wave propagation in dispersive media, and how does it affect signal transmission?What are the key features of a DC servo motor, and how is it used in robotics?
3. Explain the significance of the Smith Chart in analyzing transmission lines. How is it used to determine input impedance and standing wave ratio?
4. What are the conditions for a transmission line to be considered distortionless? How does this affect signal integrity?Describe the main components of a Robot Vision System (RVS) and their functions.
5. What is the significance of cavity resonators in waveguide systems? Describe their application in practical communication systems.
6. Compare TEM, TM, and TE modes of wave propagation in parallel plate waveguides.What is the difference between forward kinematics and inverse kinematics in robotics?
7. What is the Friis Transmission Equation, and how is it used in analyzing the link budget of a communication system?
8. Define and differentiate between radiation power density and radiation intensity. How are these quantities related to antenna directivity?
9. What are the key features of a parabolic antenna, and why is it widely used in satellite communication?
10. Briefly describe the structure and radiation mechanism of a helical antenna. What are its typical applications?
11. Define Skin Effect and give its significance.
12. Write a short note on Power transmission and attenuation.
13. Define Radiation Power Density, and Radiation Intensity.
14. Define Half wave dipole, and Quarter-wave dipole.

Long answer Questions

1. Explain the phenomenon of skin effect in good conductors. Discuss its significance in the propagation of electromagnetic waves and its impact on the design of transmission lines and antennas.

2. Discuss the reflection of uniform plane waves at both normal and oblique incidences. Explain the differences in the reflection coefficients and the conditions under which total internal reflection occurs.
3. Compare and contrast the different types of transmission lines: Co-axial, Two Wire, Microstrip, Coplanar, and Slot Lines. Discuss their applications and the advantages and disadvantages of each.
4. Derive the transmission line equations and explain how they are used to analyze wave propagation in lossless and lossy transmission lines.
5. Describe the propagation of electromagnetic waves in rectangular waveguides. Explain the difference between TE and TM modes and how they are excited in waveguides.
6. Discuss the design and operation of directional couplers, isolators, and circulators. How are these devices used in microwave communication systems?
7. Explain the concept of retarded potentials and their role in the radiation of electromagnetic waves. How do retarded potentials help in understanding the behavior of radiating antennas?
8. Analyze the various antenna parameters such as radiation pattern, directivity, gain, and efficiency. How do these parameters affect the performance of an antenna?
9. Compare and contrast the operational principles and applications of the Hertzian dipole, half-wave dipole, and quarter-wave dipole antennas. Discuss their radiation patterns and typical use cases.
10. Discuss the design and functionality of Yagi-Uda and microstrip antennas. How are these antennas used in modern communication systems, and what are their advantages?

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM82B

POWER ELECTRONICS

Theory Credits: 3 3 hrs/week

Objective:

1. To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
2. To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
3. To provide strong foundation for further study of power electronic circuits and systems.
4. The working of power semiconductor devices such as power diode, power transistor, TRIAC, MOSFET, IGBT.
5. The different types of rectifiers for single phase and three phase controls the working of inverters, choppers and cycloconverters and their application in industry

Learning Outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-linear devices.	Level 1
CO 2	Describe basic operation and compare performance of various power semiconductor devices, passive components and switching circuits.	Level 6
CO 3	Design power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.	Level 6
CO 4	Analyze power converter circuits and learn to select suitable power electronic devices.	Level 1
CO 5	Formulate and analyze a power electronic design at the system level and assess the performance.	Level 3

SYLLABUS

Unit-I

Power Semiconductor Devices: Power diode, Power transistor, TRIAC, MOSFET and IGBT - turn on methods, driver circuits - SCR characteristics - Two transistor analogy - Methods of turning ON and turning OFF - Series and parallel connections of SCRs.

Unit-II

Phase controlled converters: Single phase controlled rectifier - Half wave controlled rectifier with 1.Resistive load 2.RL load 3. RL load and battery - Full wave controlled rectifier with above types of loads - Three phase controlled rectifier - HVDC transmission.

Unit-III

Inverters: Single phase and three phase inverters - Series and parallel inverters - Bridge inverters - Current source inverter.

Unit-IV

Choppers and Cycloconverters: Various types of DC choppers - Step up chopper - AD chopper - Single phase AC chopper - Step up and step down cycloconverters - Three phase to single phase and three phase to three phase cycloconverters.

Unit-V

Control circuits and application: Generation of control pluses - Microprocessor based implementation - Static circuit breakers for DC and AC circuits - Regulated power supply - UPS - SMPS.

Suggested Books:

1. Power Electronics, P.C. Sen, TMH
2. Power Electronics & Controls, S.K. Dutta
3. Power Electronics, M.D. Singh & K.B. Khanchandani, TMH
4. Power Electronics Circuits, Devices and Applications, 3rd Edition, M.H. Rashid,Pearson Education
5. Power Electronics, Applications and Design, Ned Mohan, Tore.
6. Power Electronics, K. HariBabu, Scitech Publication.
7. Power Electronics, M.S. Jamil Asghar, PHI.
8. A Textbook of Electrical Technology-Vol-II, B.L. Thareja, A.K. Thareja, S.Chand

Reference Books

1. Thyristorised Power Controllers - G.K. Debye, Wiley Eastern Ltd.
2. An Introduction to Thyistors and Their Applications - M. Ramamoorthy, 2/e, East West press.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

IV Year BSC Electronics

SEMESTER- VIII COURSE CODE: 24ELEM82B

POWER ELECTRONICS

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2 (two out of four)**	**1 (one out of two**
Understanding/ Comprehension	**27%**	**16**	**2 (two out of four)**	
Application	**20%**	**12**	**1 (one out of two)**	**1 (one out of two**
Analysis	**13%**	**8**		**2 (two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1 (one out of two**
Total	**100**	**60**	**5 (each question has internal choice)**	**5 out of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	**8 marks**	**4 marks**
1	**I**	Power Semiconductor Devices	**2 (one out of two)**	**2**
2	**II**	Phase controlled converters	**2 (one out of two**	**2**
3	**III**	Inverters	**2 (one out of two**	**2**
4	**IV**	Choppers and Cycloconverters	**2 (one out of two**	**2**
5	**V**	Control circuits and application	**2 (one out of two**	**2**
		TOTAL QUESTIONS	**5 (each question has internal choice)**	**5 out of given 10**

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Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM82B
POWER ELECTRONICS
(MODEL PAPER)

DURATION::3 hrs **MAX.MARKS :: 60**

SECTION-A

Answer any FIVE questions of the following (5 X 4 = 20 M)

1. Briefly describe the turn-on methods used for power diodes and transistors.
2. What is the significance of driver circuits in the operation of power semiconductor devices?
3. Briefly describe the advantages of using three-phase controlled rectifiers over single-phase rectifiers.
4. What are the key applications of HVDC transmission in power systems?
5. What are the primary differences between a single-phase and a three-phase inverter?
6. Briefly explain the operation of a series inverter.
7. How does an AD chopper differ from other types of choppers?
8. Briefly describe the operation of a single-phase AC chopper.
9. Briefly describe the function of a static circuit breaker.
10. What are the key advantages of using a microprocessor for control implementation in power electronics?

SECTION-B

Answer ALL the questions of the following (5 X 8 = 40 M)

1. (a)Analyze the methods of turning ON and turning OFF an SCR (Silicon Controlled Rectifier). Compare these methods and discuss their impact on the efficiency and reliability of power circuits.

   [OR]

   (b) Discuss the challenges and solutions associated with the series and parallel connections of SCRs in power circuits. How do these configurations influence the overall performance of the circuit?
2. (a)Analyze the operation of a single-phase full-wave controlled rectifier with various types of loads. How does load type affect the performance and efficiency of the rectifier?

   [OR]

   (b)Discuss the role of three-phase controlled rectifiers in industrial applications. How do they compare with single-phase rectifiers in terms of performance and application?
3. (a)Discuss the principles and operation of single-phase and three-phase inverters. How do these inverters differ in terms of design and application?

[OR]

(b)Analyze the operation and applications of series and parallel inverters. Compare their advantages and disadvantages in different power electronic systems.

4. (a)Explain the working principles of single-phase AC choppers. What are the key factors that influence their performance in power electronic circuits?

[OR]

(b)Analyze the operation of step-up and step-down cycloconverters. Compare their applications and discuss the challenges associated with their design and implementation.

5. (a)Analyze the role of microprocessor-based control in power electronics. What are the advantages of using microprocessors for control implementation in modern power systems?

[OR]

(b)Explain the working principles and applications of static circuit breakers for DC and AC circuits. How do they compare to traditional circuit breakers in terms of performance and reliability?

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IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM82B

POWER ELECTRONICS
QUESTION BANK

Unit I: Power Semiconductor Devices

Essay Questions:

1. Discuss the working principles, characteristics, and applications of power semiconductor devices such as Power Diodes, Power Transistors, TRIACs, MOSFETs, and IGBTs. How do these devices contribute to modern power electronics?
2. Analyze the methods of turning ON and turning OFF an SCR (Silicon Controlled Rectifier). Compare these methods and discuss their impact on the efficiency and reliability of power circuits.
3. Explain the two-transistor analogy of an SCR. How does this analogy help in understanding the operation and characteristics of SCRs?
4. Discuss the challenges and solutions associated with the series and parallel connections of SCRs in power circuits. How do these configurations influence the overall performance of the circuit?

Short Questions:

1. What are the main differences between a MOSFET and an IGBT in terms of operation and applications?
2. Briefly describe the turn-on methods used for power diodes and transistors.
3. What is the significance of driver circuits in the operation of power semiconductor devices?
4. Explain the basic operation of a TRIAC and its common applications.

Unit II: Phase Controlled Converters

Essay Questions:

1. Explain the working principle of a single-phase half-wave controlled rectifier with a resistive load, RL load, and RL load with a battery. Discuss the advantages and limitations of each configuration.
2. Analyze the operation of a single-phase full-wave controlled rectifier with various types of loads. How does load type affect the performance and efficiency of the rectifier?
3. Discuss the role of three-phase controlled rectifiers in industrial applications. How do they compare with single-phase rectifiers in terms of performance and application?

4. Evaluate the significance of HVDC (High Voltage Direct Current) transmission in modern power systems. How do phase-controlled converters play a role in HVDC systems?

Short Questions:

1. What is the difference between half-wave and full-wave controlled rectifiers?
2. How does the presence of a battery in the load circuit affect the operation of a single-phase controlled rectifier?
3. Briefly describe the advantages of using three-phase controlled rectifiers over single-phase rectifiers.
4. What are the key applications of HVDC transmission in power systems?

Unit III: Inverters

Essay Questions:

1. Discuss the principles and operation of single-phase and three-phase inverters. How do these inverters differ in terms of design and application?
2. Analyze the operation and applications of series and parallel inverters. Compare their advantages and disadvantages in different power electronic systems.
3. Explain the working of bridge inverters and their role in modern power electronics. What are the key factors to consider when designing a bridge inverter?
4. Evaluate the role of current source inverters in power electronic systems. How do they compare to voltage source inverters in terms of performance and application?

Short Questions:

1. What are the primary differences between a single-phase and a three-phase inverter?
2. Briefly explain the operation of a series inverter.
3. What is a bridge inverter, and where is it commonly used?
4. How does a current source inverter differ from a voltage source inverter?

Unit IV: Choppers and Cycloconverters

Essay Questions:

1. Discuss the various types of DC choppers and their applications. How does the operation of a step-up chopper differ from that of a step-down chopper?
2. Explain the working principles of single-phase AC choppers. What are the key factors that influence their performance in power electronic circuits?
3. Analyze the operation of step-up and step-down cycloconverters. Compare their applications and discuss the challenges associated with their design and implementation.
4. Evaluate the significance of three-phase to single-phase and three-phase to three-phase cycloconverters in industrial applications. How do these devices contribute to power conversion and control?

Short Questions:

1. What is the basic function of a DC chopper in power electronics?
2. How does an AD chopper differ from other types of choppers?
3. Briefly describe the operation of a single-phase AC chopper.

4. What are the primary applications of cycloconverters in industrial settings?

Unit V: Control Circuits and Applications

Essay Questions:

1. Discuss the generation of control pulses in power electronic systems. How do these pulses influence the operation and efficiency of power converters?
2. Analyze the role of microprocessor-based control in power electronics. What are the advantages of using microprocessors for control implementation in modern power systems?
3. Explain the working principles and applications of static circuit breakers for DC and AC circuits. How do they compare to traditional circuit breakers in terms of performance and reliability?
4. Evaluate the significance of regulated power supplies, UPS (Uninterruptible Power Supply), and SMPS (Switch Mode Power Supply) in ensuring the reliability of electronic systems. How do these devices contribute to power management in various applications?

Short Questions:

1. What is the role of control pulses in power electronic circuits?
2. Briefly describe the function of a static circuit breaker.
3. What are the key advantages of using a microprocessor for control implementation in power electronics?
4. How does a UPS differ from a regulated power supply in terms of operation and application?

