AURORA'S TECHNOLOGICAL & RESEARCH INSTITUTE

(Approved by AICTE and Affiliated to JNTUH) (Accredited by NAAC with 'A' Grade)
Parvathapur, Uppal, Medipally (M), Medchal (D), Telangana, Hyderabad - 500 098

STUDENT HAND BOOK

ELECTRONICS AND COMMUNICATIONS ENGINEERING

III B. TECH – 2020-21

SECTION – A

Aurora’s Technological and Research Institute

ABOUT COLLEGE

Aurora's Technological and Research Institute, Hyderabad, a premier engineering college in the country, since its establishment in 1999, has been carrying forward the legacy of Aurora's quality education. Aurora Consortium was founded in 1989 by Dr. Ramesh B Nimmatoori, a young postgraduate in Computer Science.

Aurora’s Technological and Research Institute (formerly known as Karshak Engineering College) is one of the eight engineering colleges under the umbrella of the Aurora group of Institutions. It was established under the aegis of the Karshak Vidya Parishad in the year 1999 in Kamareddy, Nizamabad district and now functions at its permanent location at Parvathapur, Uppal (post), Ranga Reddy District. ATRI is affiliated to the Jawaharlal Nehru Technological University, Hyderabad and is approved by the All India Council for Technical Education, New Delhi. ATRI is also accredited by National Assessment and Accreditation Council with ‘A’ Grade, New Delhi, which substantiates the high standards of excellence that the institution has set itself.

The institute offers B.Tech courses in 7 streams viz; Computer Science and Engineering, Computer Science and Engineering (Artificial Intelligence and Machine Learning), Electronics and Communication Engineering, Information Technology, Electrical and Electronics Engineering, Mechanical Engineering and Civil Engineering. M.Tech. courses are offered in 2 specializations: Computer Science and Engineering and Structural Engineering.

ATRI Vision, Mission, Quality Policy & Core Values

Vision

ATRI seeks to be a center of higher learning that can provide the best learning experience, the most productive learning community, and the most creative learning environment in engineering education and to be recognized as one of the best engineering colleges in India.

Mission

To provide excellent education in Engineering and Technology.
To create environment for quality research and dissemination of knowledge.
To develop entrepreneurship and managerial abilities through world-class engineering and management education.

Quality Policy

To strive for providing uncompromised and complete education preparing every student for the future.

Institutional Core Values

Academic Excellence

ATRI strives for the uncompromising quality and excellence in Teaching, Learning, Research across various disciplines.

Integrity, Diversity and Leadership Development

ATRI respects and encourages Integrity and Diversity among students, faculty members and staff, fostering value-based leadership in all their actions.

Innovation and Creativity

ATRI promotes Creativity, Challenge the boundaries of knowledge & inculcate the spirit of innovate thinking through multidisciplinary functions.

Governance

ATRI encourages participative decision making through a Collaborative Consultation, Diverse Involvement and Collective Deliberation of all the stakeholders.

Social and Environmental Responsibility

ATRI serves the community through its various out reach activities and embraces the need for sustainable development.

Equity and Cohesive Environment

ATRI facilitates cohesive environment and team building inside and outside the classrooms. promoting equity irrespective of their social background

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT PROFILE

The department of ECE was started in 1999 with an intake of 60. Presently running with 240 intake for B.Tech course. The department has a team of well experienced, dynamic and highly qualified faculty. In order to disseminate knowledge, the department has been organizing a good number of Guest Lectures, Workshops and encouraging Industry interaction Oriented Programs for the students. To provide practical training to the students, the department has set up many laboratories in various areas of Electronics and Communication Engineering with state– of-the- art equipment and latest versions of software.

The department consists of Electronic Devices and Circuits Lab , Basic Simulation Lab, Digital Signal Processing Lab, IC Applications Lab, Analog and Digital Communication Lab , E-CAD& VLSI lab, Digital Signal Processing Lab, Microprocessor & Micro Controller Lab, Microwave and Optical Communications Lab.

The department has professional bodies like IETE, ISTE where regular activities are being conducted.

Vision & Mission

Vision

The department of ECE envisions to produce innovative, creative and ethically trained engineers with a focus to meet global challenges in Electronics and Communication Engineering.

Mission

To empower the graduates with sufficient technical knowledge to excel in research and development activities in Electronics and Communication Engineering.

To develop design competency in ECE and also to provide cost effective and eco friendly digital solutions.