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
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(COURSE CODE: 24ELEM83A)

BLUE PRINT
Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VIII
COURSE 23 A:
MICROWAVE AND OPTOELECTRONICS

MAX MARKS – 60 TIME – 3 HOURS
(CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION -A) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-B) Each one 4 marks
1	I	Microwave Components	1	2
2	II	Microwave Tubes	1	2
3	III	Microwave Solid State Device	1	2
4	IV	Optoelectronic Devices	1	2
5	V	Introduction To Radar	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\textit{Percentage of choice} = \frac{120 - 60}{120} \times 100 = 50\%$$

(COURSE CODE: 24ELEM83A)

SEMESTER-VIII

COURSE 23 A: MICROWAVE AND OPTOELECTRONICS

Theory Credits: 3 3 hrs/week

Course Objective:

The course on microwave and optoelectronics aims to provide students with a fundamental understanding of the theoretical principles underlying microwave devices and networks.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Knowledge about Microwave Solid State Devices.	Level 1 (knowledge)
CO 2	Understanding the ability to identify and study the performance of Wave Guides and Resonators. Applying Study the comparative performance analysis of Microwave Tubes and Circuits	Level 2 (Understanding) Level 3 (Applying)
CO 3	Understanding the performance of Microwave Components. Knowledge about Microwave Measurements	Level 2 (Understanding) Level 4 (Analysing)
CO 4	Understand the theoretical principles underlying microwave devices and networks.	Level 2 (Understanding) Level 4 (Analysing)
CO 5	Analysing the signal and noise characteristics of microwave systems such as communication, Networks, radars, and radiometers, and relate this to the design process.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

(COURSE CODE: 24ELEM83A)

SEMESTER-VIII

COURSE 23 A: MICROWAVE AND OPTOELECTRONICS

Theory Credits: 3 3 hrs/week

Syllabus

Unit I :

Microwave Components:

Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators, mixers & detectors, matched Load, phase shifter, wave meter, and Ferrite devices: Isolators, circulators. ***Applications, Communication Systems: Mobile phones, satellite communications, and radar systems. Radar: Used in weather forecasting, aviation, and military applications. Microwave Heating: Includes microwave ovens and industrial heating processes.***

Unit II:

Microwave Tubes:

Limitation of conventional tubes; Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, BWO, Crossed field amplifiers.

Unit III:

Microwave Solid State Device: ***Transistors, Field-Effect Transistors (FETs), Metal-Semiconductor FETs (MESFETs), High Electron Mobility Transistors (HEMTs), Bipolar Junction Transistors (BJTs), Silicon Bipolar Transistors:***

Varactor diode, Tunnel diode, Schottky diode, GUNN diode, IMPATT, TRAPATT and PIN diodes. MASER, parametric amplifiers.

Unit IV:

Optoelectronic Devices: LEDs (Light Emitting Diodes): Photodetectors, Laser Diodes: Optical Fibers, Optoelectronic modulator:

Introduction, analog and Digital modulation, Electro Optic modulators, magneto optic devices, Acoustopics devices, optical, Swithcing and Logic devices.

Unit V :

(COURSE CODE: 24ELEM83A)

Introduction To Radar:

Block Diagram and operation, Radar Frequencies, Simple form of Radar Equation, Detection and Prediction of Range Performance, Pulse Repetition frequency and Range Ambiguities, Applications of Radar.

Suggested books 1. J. Wilson and J.Haukes, "Opto Electronics – An Introduction", Prentice Hall of India Pvt. Ltd., New Delhi, 1995.

2. Bhattacharya "Semiconductor Opto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 1995.
3. Jasprit Singh, "Opto Electronics – As Introduction to materials and devices", McGraw-Hill International Edition, 1998.
4. AmnonYariv, Optical Electronics, Holt Rine hart & Winston, Philadelphia, 1991
5. Bhattacharya P., Semiconductor Optoelectronic Devices,, PHI, New Delhi.1995
6. Ben G. Streetmann& Sanjay Banerjee, Solid State Electronic Devices, 5thEdn, 2000.

7.Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.

8. Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2001

SEMESTER-VIII

COURSE 23 A: MICROWAVE AND OPTOELECTRONICS

(COURSE CODE: 24ELEM83AP)

Practical Credits: 1 2 hrs/week

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Characterization of E-Plane, H-Plane and Magic(Hybrid) Tee
2. Characterization of microwave Isolator and Circulator
3. Characterization of Microwave directional couplers
4. Characterization of Microwave attenuators
5. Characterization of Microwave phase shifters
6. Design of Wilkinson power divider
7. VI Characteristics of GUNN Diode
8. Study of PIN diode as a microwave switch

9. Operating modes of Klystron microwave source
10. Microwave measurements using a Vector Network Analyzer
a. Return loss
b. Insertion Loss
c. Bandwidth
d. Smith Chart
11. Study of a FM-CW radar
12. Impedance matching using Smith Chart
13. Operation of Vector Signal Generator and Analyzer

Programme: B.Sc. Honours in Electronics (Major) -2024-2025

SEMESTER-VIII

COURSE 23 A: MICROWAVE AND OPTOELECTRONICS

(COURSE CODE: 24ELEM83A)

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1. **What are S-parameters and why are they important in analysing microwave components?**
2. **How does a matched load differ from an attenuator in microwave systems?**
3. **What is the main difference between a Klystron amplifier and a TWT?**
4. **How does a magnetron generate microwave oscillations?**
5. **What is the principle of operation of a Tunnel diode and its application in microwave technology?**
6. **How does a PIN diode function in microwave switching applications?**
7. **What is an electro-optic modulator and how does it modulate optical signals?**
8. **How do magneto-optic devices differ from electro-optic modulators in terms of their operating principle?**
9. **What is the purpose of pulse repetition frequency in radar systems?**

(COURSE CODE: 24ELEM83A)

10. How does the radar equation help in estimating the detection range of a radar system?

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A) Discuss the construction, working principle, and applications of a directional coupler and a hybrid ring in microwave systems. How do these components contribute to signal routing and power division?

(OR)

(B) Explain the role and operation of cavity resonators and phase shifters in microwave circuits. How do these components affect signal quality and phase control?

12. (A) Compare and contrast the construction, operation, and applications of Klystron amplifiers and magnetrons. How do these devices differ in terms of performance and usage in microwave communication?

(OR)

(B) Discuss the limitations of conventional microwave tubes and how the development of advanced tubes like TWT (Traveling Wave Tube) and BWO (Backward Wave Oscillator) addresses these limitations.

13. (A) Explain the operating principles and applications of Varactor diodes and Schottky diodes in microwave circuits. How do these diodes contribute to tuning and switching operations?

(OR)

(B) Discuss the characteristics and uses of Gunn diodes and IMPATT diodes in microwave systems. How do their operating mechanisms influence their performance?

14. (A) Describe the differences between analog and digital modulation techniques in optoelectronic modulators. How does each technique impact signal transmission and quality?

(OR)

(B) Explain the working principles of electro-optic modulators and magneto-optic devices. How do these devices enable high-speed data transmission in optical communication systems?

15. (A) Outline the basic block diagram of a radar system and explain the operation of each block. How does the overall system contribute to effective radar functionality?

(OR)

(B) Discuss the radar frequency bands and their significance. How does the choice of frequency impact radar performance and applications?

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Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VIII (COURSE CODE: 24ELEM83A)
COURSE 23 A: MICROWAVE AND OPTOELECTRONICS

UNIT I: Microwave Components Essay-Type Questions

1. **Discuss the construction, working principle, and applications of a directional coupler and a hybrid ring in microwave systems. How do these components contribute to signal routing and power division?**
2. **Explain the role and operation of cavity resonators and phase shifters in microwave circuits. How do these components affect signal quality and phase control?**
3. **Describe the functioning and applications of ferrite devices, including isolators and circulators. How do these devices enhance the performance of microwave systems?**

Short Answer Questions:

1. **What are S-parameters and why are they important in analyzing microwave components?**
2. **How does a matched load differ from an attenuator in microwave systems?**
3. **What is the principle of operation of a microwave mixer and how does it contribute to signal processing?**

(COURSE CODE: 24ELEM83A)

UNIT II: Microwave Tubes **Essay-Type Questions**

1. **Compare and contrast the construction, operation, and applications of Klystron amplifiers and magnetrons. How do these devices differ in terms of performance and usage in microwave communication?**
2. **Discuss the limitations of conventional microwave tubes and how the development of advanced tubes like TWT (Traveling Wave Tube) and BWO (Backward Wave Oscillator) addresses these limitations.**
3. **Describe the working principle of a reflex Klystron and its role in microwave oscillators. How does its construction affect its frequency stability and tuning range?**

Short Answer Questions:

1. **What is the main difference between a Klystron amplifier and a TWT?**
2. **How does a magnetron generate microwave oscillations?**
3. **What are the key features of a Backward Wave Oscillator (BWO) and its typical applications?**

UNIT III: Microwave Solid State Devices **Essay-Type Questions**

1. **Explain the operating principles and applications of Varactor diodes and Schottky diodes in microwave circuits. How do these diodes contribute to tuning and switching operations?**
2. **Discuss the characteristics and uses of Gunn diodes and IMPATT diodes in microwave systems. How do their operating mechanisms influence their performance?**
3. **Describe the role of parametric amplifiers and MASERs in microwave and radio-frequency applications. How do these devices enhance signal amplification and detection?**

Short Answer Questions:

1. **What is the principle of operation of a Tunnel diode and its application in microwave technology?**
2. **How does a PIN diode function in microwave switching applications?**
3. **What is the key feature of a GUNN diode that makes it suitable for microwave oscillators?**

(COURSE CODE: 24ELEM83A)

UNIT IV: Optoelectronic Modulator Essay-Type Questions

1. **Describe the differences between analog and digital modulation techniques in optoelectronic modulators. How does each technique impact signal transmission and quality?**
2. **Explain the working principles of electro-optic modulators and magneto-optic devices. How do these devices enable high-speed data transmission in optical communication systems?**
3. **Discuss the role of acousto-optic devices in optical switching and logic applications. How do these devices operate and what are their advantages in optoelectronic systems?**

Short Answer Questions:

1. **What is an electro-optic modulator and how does it modulate optical signals?**
2. **How do magneto-optic devices differ from electro-optic modulators in terms of their operating principle?**
3. **What is the function of an optical switch in communication systems and how is it implemented using optoelectronic devices?**

UNIT V: Introduction to Radar Essay-Type Questions

1. **Outline the basic block diagram of a radar system and explain the operation of each block. How does the overall system contribute to effective radar functionality?**
2. **Discuss the radar frequency bands and their significance. How does the choice of frequency impact radar performance and applications?**
3. **Explain the radar equation and its use in predicting radar range performance. How do pulse repetition frequency and range ambiguities affect radar detection capabilities?**

Short Answer Questions:

1. **What is the purpose of pulse repetition frequency in radar systems?**
2. **How does the radar equation help in estimating the detection range of a radar system?**
3. **What are the typical applications of radar technology in modern industries?**

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Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

(COURSE CODE: 24ELEM83B)

BLUE PRINT
Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VIII
COURSE 23 B: WIRELESS BROADBAND NETWORKS

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-A) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-B) Each one 4 marks
1	I	WIRELESS PROTOCOLS	1	2
2	II	3G EVOLUTION	1	2
3	III	4G EVOLUTION	1	2
4	IV	LAYER-LEVEL FUNCTIONS	1	2
5	V	5G EVOLUTION	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120 - 60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

(COURSE CODE: 24ELEM83B)

SEMESTER-VIII

COURSE 23 B: WIRELESS BROADBAND NETWORKS

Theory Credits: 3 3 hrs/week

Course Objective:

The course on wireless broadband networks aims to provide students with a fundamental understanding of the network layers and techniques.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand various network layer and transport layer protocols for wireless networks. study the connecting networks	Level 2 (Understanding)
CO 2	Applying the architecture of 3G network standards.	Level 3 (Applying)
CO 3	Understand and Analyze the difference of LTE-A network design from 4G standard	Level 2 (Understanding) Level 4 (Analysing)
CO 4	Applying and Design the interconnecting network functionalities by layer level functions	Level 3 (Applying)
CO 5	Understanding the emerging techniques in 5G network Analysing current generation (5G) network architecture.	Level 2 (Understanding) Level 4 (Analysing)

(COURSE CODE: 24ELEM83B)

SEMESTER-VIII

COURSE 23 B: WIRELESS BROADBAND NETWORKS

Theory | Credits: 3 | 3 hrs/week

SYLLABUS

UNIT I:

WIRELESS PROTOCOLS:
Common type protocols, wi-fi, Bluetooth, zig-bee, z-wave, NFC, etc., Mobile network layer-Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing - DHCP, Mobile transport layer-Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements Indirect TCP, snooping TCP, Mobile TCP

UNIT II:

3G EVOLUTION: ***technology and standards, data speed and performance, features and capabilities, coverage and availability,*** IMT-2000 - W-CDMA, CDMA 2000 - radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA,HSUPA.

UNIT III:

4G EVOLUTION: ***technology and standards, data speed and performance, features and capabilities, coverage and availability***, Introduction to LTE-A – Requirements and Challenges, network architectures,– EPC, E- UTRAN architecture - mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT IV:

LAYER-LEVEL FUNCTIONS: Characteristics of wireless channels - downlink physical layer, uplink physical layer, and MAC scheme -frame structure, resource structure, mapping,

Synchronization, reference signals and channel estimation, SC-FDMA, interference cancellation – CoMP, Carrier aggregation, Services - multimedia broadcast/multicast, location-based services.

(COURSE CODE: 24ELEM83B)

UNIT V:

5G EVOLUTION: ***technology and standards, data speed and performance, features and capabilities, coverage and availability***, 5G Roadmap - Pillars of 5G - 5G Architecture, The 5G internet - IoT and context awareness - Networking reconfiguration and virtualization support - Mobility QoS control - emerging approach for resource over provisioning, Small cells for 5G mobile networks- capacity limits and achievable gains with densification - Mobile data demand, Demand Vs Capacity, Small cell challenges, conclusion and future directions.

Suggested Books: 1. Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2008.

2. Vijay K.Garg, "Wireless Network Evolution - 2G & 3G". Prentice Hall; August 11,
3. Clint Smith,P.E, Dannel Collins, "3G Wireless Networks" Tata McGrawHill, 2nd Edition, 2011.
4. Sassan Ahmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014.
5. Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", John Wiley, 2015 Lab experiment:

1. Recommended to perform a field work and submit project report on wireless broadband network.

(COURSE CODE: 24ELEM83B)

Programme: B.Sc. Honours in Electronics (Major) -2024-2025
SEMESTER-VIII

COURSE 23 B: **WIRELESS BROADBAND NETWORKS**
(COURSE CODE: 24ELEM83B

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1. **What is the role of DHCP in IP addressing and how does it facilitate network configuration?**
2. **How does the slow start mechanism in TCP work and why is it important for congestion control?**
3. **What are the primary differences between W-CDMA and CDMA 2000 in terms of their network structure and components?**
4. **How does the 3GPP network architecture support UMTS services?**
5. **What are the main components of the Evolved Packet Core (EPC) in LTE-A?**
6. **How does LTE-A handle mobility management?**
7. **What are the key functions of the MAC layer in wireless networks?**
8. **How does SC-FDMA differ from OFDMA in terms of interference management?**
9. **What are the main pillars of 5G technology?**
10. **How do small cells contribute to addressing capacity challenges in 5G networks?**

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Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A) Discuss the fundamentals of Mobile IP, including data forwarding procedures in Mobile IP. Compare IPv4 and IPv6 in terms of IP mobility management and addressing.

(OR)

(B) Explain the traditional TCP mechanisms for congestion control, slow start, and fast recovery/fast retransmission. How do these mechanisms address network congestion and data transmission reliability?

(COURSE CODE: 24ELEM83B)

12. (A) Describe the architecture and network components of W-CDMA and CDMA 2000. How do these technologies contribute to the 3G network structure and packet-data transport process?

(OR)

(B) Explain the concept of Channel Allocation in 3G networks. Discuss the techniques used for interference mitigation and their impact on network performance.

13. (A) Discuss the requirements and challenges associated with LTE-A (Long-Term Evolution Advanced). How does the EPC (Evolved Packet Core) architecture address these requirements?

(OR)

(B) Explain the E-UTRAN architecture, including its components and their roles in LTE-A. How does it support mobility management and resource management?

14. (A) Analyze the characteristics of wireless channels and their impact on downlink and uplink physical layers. How do these characteristics affect the design of MAC schemes and frame structures?

(OR)

(B) Discuss the concepts of SC-FDMA and interference cancellation techniques like CoMP. How do these technologies improve the performance of wireless communication systems?

15. (A) Outline the key pillars of 5G technology and describe its architectural components. How does 5G architecture support IoT and context awareness?

(OR)

(B) Discuss the role of small cells in 5G mobile networks. How do they address capacity limits and enhance network performance through densification?

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(COURSE CODE: 24ELEM83B)

SEMESTER-VIII QUESTION BANK

COURSE 23 B: WIRELESS BROADBAND NETWORKS (COURSE CODE: 24ELEM83B)

UNIT I: Wireless Protocols

Essay-Type Questions:

1. **Discuss the fundamentals of Mobile IP, including data forwarding procedures in Mobile IP. Compare IPv4 and IPv6 in terms of IP mobility management and addressing.**
2. **Explain the traditional TCP mechanisms for congestion control, slow start, and fast recovery/fast retransmission. How do these mechanisms address network congestion and data transmission reliability?**
3. **Compare and contrast Indirect TCP, Snooping TCP, and Mobile TCP in terms of their approaches to handling mobility and ensuring reliable data transfer in mobile networks.**

Short Answer Questions:

1. **What is the role of DHCP in IP addressing and how does it facilitate network configuration?**
2. **How does the slow start mechanism in TCP work and why is it important for congestion control?**
3. **Describe the key differences between Mobile TCP and traditional TCP in terms of handling mobility.**

UNIT II: 3G Evolution

Essay-Type Questions:

1. **Describe the architecture and network components of W-CDMA and CDMA 2000. How do these technologies contribute to the 3G network structure and packet-data transport process?**
2. **Explain the concept of Channel Allocation in 3G networks. Discuss the techniques used for interference mitigation and their impact on network performance.**
3. **Discuss the key features and services of UMTS, including the architecture of UTRAN. How do High-Speed Packet Data technologies like HSDPA and HSUPA enhance 3G network capabilities?**

(COURSE CODE: 24ELEM83B)

Short Answer Questions:

1. **What are the primary differences between W-CDMA and CDMA 2000 in terms of their network structure and components?**
2. **How does the 3GPP network architecture support UMTS services?**
3. **What is the role of interference-mitigation techniques in 3G networks?**

UNIT III: 4G Evolution

Essay-Type Questions:

1. **Discuss the requirements and challenges associated with LTE-A (Long-Term Evolution Advanced). How does the EPC (Evolved Packet Core) architecture address these requirements?**
2. **Explain the E-UTRAN architecture, including its components and their roles in LTE-A. How does it support mobility management and resource management?**
3. **Describe the channel mapping in LTE-A, including logical and transport channels. Discuss the significance of PDU packet formats, scheduling services, and random access procedures.**

Short Answer Questions:

1. **What are the main components of the Evolved Packet Core (EPC) in LTE-A?**
2. **How does LTE-A handle mobility management?**
3. **What is the purpose of channel mapping in LTE-A and how does it affect data transfer?**

UNIT IV: Layer-Level Functions

Essay-Type Questions:

1. **Analyze the characteristics of wireless channels and their impact on downlink and uplink physical layers. How do these characteristics affect the design of MAC schemes and frame structures?**
2. **Discuss the concepts of SC-FDMA and interference cancellation techniques like CoMP. How do these technologies improve the performance of wireless communication systems?**
3. **Explain the role of synchronization, reference signals, and channel estimation in wireless networks. How do these elements contribute to efficient resource management and service quality?**

Short Answer Questions:

(COURSE CODE: 24ELEM83B)

1. **What are the key functions of the MAC layer in wireless networks?**
2. **How does SC-FDMA differ from OFDMA in terms of interference management?**
3. **What is the purpose of channel estimation in wireless communication?**

UNIT V: 5G Evolution

Essay-Type Questions:

1. **Outline the key pillars of 5G technology and describe its architectural components. How does 5G architecture support IoT and context awareness?**
2. **Discuss the role of small cells in 5G mobile networks. How do they address capacity limits and enhance network performance through densification?**
3. **Explain the concept of network reconfiguration and virtualization support in 5G. How do these approaches contribute to mobility QoS control and resource over-provisioning?**

Short Answer Questions:

1. **What are the main pillars of 5G technology?**
2. **How do small cells contribute to addressing capacity challenges in 5G networks?**
3. **What is the significance of network virtualization in 5G architecture?**

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Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 24ELEM84A: CONSUMER ELECTRONICS

Theory | Credits: 3 | 3 hrs/week

Objectives

The subject aims to provide the student with:

1. An understanding of basic characteristics of sound, microphones, loudspeakers, sound recording with its reproduction and public address systems.
2. An understanding of signal generation to test various sections of TV receiver.
3. An introduction to various electronic household and office appliances.
4. An understanding of the concepts and techniques in marketing. Outcomes:

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Evaluate the choice of appropriate microphones and loudspeakers for recording and reproduction of sound for various environmental surroundings	Level 5 (Evaluate)
CO 2	Design block level and circuit level systems for sound recording and reproduction	Level 6 (Create)
CO 3	Explain the construction and working of the different types of electronic household and office appliances	Level 2 (Understand)
CO 4	Identify major risks associated with the circuits in electrical appliances and strategies to mitigate those risks	Level 2 (Understand)
CO 5	Develop, evaluate, and implement marketing management in a variety of business environments.	Level 6 (Create) Level 3 (Apply)

Syllabus

Unit - 1

Electro acoustical Transducers: Microphones, Loudspeakers, Pick-up characteristics, specifications, and applications. Sound Recording and Reproduction: Principle and Block schematic of disc recording system, magnetic recording system, optical recording system, compact disc, and video recording. Audio Amplifier and subsystems: Audio mixers, tone controls, Graphic equalizers,
Features of Hi-Fi and stereo systems, Dolby system, Public Address systems.

Unit - 2

Testing, Alignment & Servicing of Television Receivers: Testing and Alignment of TV receivers, TV Wobbuloscope, Video Pattern Generators, Marker Generator, Colour bar generator,
Vectroscope.Cable Television: Modern cable TV system, signal processing, Cable TV converter, Satellite Television, Direct broadcast satellite TV. Digital Television System, Three-dimensional (3D) TV, stereoscopic effect with the aid of special glasses, autostereoscopic methods.
Projection Television: Laser Projection system, LCD projection system.
High - Definition television systems: HDTV Systems, HDTV standards and compatibility.

Unit - 3

Modern home appliances with electronic control: Microwave oven, washing machine,
Air-conditioner, **Digital video disc (DVD) player, Blu –Ray Disc, MP3 player**, Digital Camera, Remote control, Inverters, UPS, Refrigerator, Iron, Kittle. **Working principle of photocopying, scanner, fax machine, Risograph**, solar cell panels and solar water heater. Maintenance and safety measures. Electricity in home: electric lighting, electric heating, Dangers of Electricity & Safety Precautions.

Unit - 4

Marketing planning: Importance of marketing planning, steps involved in marketing planning process scanning the marketing environment and spotting the business opportunities, setting the market objectives. Marketing strategy: the meaning & significance of marketing strategy, formulating the marketing strategy. Techniques and practices for mass production for reliable production.

Unit – 5 Costing: overview of costing and marketing communication.
Entrepreneurship Awareness. Introduction to Energy auditing. Patents: Introduction to patents.

Topics Deleted under autonomy are shown in red colour

Recommended Readings:

1. Gupta B. R.; Consumer Electronics; S.K. Kataria & Sons
2. R. G. Gupta; Audio and Video Systems: Principles, Maintenance and Troubleshooting; Tata McGraw-Hill
3. S. P. Bali; Consumer Electronics; Pearson
4. V. S. Ramaswamy, J. Namakumari; Marketing management planning, implementation and control, 2nd Edition; McMillan
5. Tom Duncan; Electronics for Today and Tomorrow; Hodder Education
6. R. G. Gupta; Television engineering and video systems; Tata McGraw-Hill

H. S. Kalsi; Electronic Instrumentation; Tata McGraw Hill

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	3	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

COURSE CODE 23ELEM84AP: CONSUMER ELECTRONICS

Practical Credits: 1 2 hrs/week

LIST OF EXPERIMENTS

(At least 8 experiments should be conducted from the list of experiments.)

1. Determination of frequency response of microphone.
2. Determination of frequency response of loudspeaker.
3. Determination of frequency response of crossover networks.
4. To study the working of a microwave oven.
5. Study of Semi-Automatic Washing machine trainer &Fault finding.
6. To study the various components of a Fully Automatic Washing Machine.
7. To study Risograph machine.
8. To study the basic operation of facsimile.
9. To study the various components of sound mixer.
10. To Study Fault simulation and step-by-step Fault finding of B/W TV.
11. To study the basic operation of TV pattern generator
12. To identify and understand different sections and components of mobile phone unit such as ringer section, dialer section, receiver section, transmitter section, etc.
13. To study the basic operation of photocopying machine.
14. To study the various components of Iron and kittle.
15. Interfacing using 8259

COURSE OOUTCOMES:

CO	Description	Blooms Level
CO 1	**Demonstrate** the ability to measure and analyze the frequency response of a microphone, and understand its impact on sound quality and performance.	Level 3 (Apply)
CO 2	**Evaluate** the frequency response characteristics of a loudspeaker and assess its suitability for different audio applications.	Level 5 (Evaluate)
CO 3	**Analyze** the frequency response of crossover networks and determine their effectiveness in separating audio signals into different frequency bands.	Level 4 (Analyze)
CO 4	**Explain** the principles of microwave heating, including the operation and safety mechanisms of a microwave oven.	Level 2 (Understand)
CO 5	**Identify** and troubleshoot common faults in a semi-automatic washing machine, using a trainer to understand its operational principles.	Level 4 (Analyze)

CO-PO Mapping
2- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	2	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
2- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	1	3
CO 2	3	2	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	2	2	1	3

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 23ELEM84A: CONSUMER ELECTRONICS

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 23ELEM84A: CONSUMER ELECTRONICS

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

Question Bank

UNIT-I: ELECTRO ACOUSTICAL TRANSDUCERS

Essay Type Questions:

1. Explain the different types of microphones and loudspeakers, discussing their characteristics, specifications, and applications.
2. How do microphones and loudspeakers contribute to sound recording and reproduction?
3. Describe the principle and block schematic of various sound recording systems such as disc recording, magnetic recording, optical recording, compact disc, and video recording systems.

Short Answer Questions:

1. What are the key features of Hi-Fi and stereo systems?
2. Define the Dolby system and its significance in audio reproduction.
3. Explain the basic components and function of a public address system.

UNIT-II: TESTING, ALIGNMENT & SERVICING OF TELEVISION RECEIVERS

Essay Type Questions:

1. Discuss the process of testing and aligning television receivers.
2. Describe the function and application of TV Wobbuloscope, Video Pattern Generators, Marker Generator, and Colour Bar Generator.
3. Explain the principles and technologies behind modern cable television, satellite television, and digital television systems.

Short Answer Questions:

1. What is a Vectroscope and how is it used in TV servicing?
2. Describe the differences between LCD projection and laser projection television systems.
3. What are the main features and benefits of High Definition Television (HDTV) systems?