To enhance career and self-employment opportunities through continuous sharing of knowledge and practical experience with industry.

Course Objective

The main objective of this course is to produce talented engineers in the field of Electronics and Communication Engineering. Emphasis on teaching design, testing and implementation of electronic circuits required for communication related areas. Students are taught the applications of electronics in the field of communication systems, computer engineering, radar engineering, satellite communication etc. FPGA advantage software, supposed to the best and adapted worldwide, is used. Modern methods of electronic communication like Optical Communications, FSK, PSK, MSK, and DPSK -are tested using the best modules.

Program Specific Outcomes (PSO's)

PSO 1: Professional Skills: An ability to apply concepts in Electronics & Communication Engineering to design and implement complex systems in the areas related to Analog and Digital Electronics, Communication, Signal processing, VLSI and Embedded systems.

PSO 2: Competitive Skills: An ability to make use of acquired technical knowledge for successful career and
qualifying in competitive examinations at the National
and Global levels.

Program Educational Objectives (PEO's)

PEO 1 - Professionalism & Citizenship
The first and foremost objective defined is to inculcate professionalism and citizen ship to each individual who are part of the program.
PEO 2 - Technical Accomplishments
To provide knowledge as per the Government & Industrial development plans and thrust areas considering reports and projections of AICTE, HRD etc. on industrial developments and requirements.
PEO 3: Invention, Innovation, and Creativity
Preparing students to solve complex engineering problems, which require idea about inventing, innovation and creativity.
PEO 4: Professional Development
Preparing the students to become a successful entrepreneur who can meet the societal needs.
PEO 5: Human Resource development
Preparing the students who can bring quality and cost conscious products and develop systems meeting international standards.

Program Outcomes (PO's)

PO a: An ability to apply knowledge of mathematics, science and engineering
PO b: An ability to design and conduct experiments, as well as to analyze and interpret data including hardware and software components.
PO c: An ability to design a complex electronic system or process to meet desired needs
PO d: An ability to function on multi-disciplinary
PO e: An ability to identify, formulate, and solve engineering problems
PO f: An understanding of professional and ethical responsibility
PO g: An ability to communicate effectively
PO h: The broad education necessary to understand the impact of engineering solutions in a global and societal context

PO i : A recognition of the need for, and an ability to engage in, life-long learning
PO j: A knowledge of contemporary issues
PO k: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
PO l : An ability to setup an entrepreneurship.
PO m: An ability to apply knowledge of advance mathematics (including probability, statistics and discrete mathematics) and engineering Advance mathematics will help the graduates to analyze and solve the complex engineering problems.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CLASS TIME TABLE – II SEM 2020-2021

ECE- IIIA **w.e.f : 22/3/2021**

	9:20-10:10	10:10-11:00	11:00-11:50	11:50-12:40	12:40-1:10	1:10-2:00	2:00-2:50	2:50-3:40	3:40-4:30
MON	AI	ES	A&P	FOME	**LUNCH BREAK**	DSP		VLSI D	ESD
TUE	DSP	A&P		FOME		DSP LAB		ES	SPORTS
WED	ES	VLSI D	DSP	ESD		e-CAD LAB		AI	SPORTS
THU	VLSI D	FOME	DSP	ESD		A&P		LIB	SPORTS
FRI	VLSI D		AI	LIB		SL LAB		ESD	
SAT	EXTRACURRICULAR ACTIVITIES					EXTRACURRICULAR ACTIVITIES			

Subject	Faculty Name
A&P	Ms.Nuzhath Farhana
DSP	MS.T.Jyothsna
VLSI Design	Ms.K.Sirisha
ESD (PE-II)	Mr.Md.Nizamuddin Salman
FOME (OE-I)	Ms.E.Navya Sri
AI	Ms.G.Anitha
ES	Mr.D.Ugender
DSP LAB	MS.T.Jyothsna/Mr.D.Raju
e – CAD LAB	Ms.K.Sirisha/Ms.G.Mahalaxmi
SL LAB	Ms.S.Sowmya
Class Teacher	MS.T.Jyothsna

CALENDAR

Week 1

22.03.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 1
2	ES	Lecture 1
3	A&P	Lecture 1
4	FOME	Lecture 1
5	DSP	Lecture 1,2
6	VLSID	Lecture 1
7	ESD	Lecture 1