UNIT-III: MODERN HOME APPLIANCES WITH ELECTRONIC CONTROL

Essay Type Questions:

1. Explain the working principles of modern home appliances microwave ovens, washing machines. How do electronic controls improve their functionality and efficiency?
2. Discuss the maintenance and safety measures for home electrical appliances.
3. What are the common dangers of electricity in homes and the precautions that should be taken?

Short Answer Questions:

1. How does a remote-control work and what are its common applications?
2. Describe the working principle of a inverter and UPS.
3. What are the key benefits of using solar cell panels and solar water heaters in homes?

UNIT-IV: MARKETING PLANNING

Essay Type Questions:

1. Explain the importance of marketing planning and the steps involved in the marketing planning process.
2. How does scanning the marketing environment help in spotting business opportunities and setting market objectives?
3. Discuss the meaning and significance of marketing strategy. How is a marketing strategy formulated and what techniques and practices are used for mass production and reliable production?

Short Answer Questions:

1. What are the main components of a marketing plan?
2. Define market objectives and their role in marketing planning.
3. What is environmental scanning and how does it contribute to marketing planning?

UNIT-V: COSTING AND ENTREPRENEURSHIP

Essay Type Questions:

1. Provide an overview of costing and its importance in marketing communication.
2. How does effective costing contribute to business success?
3. Explain the concept of energy auditing and its significance for businesses.
4. How does energy auditing contribute to cost savings and sustainability?

Short Answer Questions:

1. What are the key elements of entrepreneurship awareness?
2. Define patents and explain their importance in protecting intellectual property.
3. What is the role of marketing communication in business?

Programme: B.Sc. Honours in Electronics (Major)

COURSE CODE 23ELEM84A: CONSUMER ELECTRONICS

Theory | Credits: 3 | 3 hrs/week

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. What are the key features of Hi-Fi and stereo system
2. Explain the basic components and function of a public address system
3. Describe the differences between LCD projection and laser projection television systems.
4. What are the main features and benefits of High Definition Television (HDTV) systems?
5. Describe the working principle of a inverter and UPS.
6. What are the key benefits of using solar cell panels and solar water heaters in homes?
7. Define market objectives and their role in marketing planning.
8. What is environmental scanning and how does it contribute to marketing planning?
9. What are the key elements of entrepreneurship awareness?
10. Define patents and explain their importance in protecting intellectual property.

Section B

Answer all the questions (8M$\times$ $5 = 40M$)

11. (a) Explain the different types of microphones and loudspeakers, discussing their characteristics, specifications, and applications.

(OR)

(b) Describe the principle and block schematic of various sound recording systems such as disc recording, magnetic recording, optical recording, compact disc, and video recording systems.

12.(a) Discuss the process of testing and aligning television receivers

(OR)

(b) Explain the principles and technologies behind modern cable television, satellite television, and digital television systems.

13.(a) Explain the working principles of modern home appliances microwave ovens, washing machines

(OR)

(b) Discuss the maintenance and safety measures for home electrical appliances.

14.(a) Explain the importance of marketing planning and the steps involved in the marketing planning process.

(OR)

(b) How does scanning the marketing environment help in spotting business opportunities and setting market objectives?

15.a) Provide an overview of costing and its importance in marketing communication.

(OR)

(b) Explain the concept of energy auditing and its significance for businesses.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M84B

IV Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-VIII

COURSE 24 B: MOBILE COMPUTING

Theory Credits: 3 3 hrs/week

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	**Evaluate** the evolution of mobile computing and its impact on modern technological advancements, considering architecture, design principles, and future trends.	Level-5
2.	CO-2	**Analyze** the differences between various wireless network generations (1G, 2G, 3G, 4G) and technologies (Bluetooth, RFID), focusing on their functionalities and applications.	Level-4
3.	CO-3	**Explain** TCP/IP protocols and their enhancements for mobile environments, including Mobile IP, Mobile TCP, and security mechanisms, to manage performance and mobility challenges effectively.	Level-3
4.	CO-4	**Discuss** the architecture and deployment strategies of Wireless LANs, emphasizing IEEE 802.11 standards, security protocols, and the integration of mobile ad-hoc networks and sensor networks.including mobile ad-hoc networks.	Level-4
5.	CO-5	**Evaluate** Voice over IP (VoIP) technologies and frameworks (H.323, SIP), comparing their functionalities, real-time protocols, and security considerations in mobile communication environments.	Level-5

COURSE OBJECTIVES:

To learn Wireless technologies and planning Ad-hoc Network.

Outcomes:

Instructional Method and Pedagogy:

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
3. Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
4. One internal exam will be conducted as a part of internal theory evaluation.
5. Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
6. Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
7. The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
8. Experiments shall be performed in the laboratory related to course contents.

UNIT I (HOURS 12)

BASIC HISTORY OF MOBILE COMPUTING

Architecture for mobile computing, Three tier architecture, design considerations for mobile computing, mobile computing through internet, Wireless network architecture,
Applications, Security, Concerns and Standards, Benefits, Future. Evolution of mobile computing.

UNIT II (HOURS 12)

OVERVIEW OF WIRELESS N/W. AND TECHNOLOGIES

Introduction, Different generations. Introduction to 1G, 2G, 3G and 4G, Bluetooth, Radio frequency identification (Rfid),Wireless Broadband, Mobile IP: Introduction, Advertisement, Registration, TCP connections, two level addressing, abstract mobility management model, performance issue, routing in mobile host, Adhoc networks, Mobile transport layer: Indirect TCP, Snooping

UNIT III (HOURS 12)

WIRELESS NETWORK TOPOLOGIES

TCP, Mobile TCP, Time out freezing, Selective retransmission, transaction oriented TCP. ,IPv6 Wireless network topologies, Cell fundamentals and topologies, Global system for mobile communication, Global system for mobile communication, GSM architecture, GSM entities, call routing in GSM,PLMN interface, GSM addresses and identifiers, network aspects in GSM,GSM frequency allocation, authentication and security, Short message services, Mobile computing over SMS,SMS, value added services through SMS, accessing the SMS bearer, Security in wireless networks.

UNIT IV (HOURS 12)

WIRELESS APPLICATION PROTOCOL

Wireless application protocol(WAP) WAP,MMS,GPRS application CDMA and 3G Spread-spectrum Technology, CDMA versus GSM, Wireless data, third generation networks, applications in 3G Wireless LAN, Wireless LAN advantages,IEEE802.11 standards ,Wireless LAN architecture, Mobility in Wireless LAN, Deploying Wireless LAN, Deploying Wireless LAN, Mobile ad-hoc networks and sensor networks, wireless LAN security.

UNIT V (HOURS 12)

WIRELESS FIDELITY

WiFi v/s 3G Voice over Internet protocol and convergence, Voice over IP,H.323 framework for voice over IP,SIP, comparison between H.323 and SIP, Real time protocols, convergence technologies, call routing, call routing, voice over IP applications, IMS, Mobile VoIP, Security issues in mobile. Information security, security techniques and algorithms, security framework for mobile environment.

Reference Books:

1. Mobile Computing , Asoke K Telukder, Roopa R Yavagal, TMH
2. Mobile Communications, Jochen Schiller, Pearson
3. Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH.
4. Principle of wireless Networks by Kaveh Pahlavan and Prashant Krishnamurthy, Pearson 2002.

SEMESTER-VIII

Course Code: 24(ELE)M84BP

COURSE 24 B: MOBILE COMPUTING

Practical Credits: 1 2 hrs/week

List of experiments:

Name of Experiment

1) What is Mobile Computing? Explain the three tier architecture of mobile computing with diagram.
2) Write a WML program to create a card.
3) Write a WML program to create a deck that contain two cards and provide the Functionality of calling two cards from one another.
4) Write a WML program to display list of following card and provide the functionality to load a particular card,

a. Sales
b. Product
c. Services

5) Write a WML program for usage of template tag.
6) Write a WML program to display the text in the following format.

a) Bold
b) Underlined
c) Emphasized
d) Big font
e) Small font
f) Strong font

7) Write a WML program to implement the functionality of Login by username. 8) Write a WML program to create following selection list.

a. Red
b. Green
c. Yellow
d. Blue

9) Write a WML program to display the image on the screen after 5 seconds 10) Write a WML program to develop the calculator.

B.Sc. ELECTRONICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(ELE)M84B

IV Year B.Sc (Hons.)-ELECTRONICS

SEMESTER-VIII

COURSE 24 B: MOBILE COMPUTING

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	2	2	1	1	2	2	3	2	3
CO 2	3	2	2	1	1	2	3	3	3	2
CO 3	3	3	1	1	2	1	2	2	3	3
CO 4	2	3	1	2	1	2	2	2	3	3
CO 5	3	3	1	2	2	1	3	2	2	2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	2	3	2	2	2
CO 2	3	2	3	3	3
CO 3	3	3	2	3	3
CO 4	3	2	3	2	2
CO 5	2	3	2	2	3

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

Dr V.S.Krishna Govt. Degree College(A),

Visakhapatnam 2023-2024
Course Code: 24(ELE)M84B

BLUE PRINT (:MOBILE COMPUTING)

IV B.Sc. (Hons.) ELECTRONICS- SEM-VIII/Course : 24B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	BASIC HISTORY OF MOBILE COMPUTING	2	2	30
2.	II	OVERVIEW OF WIRELESS N/W. AND TECHNOLOGIES	2	2	30
3.	III	WIRELESS NETWORK TOPOLOGIES	2	2	30
4.	IV	WIRELESS APPLICATION PROTOCOL	2	2	30
5.	V	WIRELESS FIDELITY	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M84B

IV Year B.Sc (Hons.)- ELECTRONICS
SEMESTER-VIII COURSE 24B: **MOBILE COMPUTING**

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Write about the architecture of mobile computing?
   [OR]
   b) Explain wireless network architecture of mobile computing?

2. a) Explain 3G and 4G mobile networks?
   [OR]
   b) Explain about Mobile transport layer?
3. a) Discuss about IPv6 Wireless network topologies?
   [OR]
   b) Write about GSM frequency allocation, authentication and security?

4. a) Write about GPRS application CDMA and 3G Spread-spectrum Technology?
   [OR]
   b) Explain about Wireless LAN architecture?

5. a) Write about WiFi v/s 3G Voice over Internet protocol and convergence?
   [OR]
   b) Write about voice over IP applications?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) Write about design considerations for mobile?
7. a) Write about Security, Concerns and Standards for mobile computing?
8. a) Write about Radio frequency identification ?
9. a) Discuss about abstract mobility management model?
10. a) Briefly write about Selective retransmission?
11. a) Write about Mobile computing over SMS?
12. a) Discuss about CDMA versus GSM?
13. a) Write about wireless LAN security?
14. a) Discuss about Real time protocols?
15. a) Write about Information security, security techniques?

B.Sc. ELECTRONICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)M84B

IV Year B.Sc (Hons.)- ELECTRONICS
SEMESTER-VIII COURSE 24B: **MOBILE COMPUTING**

QUESTION BANK

Unit I: Basic History of Mobile Computing

Essay Type Questions:

1. Discuss the evolution of mobile computing from its early beginnings to the present day, highlighting key technological advancements and their impacts.
2. Explain the three-tier architecture for mobile computing. What are the design considerations that need to be addressed in mobile computing architectures?
3. Discuss the applications, security concerns, and standards in mobile computing. How do these factors contribute to shaping the future of mobile computing?

Short Type Questions:

1. Define mobile computing and its significance in today's digital landscape.
2. Describe the wireless network architecture suitable for mobile computing.
3. What are the benefits of mobile computing? Provide examples of how mobile computing enhances user experience and productivity.

Unit II: Overview of Wireless Networks and Technologies

Essay Type Questions:

1. Provide an overview of wireless networks by discussing the different generations (1G to 4G). Highlight the technological advancements and features introduced in each generation.
2. Explain the concept of Mobile IP and its components. Discuss the challenges and solutions related to mobility management in Mobile IP.
3. What are Ad hoc networks? Discuss their characteristics, advantages, and applications in the context of mobile computing.

Short Type Questions:

1. Differentiate between Bluetooth and RFID technologies. Where are they commonly used?
2. Explain the concept of TCP connections in mobile computing. How does mobile TCP address performance issues and routing challenges?
3. Describe the Mobile Transport Layer and its role in managing communications in mobile computing environments.

Unit III: Wireless Network Topologies

Essay Type Questions:

1. Discuss TCP enhancements for wireless networks, such as Selective Retransmission and Time Out Freezing. How do these improvements address challenges specific to wireless communication?
2. Explain the GSM architecture in detail. Include discussions on GSM entities, call routing, authentication, and security aspects.
3. Describe IPv6 Wireless Network Topologies. How does IPv6 address the limitations of IPv4 in wireless networks?

Short Type Questions:

1. What are Short Message Services (SMS)? Explain the value-added services that can be delivered through SMS.
2. Describe the fundamentals and topologies of cellular networks. How does a cellular network differ from other wireless network topologies?
3. Discuss the security considerations in GSM networks. What measures are taken to ensure secure communication over GSM?

Unit IV: Wireless Application Protocol

Essay Type Questions:

1. Discuss the Wireless Application Protocol (WAP) and its significance in enabling internet access from mobile devices. How does WAP differ from traditional web browsing?
2. Compare CDMA and GSM technologies. What are the advantages and disadvantages of each in the context of wireless data transmission?
3. Explain the architecture of Wireless LAN (WLAN). Discuss the deployment strategies and security considerations in WLAN environments.

Short Type Questions:

1. What are the applications of GPRS in mobile computing? How does GPRS facilitate internet access on mobile devices?
2. Describe the IEEE 802.11 standards for Wireless LANs. What are the key features and improvements introduced by these standards?
3. Discuss the security challenges in Wireless LANs. What are the common security measures adopted to protect WLANs from unauthorized access?

Unit V: Wireless Fidelity

Essay Type Questions:

1. Compare WiFi and 3G technologies in terms of their capabilities and applications. How do these technologies contribute to the evolution of mobile communication?
2. Explain Voice over Internet Protocol (VoIP) and its convergence with mobile networks. Discuss the frameworks such as H.323 and SIP used in VoIP.
3. Discuss the security issues specific to mobile VoIP. What are the techniques and algorithms used to enhance the security of VoIP communications?

Short Type Questions:

1. What is IMS (IP Multimedia Subsystem)? How does IMS facilitate multimedia services over IP networks?
2. Compare H.323 and SIP protocols for VoIP. What are the similarities and differences between these two protocols?
3. Explain the concept of convergence technologies in mobile communication. How do these technologies integrate different communication services into a unified platform?

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM85A**
SEMESTER-VIII (IV Year) COURSE 25A: ROBOTICS

Theory Credits: 3 3 Hrs/Week

Course Objectives: The course on Robotics aims

- To familiarize students with basic terminologies of the robotics.
- Essential knowledge to be acquainted in the field of Robotics.
- It also aims to inculcate thorough understanding about basic terminologies, grippers, sensors, actuators and robot kinematics.

Learning Outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand terminologies related to robotics.	Level 2 (Understanding)
CO 2	Identify gripper, sensor and actuator of a robot.	Level 3 (Applying)
CO 3	Apply mathematics for manipulator positioning and motion planning.	Level 3 (Applying)
CO 4	Analyse robot mechanism using kinematics.	Level 4 (Analysing)
CO 5	Acquainted with various applications and futuristic robotic technology.	Level 2 (Understanding) Level 3 (Applying)

SYLLABUS

Unit–I

Introduction to robotics: Brief History, Definition, Robot Anatomy, Three laws, Classification of robots, Robot terminologies: work volume, Degree of Freedom, resolution, accuracy, repeatability, dexterity, compliance, payload capacity, speed of response etc., Wrist assembly, Joint notations, Selection criteria of any robot, Industrial applications of robot, *specifications of different industrial robots*, Futuristic robotics.

Unit–II

Robot drive systems: Robot drive systems End effectors and Automation Types of drives – Hydraulic, Pneumatic and Electric, Comparison of all such drives, DC servo motors, Stepper motors, AC servo motor – salient features and applications, pulse count calculations End effectors - Types of Grippers – Mechanical, Magnetic, vacuum, pneumatic and hydraulic, selection and design considerations.

Unit–III

Robot sensors and Machine Vision: Need for sensors, types of sensors used in Robotics, classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Robot Vision setup (RVS), block diagram, components, working of RVS, Human vision Vs Robot Vision, Gradient calculations, Applications of RVS.

Unit–IV

Mathematical Preliminaries of Robotics Spatial Descriptions: positions, orientations, and frame, mappings: changing description from frame to frame, Operators: translations, rotations and transformations, Homogeneous transformations, transformation arithmetic, compound Transformations, inverting a transform, transform equations, Euler Angles, Fixed Angles, Euler Parameters.

Unit–V

Robot Kinematics: Manipulator Kinematics, Link Description, Link to reference frame connections, Denavit–Hartenberg approach, D-H Parameters, *D-H Parameters Visualization*, Position Representations, Forward Kinematics, Inverse Kinematics.

Suggested Books:

1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014).
2. Ashitava Ghosal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006).
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).
4. R. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, New Delhi (2003).

5. S. B. Niku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition, John Wiley & Sons Ltd., (2020).
6. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer (1997).
7. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, Industrial Robotics 2nd edition, SIE, McGraw Hill Education (India) Pvt Ltd (2012).
8. R. D. Klafter, Thomas A. Chmielewski, and MechaelNegin, Robotic Engineering – An Integrated Approach, EEE, Prentice Hall India, Pearson Education Inc. (2009).

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	2	3	3	3
CO 5	3	1	1	1	1	2	2	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM85AP**
SEMESTER-VIII COURSE 25A: ROBOTICS Practical Course

Practical Credits: 1 2 Hrs/Week

COURSE OBJECTIVE:
To develop practical skills in the use of laboratory equipment and experimental techniques for measuring components in Robotics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques to measure properties of Robots.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 2	Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.	Level 3 (Applying)
CO 3	Accurate recording and analysis of data: Students should be able to accurately record and analyse experimental data, including understanding the significance of error analysis and statistical methods.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Understanding of fundamental principles: Students should develop an understanding of the fundamental principles.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

List of Practical's on Robotics:

1. Study of components of real robot and its performance.
2. Basics of 3D modelling software.
3. Modelling of Robot Joints.
4. Assembly of 2DOF/3DOF Robot Manipulator.
5. Use of drives for robotic joints and its simulation.
6. Robo analyzer: A learning software of robotics study.
7. Understanding coordinate frames and transformation.
8. Formulation of DH parameters of robot configuration.
9. Simulation using open-source software of robot kinematics using DH Parameters.
10. Forward kinematic analysis of a robot.
11. Inverse kinematic analysis of a robot.
12. Introduction of MATLAB and Robotic Toolkit introduction.

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM85A**

SEMESTER-VIII (IV Year) COURSE 25A: ROBOTICS

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics (Major)

w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM85A**

SEMESTER-VIII (IV Year) COURSE 25A: ROBOTICS

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage

S. No.	Module/ Unit	Name of the chapter	8 Marks	4 Marks
1	Unit – I	Introduction to robotics	2 (One out of two)	2
2	Unit – II	Robot drive systems	2 (One out of two)	2
3	Unit – III	Robot sensors and Machine Vision	2 (One out of two)	2
4	Unit – IV	Mathematical Preliminaries of Robotics Spatial Descriptions	2 (One out of two)	2
5	Unit – V	Robot Kinematics	2 (One out of two)	2

Programme: B.Sc. Honours in Electronics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24ELEM85A**
SEMESTER-VIII (IV Year) COURSE 25A: ROBOTICS

Theory | Credits: 3 | 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs | Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. Define 'Degree of Freedom' and explain its significance in robotic systems.
2. What are the Three Laws of Robotics, and why are they important in the field of robotics?
3. What are the key features of a DC servo motor, and how is it used in robotics?
4. Explain the significance of pulse count calculations in stepper motors.
5. What are the key differences between Human Vision and Robot Vision?
6. Describe the main components of a Robot Vision System (RVS) and their functions.
7. What is a transformation matrix, and how is it used in robotics?
8. Explain the difference between fixed angles and Euler angles in the context of spatial transformations.
9. What is the difference between forward kinematics and inverse kinematics in robotics?
10. Briefly describe the role of link descriptions in the D-H approach to robotic kinematics.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Discuss the Evolution and Impact of Robotics from Its Inception to Modern-Day Applications.

(Or)

(b) Analyse the Classification and Selection Criteria of Robots for Industrial Applications.

12. (a) Compare and Contrast Hydraulic, Pneumatic, and Electric Drive Systems in Robotics.

(Or)

(b) Examine the Role of End Effectors in Robotics: Types, Design Considerations, and Applications.

13. (a) Evaluate the Role of Sensors in Enhancing the Capabilities of Robotic Systems.

(Or)

(b) Discuss the Development and Applications of Robot Vision Systems (RVS).

14. (a) Explain the Concept of Homogeneous Transformations and Their Role in Robotic Spatial Descriptions.

(Or)

(b) Analyze the Use of Euler Angles and Euler Parameters in Robotic Transformations.

15. (a) Discuss the Denavit–Hartenberg (D-H) Approach to Manipulator Kinematics.

(Or)

(b) Explore the Challenges and Solutions in Inverse Kinematics for Robotic Manipulators.

Question Bank

Short answer Questions

1. Define 'Degree of Freedom' and explain its significance in robotic systems.
2. What are the Three Laws of Robotics, and why are they important in the field of robotics?
3. What are the key features of a DC servo motor, and how is it used in robotics?
4. Explain the significance of pulse count calculations in stepper motors.
5. What are the key differences between Human Vision and Robot Vision?
6. Describe the main components of a Robot Vision System (RVS) and their functions.
7. What is a transformation matrix, and how is it used in robotics?
8. Explain the difference between fixed angles and Euler angles in the context of spatial transformations.
9. What is the difference between forward kinematics and inverse kinematics in robotics?
10. Briefly describe the role of link descriptions in the D-H approach to robotic kinematics.
11. What are the industrial applications of robot.
12. Write a short note on Futuristic robotics.
13. Discuss about the DC servo motors
14. Discuss about the Stepper motors.
15. Write the Characteristics of sensing devices.
16. What are the Euler Angles, and Fixed Angles.
17. Discuss about the Forward Kinematics, and Inverse Kinematics.

Long answer Questions

1. Discuss the Evolution and Impact of Robotics from Its Inception to Modern-Day Applications.
2. Analyse the Classification and Selection Criteria of Robots for Industrial Applications.
3. Compare and Contrast Hydraulic, Pneumatic, and Electric Drive Systems in Robotics.
4. Examine the Role of End Effectors in Robotics: Types, Design Considerations, and Applications.
5. Evaluate the Role of Sensors in Enhancing the Capabilities of Robotic Systems.
6. Discuss the Development and Applications of Robot Vision Systems (RVS).
7. Explain the Concept of Homogeneous Transformations and Their Role in Robotic Spatial Descriptions.
8. Analyze the Use of Euler Angles and Euler Parameters in Robotic Transformations.
9. Discuss the Denavit–Hartenberg (D-H) Approach to Manipulator Kinematics.

10. Explore the Challenges and Solutions in Inverse Kinematics for Robotic Manipulators.
11. Explain the following:
    a. Transform equations.
    b. Euler Angles.
    c. Fixed Angles.
    d. Euler Parameters.

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM85B

INTRODUCTION TO MEMs

Theory Credits: 3 3 hrs/week

Objectives:

The subject aims to provide the student with:

1. An overview of Microsystems and their applications in various branches of Engineering medical science and basic sciences.
2. An understanding of the principles and applications of the Microsystems and Micro actuators.
3. An understanding of the different materials used in the MEMS technology.
4. An ability to analyze the various techniques and parameters used in the micro system fabrication.
5. An understanding of the microsystem packaging techniques.

Learning Outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Explain the applications of MEMS in various branches of Engineering medical science and basic sciences	Level 1
CO 2	Explain the principles and operation of the different microsensors and microactuators.	Level 6
CO 3	Analyze the various techniques and parameters in the microsystem fabrication.	Level 6
CO 4	Explain the microsystem packaging techniques	Level 1

SYLLABUS

Unit - 1

Basic device technology: depletion region and diffusion capacitance, junction breakdown, breakdown voltage enhancement in pn junction. Thermal properties and second breakdown phenomenon, calculation of reverse leakage current. IC technology:Lithography, diffusion, ion implantation, oxidation and epitaxial growth.

MEMS and Microsystems: Applications, Multidisciplinary nature of MEMS. The effects of miniaturization and scaling.

Unit - 2

Working principles of Microsystems: Micro sensors -Biomedical sensors and biosensors, Optical sensors, pressure sensors.

Microactuation: Actuation using piezoelectric crystals, Actuation using Electrostatic forces, (Parallel plate, Comb drive actuators) MEMS with Micro actuators: Micro grippers, micro motors, micro valves, micro pumps, micro accelerometers, Microfluidics.

Unit - 3

Materials for MEMS: Substrates and wafers, silicon as substrate material, Single crystal silicon and wafers, crystal structure, The Miller Indices, Mechanical properties of Silicon, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, polymers for MEMS,

Packaging materials. Microsystem fabrication – Environment for Microfabrication, Photolithography, Ion implantation, Diffusion, Oxidation, Chemical vapour deposition, Sputtering, Epitaxy, Etching.

Unit - 4

Overview of Micro manufacturing: Bulk micro manufacturing, Surface micro machining Microsystems Design - Design considerations – Selection of signal transduction ,Process design, Design of a silicon die for a micro pressure sensor,

Unit - 5

Microsystem packaging :Microsystem packaging, The three levels of micro system packaging ,interfaces in micro system packaging, Signal mapping and transduction RF MEMS and optical MEMS components.