23.03.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 3
2	A&P	Lecture 2,3
3	FOME	Lecture 2
4	DSP Lab	Lab session 1
5	ES	Lecture 2
6	Sports	-

24.03.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 3
2	VLSID	Lecture 2
3	DSP	Lecture 4
4	ESD	Lecture 2
5	e-CAD Lab	Lab session 1
6	AI	Lecture 2
7	Sports	-

25.03.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 3
2	FOME	Lecture 3
3	DSP	Lecture 5
4	ESD	Lecture 3
5	A&P	Lecture 4,5
6	LIB	-
7	Sports	-

26.03.2021 – Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 4,5
2	AI	Lecture 3
3	LIB	-
4	SL Lab	Lab Session 1
5	ESD	Lecture 4,5

Week 2

29.03.2021– Monday

Holiday - Holi

30.03.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 6
2	A&P	Lecture 6,7
3	FOME	Lecture 4
4	DSP Lab	Lab session 2
5	ES	Lecture 4
6	Sports	-

31.03.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 5
2	VLSID	Lecture 6
3	DSP	Lecture 7
4	ESD	Lecture 6
5	e-CAD Lab	Lab session 2
6	AI	Lecture 4
7	Sports	-

01.04.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 7
2	FOME	Lecture 5
3	DSP	Lecture 8
4	ESD	Lecture 7
5	A&P	Lecture 8,9
6	LIB	-
7	Sports	-

02.04.2021 – Friday

Holiday – Good Friday

Week 3

05.04.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 5
2	ES	Lecture 6
3	A&P	Lecture 10
4	FOME	Lecture 6 **(Unit-1 Completed)**
5	DSP	Lecture 9,10
6	VLSID	Lecture 8
7	ESD	Lecture 8

06.04.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 11
2	A&P	Lecture 11,12
3	FOME	Lecture 7
4	DSP Lab	Lab session 3
5	ES	Lecture 7
6	Sports	-

07.04.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 8
2	VLSID	Lecture 9
3	DSP	Lecture 12
4	ESD	Lecture 9
5	e-CAD Lab	Lab session 3
6	AI	Lecture 6
7	Sports	-

08.04.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 10
2	FOME	Lecture 8
3	DSP	Lecture 13
4	ESD	Lecture 10
5	A&P	Lecture 13,14
6	LIB	-
7	Sports	-

09.04.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 11,12
2	AI	Lecture 7
3	LIB	-
4	SL Lab	Lab Session 2
5	ESD	Lecture 11,12

Week 4

12.04.2021– Monday

Holiday – Ramzan Starts

13.04.2021– Tuesday

Holiday – Ugadi

14.04.2021– Wednesday

Holiday – Ambedkar Jayanthi

15.04.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 13
2	FOME	Lecture 9
3	DSP	Lecture 14
4	ESD	Lecture 13 **(Unit-1 Completed)**
5	A&P	Lecture 15,16
6	LIB	-
7	Sports	-

16.04.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 14,15 **(Unit-1 Completed)**
2	AI	Lecture 8 **(Unit-1 Completed)**
3	LIB	-
4	SL Lab	Lab Session 3
5	ESD	Lecture 14,15

Week 5

19.04.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 9
2	ES	Lecture 9
3	A&P	Lecture 17**(Unit-1 Completed)**
4	FOME	Lecture 10
5	DSP	Lecture 15,16 **(Unit-1 Completed)**
6	VLSID	Lecture 16
7	ESD	Lecture 16

20.04.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 17
2	A&P	Lecture 18,19
3	FOME	Lecture 11
4	DSP Lab	Lab session 4
5	ES	Lecture 10
6	Sports	-

21.04.2021– Wednesday

Holiday – Sri Rama Navami

22.04.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 17
2	FOME	Lecture 12
3	DSP	Lecture 18
4	ESD	Lecture 17
5	A&P	Lecture 20,21
6	LIB	-
7	Sports	-

23.04.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 18,19
2	AI	Lecture 10
3	LIB	-
4	SL Lab	Lab Session 4
5	ESD	Lecture 18,19

Week 6

26.04.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 11
2	ES	Lecture 11
3	A&P	Lecture 22
4	FOME	Lecture 13
5	DSP	Lecture 19,20
6	VLSID	Lecture 20
7	ESD	Lecture 20

27.04.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 21
2	A&P	Lecture 23,24
3	FOME	Lecture 14
4	DSP Lab	Lab session 5
5	ES	Lecture 12
6	Sports	-