Recommended Books:

1. Tai-Ran Hsu; MEMS and Microsystems, Design and Manufacture; TMH
2. Mark Madou; Fundamentals of Micro fabrication; CRC Press
3. Julian W Gardner; Microsensors: Principles and Applications; John Wiley & Sons
4. Sze S. M.; Semiconductor Sensors; McGraw-Hill
5. Nadim Maluf; An Introduction to Micro Electro Mechanical System Design; Artech House
6. Chang Liu; Foundations of MEMS; Pearson Education Inc.
7. M. H. Bao; Micro Mechanical Transducers, Volume 8, Handbook of Sensors and Actuators; Elsevier
8. Chang C. Y., Sze S. M.; VLSI Technology; McGraw

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM85B

INTRODUCTION TO MEMs
BLUE PRINT (INTRODUCTION TO MEMs)

Max Marks-60 **Time-3Hrs.** **Credits:3**

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Electronics(Major)
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SEMESTER- VIII COURSE CODE: 24ELEM85B

INTRODUCTION TO MEMs

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2(two out of four)**	**1(one out of two**
Understanding/ Comprehension	**27%**	**16**	**2(two out of four)**	
Application	**20%**	**12**	**1(one out of two)**	**1(one out of two**
Analysis	**13%**	**8**		**2(two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1(one out of two**
Total	**100**	**60**	**5(each question has internal choice)**	**5 outb of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	**8 marks**	**4 marks**
1	**I**	Basic device technology	**2(one out of two)**	**2**
2	**II**	Working principles of Microsystems	**2(one out of two**	**2**
3	**III**	Materials for MEMS	**2(one out of two**	**2**
4	**IV**	Overview of Micro manufacturing	**2(one out of two**	**2**
5	**V**	Microsystem packaging	**2(one out of two**	**2**
		TOTAL QUESTIONS	**5(each question has internal choice)**	**5 out of given 10**

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM85B

INTRODUCTION TO MEMs
(MODEL PAPER)

DURATION::3 hrs **MAX.MARKS :: 60**

SECTION-A

Answer any FIVE questions of the following (5 X 4 = 20 M)

1. What is the depletion region, and how is it formed in a pn junction?
2. Define diffusion capacitance and its significance in semiconductor devices.
3. How does actuation using piezoelectric crystals differ from actuation using electrostatic forces?
4. What is the significance of micro accelerometers in MEMS technology?
5. How do silicon compounds enhance the functionality of MEMS devices?
6. What are the advantages of using Gallium Arsenide in MEMS over silicon?
7. What is the primary difference between bulk micro manufacturing and surface micro machining?
8. What is signal transduction, and why is it important in microsystem design?
9. How do interfaces in microsystem packaging influence device performance?
10. What are RF MEMS, and how are they used in communication systems?.

SECTION-B

Answer ALL the questions of the following (5 X 8 = 40 M)

11. (a) Explain the phenomenon of junction breakdown in pn junctions. How can breakdown voltage be enhanced, and what are the implications for device reliability?

[OR]

(b) Analyze the thermal properties of semiconductor devices and explain the second breakdown phenomenon. How does it influence the performance and reliability of semiconductor components?

12. (a) Analyze the role of MEMS with micro actuators in modern technology, with specific examples of micro grippers, micro motors, micro valves, micro pumps, and micro accelerometers.

[OR]

(b)Describe the principles and challenges associated with microfluidics in MEMS. How is microfluidics applied in various industries?

13. (a) Discuss the role of silicon as a substrate material in MEMS. What are the mechanical properties of silicon that make it suitable for this application?

[OR]

(b)Explain the significance of silicon piezoresistors in MEMS technology. How are they used, and what are their advantages?

14. (a) Explain the process of designing a silicon die for a micro pressure sensor. What factors must be considered to ensure accurate and reliable performance?

[OR]

(b) Evaluate the impact of advancements in micro manufacturing on the future of MEMS technology. What are the potential challenges and opportunities?

15. (a) Explore the various interfaces in microsystem packaging. How do these interfaces affect signal mapping and transduction in MEMS?

[OR]

(b) Analyze the role of RF MEMS and optical MEMS components in modern communication systems. What are their advantages and limitations?

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SEMESTER- VIII COURSE CODE: 24ELEM85B
INTRODUCTION TO MEMs
QUESTION BANK

Unit I: Basic Device Technology & IC Technology

Essay Questions:

1. Discuss the physical principles underlying the formation of the depletion region in a pn junction and the factors affecting diffusion capacitance.
2. Explain the phenomenon of junction breakdown in pn junctions. How can breakdown voltage be enhanced, and what are the implications for device reliability?
3. Analyze the thermal properties of semiconductor devices and explain the second breakdown phenomenon. How does it influence the performance and reliability of semiconductor components?
4. Describe the key processes involved in IC technology, such as lithography, diffusion, ion implantation, oxidation, and epitaxial growth. How do these processes contribute to the development of modern integrated circuits?

Short Questions:

1. What is the depletion region, and how is it formed in a pn junction?
2. Define diffusion capacitance and its significance in semiconductor devices.
3. What are the key differences between thermal breakdown and second breakdown in semiconductor devices?
4. Briefly explain the process of ion implantation in IC fabrication.

Unit II: Working Principles of Microsystems

Essay Questions:

1. Explore the working principles of various microsensors, including biomedical sensors, optical sensors, and pressure sensors. How do these sensors contribute to the development of microsystems?
2. Discuss the mechanisms of microactuation, focusing on actuation using piezoelectric crystals and electrostatic forces. Compare parallel plate and comb drive actuators in terms of their design and applications.

3. Analyze the role of MEMS with micro actuators in modern technology, with specific examples of micro grippers, micro motors, micro valves, micro pumps, and micro accelerometers.
4. Describe the principles and challenges associated with microfluidics in MEMS. How is microfluidics applied in various industries?

Short Questions:

1. What are the primary functions of biomedical sensors in microsystems?
2. How does actuation using piezoelectric crystals differ from actuation using electrostatic forces?
3. What is the significance of micro accelerometers in MEMS technology?
4. Define microfluidics and its importance in the design of MEMS.

Unit III: Materials for MEMS

Essay Questions:

1. Discuss the role of silicon as a substrate material in MEMS. What are the mechanical properties of silicon that make it suitable for this application?
2. Explain the significance of silicon piezoresistors in MEMS technology. How are they used, and what are their advantages?
3. Evaluate the use of different materials, such as Gallium Arsenide, Quartz, and polymers, in MEMS fabrication. How do these materials contribute to the performance and versatility of MEMS devices?
4. Describe the various processes involved in microsystem fabrication, including photolithography, ion implantation, diffusion, oxidation, chemical vapor deposition, sputtering, epitaxy, and etching. How do these processes interact to produce functional MEMS?

Short Questions:

1. What are the Miller Indices, and how are they used to describe crystal structures in MEMS?
2. How do silicon compounds enhance the functionality of MEMS devices?
3. What are the advantages of using Gallium Arsenide in MEMS over silicon?
4. Briefly explain the process of chemical vapor deposition in MEMS fabrication.

Unit IV: Overview of Micro Manufacturing

Essay Questions:

1. Analyze the differences between bulk micro manufacturing and surface micro machining. How do these techniques influence the design and functionality of MEMS?
2. Discuss the key considerations in the design of microsystems, particularly the selection of signal transduction methods and process design.
3. Explain the process of designing a silicon die for a micro pressure sensor. What factors must be considered to ensure accurate and reliable performance?
4. Evaluate the impact of advancements in micro manufacturing on the future of MEMS technology. What are the potential challenges and opportunities?

Short Questions:

1. What is the primary difference between bulk micro manufacturing and surface micro machining?
2. What is signal transduction, and why is it important in microsystem design?
3. Describe one key consideration when designing a silicon die for a micro pressure sensor.
4. What role does process design play in the development of MEMS?

Unit V: Microsystem Packaging

Essay Questions:

1. Discuss the three levels of microsystem packaging and their importance in ensuring the functionality and reliability of MEMS devices.
2. Explore the various interfaces in microsystem packaging. How do these interfaces affect signal mapping and transduction in MEMS?
3. Analyze the role of RF MEMS and optical MEMS components in modern communication systems. What are their advantages and limitations?
4. Evaluate the challenges associated with microsystem packaging in terms of thermal management, mechanical stress, and signal integrity. How are these challenges addressed in current packaging techniques?

Short Questions:

1. What are the three levels of microsystem packaging?
2. How do interfaces in microsystem packaging influence device performance?
3. What are RF MEMS, and how are they used in communication systems?
4. Briefly describe the significance of thermal management in microsystem packaging.

Programme: B.Sc. Honours in Electronics(Major)
w.e.f. AY 2023-24
IV Year BSC Electronics
SEMESTER- VIII COURSE CODE: 24ELEM85BP

INTRODUCTION TO MEMs
SEMESTER-VIII
COURSE 25 B: INTRODUCTION TO MEMs

Practical Credits: 1 2 hrs/week

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Microsensors
2. Microactuators
3. Materials for MEMS
4. The Miller Indices
5. Microsystem fabrication
6. Micro manufacturing
7. Microsystem Design

Learning Outcomes

1. Examine and interpret the operational principles and applications of various microsensors in MEMS technology, assessing their performance and integration in microsystems.
2. Develop and evaluate microactuators, demonstrating the ability to design and integrate them into functional microsystems for precise control and actuation.
3. Investigate and assess the properties and suitability of different materials used in MEMS, analyzing their impact on device performance and fabrication processes.
4. Understand and apply the Miller Indices to analyze crystal structures, enhancing the ability to describe and predict the behavior of materials in microsystems.
5. Construct and optimize microsystem fabrication processes, demonstrating proficiency in micro manufacturing methods and the ability to produce reliable and functional MEMS devices.

B.Sc. ELECTRONICS MINOR SYLLABUS UNDER CBCS

[W.E.F. AY 2023-24 Batch onwards]

Course Code: 24(ELE)N31

II Year B.Sc (Hons.)-ELECTRONICS MINOR

SEMESTER-III

COURSE 2: SEMICONDUCTOR DEVICES AND MATERIALS

Theory Credits: 3 3 hrs/week

Course Objective:

1. To provide basic knowledge and concepts of Semiconductor materials and devices.
2. To facilitate students learn on the physical principles and operational characteristics of Semiconductor devices and some of its important applications. Pre-requisites: Basic understanding of semiconductors.

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Ability to apply basic concepts of Inorganic and Organic Semiconductor materials for electronic device application in modern electronic industry.	Level-5
2.	CO-2	Detailed knowledge of various classifications and applications to VLSI, LEDs and solar cells.	Level-4
3.	CO-3	Holistic view of the latest progress in two-dimensional (2D)-one-dimensional (1D) and nano materials.	Level-5
4.	CO-4	Emphasis on nano-electronic applications such as Schottky barrier transistors, flexible Electronics.	Level-5
5.	CO-5	**Evaluate** BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier.	Level-5

Unit I:

INORGANIC AND ORGANIC SEMICONDUCTOR: Energy bands, carrier transport, mobility, drift- diffusivity, excess carrier, injection and recombination of the excess carriers, carrier statistics; High field effects: velocity saturation, hot carriers and avalanche breakdown.

Unit II:

MAJORITY CARRIER DEVICES: MS contacts rectifier and non-rectifier, MIS structures, MESFET,hetero-junction, HEMT and band diagrams, I-V and C-V characteristics.

Unit III:

MOS STRUCTURES: SEMICONDUCTOR SURFACES; The ideal and non-ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states. MOSFET: Structures and Device Characteristics, Short-Channel effects. Charge coupled Devices (CCDs), application to VLSI.

Unit IV:

NONVOLATILE MEMORY DEVICE. Optoelectronic Devices: solar cell, photo detectors, LEDs, laser diodes. Nano structures and concepts: quantum wells, supper lattice structures, nanorod, quantum dot, CNTs, 2D materials: grapheme, BN, MoS_2 etc, matamaterials.

UNIT-V:

MULTISTAGE AMPLIFIERS: BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier.

<u>Reference Books:</u>

1. Donald A. Neamen, Semiconductor Physics and Devices Basic Principles, 3rdedn. McGraw-Hil (2003)
2. B.G. Streetman and Sanjay Banerjee, Solid State Electronic Devices, 6thEdn., Prentice Hall, 2006.
3. S. M. Sze and Kwok K. Ng Physics of Semiconductor Devices, Wiley (2013).
4. M. Hussa, A. Dimoulas and A. Molle, 2D Materials for NanoElectronics, CRC press (2016)
5. M.S.Tyagi, Introduction to Semiconductor Materials and Devices, Willey, Student Edition

B.Sc. ELECTRONICS MINOR SYLLABUS UNDER CBCS
[W.E.F. AY 2023-24 Batch onwards]

Course Code: 24(ELE)N31P

II Year B.Sc (Hons.)-ELECTRONICS MINOR

SEMESTER-III
COURSE 2: SEMICONDUCTOR DEVICES AND MATERIALS

Practical Credits: 1 2 hrs/week

List of Experiments

1. To study the Hall Effect: determine the Hall coefficient, type of semiconductor and carrier concentration in the given semiconductor sample.
2. To study the four probe method: calculate the resistivity and energy band gap of given semiconductor sample.
3. To determine the resistivity of the given semiconductor specimen using Vander Pauw method.
4. To design a MOSFET as switching regulator for given duty cycle and plot the current- voltage (I-V) characteristic of MOSFET using Keithley.
5. To design a phase controlled rectifier using SCR and plot the I-V characteristic of SCR using Keithley.
6. To design a relaxation oscillator using UJT and plot the I-V characteristic of UJT using Keithley.
7. I-V characteristics measurement of a p-n diode/LEDs using Keithley - calculate its ideality factor.

B.Sc. ELECTRONICS MINOR SYLLABUS UNDER CBCS

[W.E.F. AY 2023-24 Batch onwards]

Course Code: 24(ELE)N31

II Year B.Sc (Hons.)-ELECTRONICS MINOR

SEMESTER-III

COURSE 2: SEMICONDUCTOR DEVICES AND MATERIALS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	3	2	1	1	1	2	3	2	3
CO 2	3	3	2	1	1	2	3	3	3	3
CO 3	3	3	1	2	1	2	3	2	2	3
CO 4	3	2	2	2	1	2	3	3	3	3
CO 5	3	2	2	2	2	1	3	2	2	2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	2	2	2	3
CO 2	3	3	2	3	2
CO 3	3	3	3	2	3
CO 4	2	3	2	3	3
CO 5	3	3	3	2	3

Dr V.S.Krishna Govt. Degree College(A), Visakhapatnam
[W.E.F. AY 2023-24 Batch onwards]

Course Code: 24(ELE)N31

BLUE PRINT (:: SEMICONDUCTOR DEVICES AND MATERIALS)
IIB.Sc. (Hons.) Electronics- SEM-III/Course : 2
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	INORGANIC AND ORGANIC SEMICONDUCTOR:	2	2	30
2.	II	MAJORITY CARRIER DEVICES	2	2	30
3.	III	MOS STRUCTURES: SEMICONDUCTOR SURFACES	2	2	30
4.	IV	NONVOLATILE MEMORY DEVICE	2	2	30
5.	V	MULTISTAGE AMPLIFIERS	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)N31
II Year B.Sc (Hons.)-ELECTRONICS-MINOR

SEMESTER-III COURSE 2: SEMICONDUCTOR DEVICES AND MATERIALS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Explain the concept of energy bands in semiconductors?
[OR]
b) Discuss the injection, recombination, and lifetime of excess carriers in semiconductors?

2. a) Explain the operation and characteristics of MS (Metal-Semiconductor) contacts?
[OR]
b) Discuss the operation and band diagrams of MESFET?

3. a) Describe the structure and operating principles of MOSFET?
[OR]
b) Explain the application of Charge Coupled Devices (CCDs) in VLSI technology?

4. a) Explain the concepts of various nanostructures?
[OR]
b) Discuss the concept of metamaterials in optics and novel optical properties and functionalities?

5. a) Describe the frequency response of RC coupled amplifiers and transformer-coupled amplifiers?
[OR]
b) Explain the design and operation of multistage amplifiers?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) What are the high-field effects in semiconductors?
7. a) What are the key differences between inorganic and organic semiconductors?
8. a) Discuss the significance of interface states in MOS structures?
9. a) What are the key differences between MOSFETs and other types of field-effect transistors?
10. a) How does a solar cell convert sunlight into electrical energy?
11. a) What are the unique properties of 2D materials such as graphene and MoS2?
12. a) How does the frequency response of a BJT amplifier change at high frequencies?
13. a) Explain the role of feedback in improving the stability and linearity of amplifiers?
14. a) Compare the band diagrams of ideal and non-ideal MOS capacitors?
15. a) Explain the band diagrams of hetero-junctions in semiconductor devices?

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B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)N31
II Year B.Sc (Hons.)-ELECTRONICS-MINOR
SEMESTER-III COURSE 2: SEMICONDUCTOR DEVICES AND MATERIALS

QUESTION BANK

Unit I: INORGANIC AND ORGANIC SEMICONDUCTOR

Essay Questions:

1. Explain the concept of energy bands in semiconductors. Discuss the formation of energy bands and their significance in determining electronic properties.
2. Describe the mechanisms of carrier transport in semiconductors. Discuss carrier mobility, drift-diffusivity, and their relationship with carrier statistics.
3. Discuss the injection, recombination, and lifetime of excess carriers in semiconductors. How do these factors affect device performance?

Short Questions:

1. Define mobility and drift-diffusivity in the context of semiconductor physics.
2. Explain the concept of excess carriers in semiconductors. How are they generated and recombined?
3. What are the high-field effects in semiconductors? Discuss velocity saturation, hot carriers, and avalanche breakdown.
4. How does carrier statistics influence the behavior of carriers in semiconductors?
5. Discuss the role of energy bands in determining the electrical conductivity of semiconductors.
6. What are the key differences between inorganic and organic semiconductors in terms of electronic properties?

Unit II: MAJORITY CARRIER DEVICES

Essay Questions:

1. Explain the operation and characteristics of MS (Metal-Semiconductor) contacts. Differentiate between rectifying and non-rectifying contacts.
2. Describe the structure and working principle of MIS (Metal-Insulator-Semiconductor) structures. Discuss their applications and advantages.
3. Discuss the operation and band diagrams of MESFET (Metal-Semiconductor Field-Effect Transistor) and HEMT (High Electron Mobility Transistor). Compare their characteristics and applications.

Short Questions:

1. Explain the band diagrams of hetero-junctions in semiconductor devices.
2. Describe the I-V (current-voltage) characteristics of MESFET and HEMT.
3. What are the key differences between MESFET and HEMT in terms of structure and performance?
4. Discuss the significance of band diagrams in understanding the behavior of semiconductor devices.
5. How does the C-V (capacitance-voltage) characteristics vary with bias voltage in MIS structures?
6. Explain the concept of majority carriers and their role in semiconductor device operation.

Unit III: MOS STRUCTURES AND MOSFET

Essay Questions:

1. Discuss the ideal and non-ideal characteristics of MOS (Metal-Oxide-Semiconductor) capacitors. Explain the effects of oxide charges, defects, and interface states on MOS device performance.
2. Describe the structure and operating principles of MOSFET (Metal-Oxide-Semiconductor Field-Effect Transistor). Discuss short-channel effects and their impact on device scaling.
3. Explain the application of Charge Coupled Devices (CCDs) in VLSI technology. How do CCDs improve signal processing and imaging capabilities?

Short Questions:

1. Compare the band diagrams of ideal and non-ideal MOS capacitors. What role do oxide charges play in device behavior?
2. Discuss the significance of interface states in MOS structures. How do they affect device reliability and performance?
3. What are short-channel effects in MOSFETs? How are they mitigated in modern semiconductor technologies?
4. Explain the principle of operation and applications of Charge Coupled Devices (CCDs).
5. How does the capacitance-voltage (C-V) characteristic vary with bias voltage in MOS capacitors?
6. What are the key differences between MOSFETs and other types of field-effect transistors?

Unit IV: OPTOELECTRONIC DEVICES AND NANOSTRUCTURES

Essay Questions:

1. Describe the working principles of optoelectronic devices such as solar cells, photodetectors, LEDs, and laser diodes. Discuss their applications in modern technology.
2. Explain the concepts of nanostructures including quantum wells, superlattice structures, nanorods, quantum dots, CNTs (Carbon Nanotubes), and 2D materials (e.g., graphene, BN, MoS2). Discuss their unique properties and potential applications.
3. Discuss the concept of metamaterials in optics. How do metamaterials enable novel optical properties and functionalities?

Short Questions:

1. How does a solar cell convert sunlight into electrical energy? Discuss its efficiency and applications.
2. Explain the operation of LEDs (Light-Emitting Diodes) and their advantages over traditional light sources.
3. Describe the principle of operation of quantum dots. What are their potential applications in optoelectronics?
4. Discuss the properties and applications of carbon nanotubes (CNTs) in nanoelectronics and optoelectronics.
5. What are the unique properties of 2D materials such as graphene and MoS2? How are they utilized in semiconductor devices?
6. Explain the concept of optical metamaterials and their role in manipulating light at the nanoscale.

Unit V: MULTISTAGE AMPLIFIERS AND HIGH-FREQUENCY BEHAVIOR

Essay Questions:

1. Discuss the behavior of BJTs (Bipolar Junction Transistors) at high frequencies. Explain the factors affecting high-frequency response and their implications in amplifier design.
2. Describe the frequency response of RC coupled amplifiers and transformer-coupled amplifiers. What are the advantages and limitations of each type?
3. Explain the design and operation of multistage amplifiers. How do they improve overall gain and bandwidth compared to single-stage amplifiers?

Short Questions:

1. How does the frequency response of a BJT amplifier change at high frequencies? What mechanisms contribute to this change?
2. Compare the frequency response of RC coupled and transformer-coupled amplifiers.
3. Describe the concept of multistage amplification. How are multiple stages interconnected to achieve high gain and bandwidth?
4. Discuss the importance of bandwidth in amplifier design. How is it related to the overall performance of electronic systems?
5. Explain the role of feedback in improving the stability and linearity of amplifiers.
6. What are the key factors to consider when designing an amplifier for specific frequency ranges?

B.Sc. ELECTRONICS MINOR SYLLABUS UNDER CBCS
[W.E.F. AY 2023-24 Batch onwards]
Course Code: 24(ELE)N42

II Year B.Sc (Hons.)- ELECTRONICS MINOR

SEMESTER-IV COURSE 4: MICROPROCESSOR SYSTEMS

Theory Credits: 3 3 hrs/week

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	**Describe** the architecture and functional components of Intel 8085 and 8086 microprocessors, including CPU, ALU, register organization, and addressing modes.	**Level-5**
2.	**CO-2**	**Explain** the instruction set of Intel 8085 microprocessor, covering data transfer, logical operations, arithmetic computations, branching, and machine control instructions.	**Level-4**
3.	**CO-3**	**Develop** assembly language programs using Intel 8085 for basic operations such as addition, subtraction, multiplication, division, and tasks like finding the largest and smallest number in an array, and converting between BCD and ASCII formats.	**Level-5**
4.	**CO-4**	• **Design** and **implement** basic configurations of 8086 microprocessor in minimum and maximum modes, and manage interrupt priorities. Develop programs utilizing I/O interfaces including serial and parallel communication, programmable timers, keyboard, display, and DMA controller.	**Level-5**
5.	**CO-5**	**Evaluate** the architecture, organization, and programming model of ARM processors, focusing on 16/32 bit processors and ARM-based MCUs. Analyze the ARM instruction set and its application in embedded systems.	**Level-5**

UNIT -I:

CPU ARCHITECTURE *Introduction to Microprocessor, INTEL -8085(P)*

Architecture, CPU, ALU unit, Register organization, Address, data and control Buses. Pin configuration of 8085. Addressing modes 8086 Microprocessor: Architecture, Pin description. Instruction format, Instruction Execution timing, Addressing modes

UNIT -II:

8085 INSTRUCTION SET:

Data transfer Instruction, Logical Instructions, Arithmetic Instructions, Branch Instructions, Machine Control instructions.

UNIT -III:

ASSEMBLY LANGUAGE PROGRAMMING USING 8085, Programmes for Addition, Subtraction, Multiplication,Division, largest and smallest number in an array. BCD to ASCII and ASCII to BCD.

UNIT -IV:

BASIC 8086 CONFIGURATIONS – Minimum mode and Maximum Mode, Interrupt Priority Management I/O Interfaces: Serial Communication interfaces, Parallel Communication, Programmable Timers, Keyboard and display, DMA controller

UNIT -V: ARM PROCESSOR: Introduction to 16/32 bit processors, Arm architecture & organization, Arm based MCUs, Programming model, Instruction set.

TEXTBOOKS:

1. Microprocessor Architecture, Programming and Applications with the 8085 – Penram International Publishing, Mumbai.- Ramesh S. Gaonakar

2. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and Glenn SA Gibson
3. Microcontrollers Architecture Programming, Interfacing and System Design

   – Raj Kamal Chapter: 15.1, 15.2, 15.3, 15.4.1 5. 8086 and

   8088 Microprocessor by Tribel and avatar singh

REFERENCES:

1. Microprocessors and Interfacing – Douglas V.Hall
2. Microprocessor and Digital Systems – Douglas V. Hall
3. Advanced Microprocessors & Microcontrollers - B.P.Singh & Renu Singh – New Age
4. The Intel Microprocessors – Architecture, Programming and Interfacing – Bary B. Brey.
5. Arm Architecture reference manual –Arm ltd.

OUTCOMES:

- The student can gain good knowledge on microprocessor and implement in practical applications
- Design system using memory chips and peripheral chips for 16 bit 8086 microprocessor.
- Understand and devise techniques for faster execution of instructions, improve speed of operations and enhance performance of microprocessors.
- Understand multi core processor and its advantages
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Dr. V S KRISHNA GOVERNMENT DEGREE COLLEGE (A)
VISAKHAPATNAM
B.Sc. ELECTRONICS MINOR SYLLABUS UNDER CBCS
[W.E.F. AY 2023-24 Batch onwards]
Course Code: 24(ELE)N42P

II Year B.Sc (Hons.)- ELECTRONICS MINOR
SEMESTER-IV COURSE 4: MICROPROCESSOR SYSTEMS
Practical Credits: 1 2 hrs/week

List of Experiment

Programs using Intel 8085 /8086
1. Addition and Subtraction (8 bit and 16-bit) 2. Multiplication and Divition (8-bit)
3. Largest number in an array.
4. Smallest number in an array.
5. BCD to ASCII and ASCII to BCD .
6. Program To Convert Two Bcd Numbers In To Hex
7. Program To Convert Hex Number In To Bcd Number.
8. Program To Find The Square Root Of A Given Number.
9. Interfacing Experiments Using 8086 Microprocessor (Demo):
1. Traffic Light Controller
2. Elevator,
3. 7-Segment Display

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SEMESTER-IV COURSE 4: MICROPROCESSOR SYSTEMS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	1	2	3	3	3	3
CO 2	2	3	2	2	1	1	3	2	3	3
CO 3	3	2	1	2	2	2	3	3	3	3
CO 4	3	2	2	2	2	1	3	3	2	2
CO 5	3	3	1	1	1	2	2	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	3	2	3
CO 2	3	3	2	3	2
CO 3	3	3	3	2	3
CO 4	2	3	2	2	3
CO 5	3	2	3	3	3

Dr V.S.Krishna Govt. Degree College(A), Visakhapatnam
[W.E.F. AY 2023-24 Batch onwards]
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BLUE PRINT (:MICROPROCESSOR SYSTEMS)
IIB.Sc. (Hons.) ELECTRONICS- SEM-IV/Course : 4
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	CPU ARCHITECTURE	2	2	30
2.	II	8085 INSTRUCTION SET	2	2	30
3.	III	ASSEMBLY LANGUAGE PROGRAMMING USING 8085	2	2	30
4.	IV	BASIC 8086 CONFIGURATIONS	2	2	30
5.	V	ARM PROCESSOR	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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0891-2553262, https://www.drvskrishnagdc.edu.in

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(ELE)N42

II Year B.Sc (Hons.)- ELECTRONICS-MINOR
SEMESTER-IV COURSE 4: MICROPROCESSOR SYSTEMS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Explain the architecture of INTEL 8085 microprocessor?
   [OR]
   b) Describe the addressing modes supported by the INTEL 8086 microprocessor?

2. a) Discuss the various categories of instructions in the 8085 microprocessor instruction set?
   [OR]
   b) Explain the timing diagram for the execution of an instruction in the 8085 microprocessor?

3. a) Write assembly language programs for multiplication, and division using the 8085?
   [OR]
   b) Explain the process of finding the largest and smallest number in an array by using 8085?

4. a) Explain the interrupt priority management system in the INTEL 8086 microprocessor?
   [OR]
   b) Discuss the significance of programmable timers in microprocessor-based systems?

5. a) Compare and contrast 16-bit and 32-bit ARM processors in terms of architecture?
   [OR]
   b) Discuss the instruction set architecture (ISA) of ARM processors?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) Define the components of the CPU architecture in a microprocessor?
7. a) Explain the pin configuration of INTEL 8085 microprocessor?
8. a) What are the different types of data transfer instructions in the 8085?
9. a) Explain the purpose and usage of branch instructions in the 8085?
10. a) Write the addition and subtraction operations in assembly language using the 8085?
11. a) What are BCD and ASCII representations?
12. a) Explain how interrupt handling is managed in the 8086 microprocessor?
13. a) What role do DMA controllers play in enhancing the efficiency of data transfer in 8086?
14. a) What distinguishes ARM processors from other microprocessor architectures?
15. a) How does ARM processor architecture support scalability in embedded systems?

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SEMESTER-IV COURSE 4: MICROPROCESSOR SYSTEMS
QUESTION BANK

UNIT - I: CPU ARCHITECTURE

Essay Questions:

1. Explain the architecture of INTEL 8085 microprocessor. Discuss its CPU, ALU unit, Register organization, and the roles of Address, Data, and Control Buses.
2. Describe the addressing modes supported by the INTEL 8086 microprocessor. How do these modes influence the flexibility and efficiency of programming?
3. Compare and contrast the pin configuration and instruction execution timing between INTEL 8085 and INTEL 8086 microprocessors.

Short Questions:

1. Define the components of the CPU architecture in a microprocessor.
2. Explain the role and function of the Arithmetic Logic Unit (ALU) in a microprocessor.
3. What are the different types of addressing modes used in microprocessors?
4. Discuss the significance of Address, Data, and Control Buses in microprocessor communication.
5. List and briefly explain the pin configuration of INTEL 8085 microprocessor.
6. How does the instruction format of INTEL 8086 microprocessor influence its operation?

UNIT - II: 8085 INSTRUCTION SET

Essay Questions:

1. Discuss the various categories of instructions in the 8085 microprocessor instruction set. Provide examples and explain their significance in programming.
2. Explain the timing diagram for the execution of an instruction in the 8085 microprocessor. How does timing affect the performance of the processor?
3. How are machine control instructions used in the 8085 microprocessor? Provide examples and discuss their role in program control.

Short Questions:

1. What are the different types of data transfer instructions in the 8085 microprocessor?
2. Describe the logical instructions available in the 8085 microprocessor instruction set.
3. Provide examples of arithmetic instructions in the 8085 microprocessor and explain their operation.
4. Explain the purpose and usage of branch instructions in the 8085 microprocessor.
5. How do machine control instructions differ from data transfer and arithmetic instructions?
6. Discuss the role of the instruction set in determining the capabilities of a microprocessor.

UNIT - III: ASSEMBLY LANGUAGE PROGRAMMING USING 8085

Essay Questions:

1. Write assembly language programs for addition, subtraction, multiplication, and division using the 8085 microprocessor. Discuss the steps involved in programming each operation.
2. Explain the process of finding the largest and smallest number in an array using assembly language programming with the 8085 microprocessor.
3. Discuss the conversion processes between BCD (Binary Coded Decimal) and ASCII (American Standard Code for Information Interchange) using assembly language programming with the 8085 microprocessor.

Short Questions:

1. How are addition and subtraction operations implemented in assembly language using the 8085 microprocessor?
2. Describe the multiplication and division algorithms typically used in assembly language programming for the 8085 microprocessor.
3. Explain the method to find the largest and smallest number in an array using assembly language.
4. What are BCD and ASCII representations, and how do they differ in terms of data encoding?
5. Discuss the significance of BCD to ASCII and ASCII to BCD conversions in microprocessor applications.
6. How does assembly language programming differ from high-level language programming?

UNIT - IV: BASIC 8086 CONFIGURATIONS AND I/O INTERFACES

Essay Questions:

1. Differentiate between Minimum Mode and Maximum Mode configurations of the INTEL 8086 microprocessor. Discuss their respective advantages and applications.
2. Explain the interrupt priority management system in the INTEL 8086 microprocessor. How are interrupts prioritized and handled during program execution?
3. Discuss the role and functionality of various I/O interfaces such as serial communication interfaces, parallel communication, programmable timers, keyboard and display controllers, and DMA controllers in the context of microprocessor-based systems.

Short Questions:

1. What are the key differences between Minimum Mode and Maximum Mode configurations in the 8086 microprocessor?
2. Explain how interrupt handling is managed in the 8086 microprocessor.
3. Describe the purpose and operation of serial communication interfaces in microprocessor systems.
4. How does parallel communication interface with microprocessors differ from serial communication?
5. Discuss the significance of programmable timers in microprocessor-based systems.
6. What role do DMA controllers play in enhancing the efficiency of data transfer in microprocessor systems?

UNIT - V: ARM PROCESSOR

Essay Questions:

1. Compare and contrast 16-bit and 32-bit ARM processors in terms of architecture, organization, and application domains. Discuss their advantages and disadvantages.
2. Explain the architecture and organization of ARM-based MCUs (Microcontroller Units). How do they differ from traditional ARM processors?
3. Discuss the programming model and instruction set architecture (ISA) of ARM processors. How does ARM ISA support both high-level and low-level programming paradigms?

Short Questions:

1. What distinguishes ARM processors from other microprocessor architectures?
2. Describe the typical architecture of ARM-based MCUs and their targeted applications.
3. How does the ARM instruction set architecture facilitate efficient program execution?
4. Compare the advantages of 16-bit and 32-bit ARM processors in embedded system applications.
5. Discuss the impact of ARM architecture on the development of mobile computing devices.
6. How does ARM processor architecture support scalability and versatility in embedded systems?

Multidisciplinary Course

SEMESTER-III

Basic Electronics Course Code 24BELD34

Credits: 2 2 hrs/week

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand the fundamental concepts of voltage, current, and resistance, and apply Ohm's Law in analyzing series and parallel circuits. Demonstrate the ability to use digital multimeters and recognize the importance of electrical safety in basic house wiring and protection systems.	Level 3 (Applying)
CO 2	Classify solids based on electrical conductivity and differentiate between intrinsic and extrinsic semiconductors. Explain the working principles, advantages, and applications of vacuum tubes, diodes, transistors, ICs, and relays, and understand the role of transducers and sensors in electronic systems.	Level 3 (Applying)
CO 3	Comprehend the basics of communication systems, including the functions of transmitters, receivers, and channels. Analyze the significance of modulation and demodulation processes and the role of daily electronic devices in modern communication, emphasizing energy efficiency in electrical appliances.	Level 6 (Creation)

UNIT-I: (10 hrs)

Brief History of Electronics, Overview of Atom and its particles, Voltage, Current & Resistance. Ohms Law, Series and Parallel Circuits, Short and Open circuit. Usage of Digital multimeter.

Power Sources: DC and AC, Electrical energy, consumption of electrical power, Kilowatt hour (KWh). Batteries: How to Choose a Battery, types, lead acid batteries, Nickel – Cadmium, Lithium – Ion & Solar cell.

Identifying Phase, Neutral and Earth on power sockets, Electric tester, First aid for electric shock. Basics of House wiring, Overloading, electrical circuit protection using Fuses, MCBs, earthing and its necessity, awareness of electrical safety tools.

UNIT-II: (10 hrs)

Classification of solids according to electrical conductivity (Conductor, Semiconductor & Insulator). Intrinsic & Extrinsic Semiconductors. Vacuum Tubes, Diodes, Transistors, ICs & Relays: advantages, disadvantages, applications, and their uses.

Transducers and Sensors: Advantages, various parts, types, and applications, LED, IR LED, Photo Resistor & Photodiode (Symbol & applications of each)

DC Regulated Power Supply, IC Voltage Regulators, UPS

Home Appliances: Electric geyser, micro wave oven and refrigerator

UNIT-III: (10 hrs)

Basics of Communication Systems: Transmitter, Receiver, Channel i) wired channels ii) wireless channels, Modulation, Demodulation.

Daily usage of Electronic Devices include: Mobile phones, Digital Camera, audio & video systems, TV (Television), Computer, Laptop, LED lights, GPS, iPod and Tablets, Wi-Fi and Internet. Importance of energy efficiency in electrical appliances.

Electronics in different fields: Information processing, Medicine and research, Computers and other electronic instruments, Automation.

Resource Material

(1) Electrical technology by V.K. Mehta & Rohit Mehta (S. Chand & Company Pubs.)

(2) Few references from Wikipedia free Encyclopedia.

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1- Low, 2- Moderate, 3- High, '-' No Correlation

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CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2

Multidisciplinary Course

SEMESTER-III

Basic Electronics Course Code 24BELD34

Question Bank

UNIT-I: (10 hrs)

Long Answer Questions:

1. **Describe the historical development of electronics and discuss the significance of Ohm's Law in understanding the relationship between voltage, current, and resistance in electrical circuits.**
2. **Explain the different types of batteries, including lead-acid, Nickel-Cadmium, Lithium-Ion, and Solar cells. Discuss how to choose a battery for specific applications and the factors that influence this choice.**
3. **Discuss the basics of house wiring, including the importance of identifying phase, neutral, and earth on power sockets, the role of electrical safety tools, and the necessity of earthing. Also, explain the protection mechanisms like fuses and MCBs against overloading.**

Short Answer Questions:

1. **What are the key differences between series and parallel circuits? Provide examples where each type of circuit might be used.**
2. **How does a digital multimeter work, and what are its primary uses in measuring electrical quantities?**
3. **Explain the concept of Kilowatt-hour (KWh) and its significance in measuring electrical energy consumption.**

UNIT-II: (10 hrs)

Long Answer Questions:

1. **Compare and contrast intrinsic and extrinsic semiconductors. Discuss the role of doping in modifying the electrical properties of semiconductors.**
2. **Explain the working principles, advantages, disadvantages, and applications of Vacuum Tubes, Diodes, Transistors, ICs, and Relays in electronic circuits.**

3. **Describe the different types of transducers and sensors, including LED, IR LED, Photo Resistor, and Photodiode. Discuss their symbols, working principles, and applications in modern electronics.**

Short Answer Questions:

1. **What are the main differences between conductors, semiconductors, and insulators based on their electrical conductivity?**
2. **Discuss the role of a DC regulated power supply and IC voltage regulators in electronic circuits.**
3. **Briefly explain the working of home appliances like electric geysers, microwave ovens, and refrigerators.**

UNIT-III: (10 hrs)

Long Answer Questions:

1. **Describe the basic components of a communication system, including the transmitter, receiver, and channel. Explain the differences between wired and wireless channels, and the processes of modulation and demodulation.**
2. **Discuss the daily usage of electronic devices such as mobile phones, digital cameras, audio & video systems, and LED lights. How has the evolution of these devices impacted modern life?**
3. **Examine the role of electronics in various fields such as information processing, medicine, research, and automation. Provide examples of how electronic instruments and computers are used in these fields.**

Short Answer Questions:

1. **What is the importance of energy efficiency in electrical appliances, and how can it be achieved?**
2. **Explain the significance of GPS, Wi-Fi, and the Internet in modern communication systems.**
3. **What are the primary functions of modulation and demodulation in a communication system?**

Multidisciplinary Course

SEMESTER-III

Basic Electronics Course Code 24BELD34
Model Paper
Section A (3x10=30)

Answer any THREE of the following questions.

1. **Describe the historical development of electronics and discuss the significance of Ohm's Law in understanding the relationship between voltage, current, and resistance in electrical circuits.**
2. **Explain the different types of batteries, including lead-acid, Nickel-Cadmium, Lithium-Ion, and Solar cells.**
3. **Compare and contrast intrinsic and extrinsic semiconductors. Discuss the role of doping in modifying the electrical properties of semiconductors.**
4. **Explain the working principles, advantages, disadvantages, and applications of Diodes, Transistors, ICs, and Relays in electronic circuits.**
5. **Discuss the daily usage of electronic devices such as mobile phones, digital cameras, audio & video systems, and LED lights.**
6. **Examine the role of electronics in various fields such as information processing, medicine, research, and automation.**

Section B (4x5=20)

Answer any FOUR of the following.

7. **What are the key differences between series and parallel circuits? Provide examples where each type of circuit might be used.**
8. **How does a digital multimeter work, and what are its primary uses in measuring electrical quantities?**
9. **Discuss the role of a DC regulated power supply and IC voltage regulators in electronic circuits.**
10. **Briefly explain the working of home appliances like electric geysers, microwave ovens, and refrigerators.**
11. **Explain the significance of GPS, Wi-Fi, and the Internet in modern communication systems.**
12. **What are the primary functions of modulation and demodulation in a communication system?**