28.04.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 13
2	VLSID	Lecture 21
3	DSP	Lecture 22
4	ESD	Lecture 21
5	e-CAD Lab	Lab session 4
6	AI	Lecture 12
7	Sports	-

29.04.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 22
2	FOME	Lecture 15
3	DSP	Lecture 23
4	ESD	Lecture 22
5	A&P	Lecture 25,26
6	LIB	-
7	Sports	-

30.04.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 23,24
2	AI	Lecture 13
3	LIB	-
4	SL Lab	Lab Session 5
5	ESD	Lecture 23,24

Week 7

03.05.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 14 **(Unit-2 Completed)**
2	ES	Lecture 14
3	A&P	Lecture 27
4	FOME	Lecture 16
5	DSP	Lecture 24,25
6	VLSID	Lecture 25
7	ESD	Lecture 25**(Unit-2 Completed)**

04.05.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 26
2	A&P	Lecture 28,29**(Unit-2 Completed)**
3	FOME	Lecture 17
4	DSP Lab	Lab session 6
5	ES	Lecture 15
6	Sports	-

05.05.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 16
2	VLSID	Lecture 26
3	DSP	Lecture 27
4	ESD	Lecture 26
5	e-CAD Lab	Lab session 5
6	AI	Lecture 15
7	Sports	-

06.05.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 27
2	FOME	Lecture 18 **(Unit-2 Completed)**
3	DSP	Lecture 28**(Unit-2 Completed)**
4	ESD	Lecture 27
5	A&P	Lecture 30,31
6	LIB	-
7	Sports	-

07.05.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 28,29 **(Unit-2 Completed)**
2	AI	Lecture 16
3	LIB	-
4	SL Lab	Lab Session 6
5	ESD	Lecture 28,29

Week 8

10.05.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 17
2	ES	Lecture 17
3	A&P	Lecture 32
4	FOME	Lecture 19
5	DSP	Lecture 29,30
6	VLSID	Lecture 30
7	ESD	Lecture 30

11.05.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 31
2	A&P	Lecture 33,34
3	FOME	Lecture 20
4	DSP Lab	Lab session 7
5	ES	Lecture 18
6	Sports	-

12.05.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 19
2	VLSID	Lecture 31
3	DSP	Lecture 32
4	ESD	Lecture 31
5	e-CAD Lab	Lab session 6
6	AI	Lecture 18
7	Sports	-

13.05.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 32
2	FOME	Lecture 21
3	DSP	Lecture 33
4	ESD	Lecture 32 **(Unit-3 Completed)**
5	A&P	Lecture 35,36
6	LIB	-
7	Sports	-

14.05.2021– Friday

Holiday – Eidul Fitar

17.05.2021 - 29.05.2021

Summer Vacation

31.05.2021 – 05.06.2021

I Mid Term Examination

Week 9

07.06.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 19
2	ES	Lecture 20
3	A&P	Lecture 37
4	FOME	Lecture 22
5	DSP	Lecture 34,35
6	VLSID	Lecture 33
7	ESD	Lecture 33

08.06.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 36
2	A&P	Lecture 38,39
3	FOME	Lecture 23
4	DSP Lab	Lab session 8
5	ES	Lecture 21
6	Sports	-

09.06.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 22
2	VLSID	Lecture 34
3	DSP	Lecture 37
4	ESD	Lecture 34
5	e-CAD Lab	Lab session 7
6	AI	Lecture 20 **(Unit-3 Completed)**
7	Sports	-

10.06.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 35
2	FOME	Lecture 24
3	DSP	Lecture 38
4	ESD	Lecture 35
5	A&P	Lecture 40,41 **(Unit-3 Completed)**
6	LIB	-
7	Sports	-

11.06.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 36,37
2	AI	Lecture 21
3	LIB	-
4	SL Lab	Lab Session 7
5	ESD	Lecture 36,37

Week 10

14.06.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 22
2	ES	Lecture 23
3	A&P	Lecture 42
4	FOME	Lecture 25
5	DSP	Lecture 39,40
6	VLSID	Lecture 38 **(Unit-3 Completed)**
7	ESD	Lecture 38

15.06.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 41
2	A&P	Lecture 43,44
3	FOME	Lecture 26
4	DSP Lab	Lab session 9
5	ES	Lecture 24
6	Sports	-

16.06.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 25
2	VLSID	Lecture 39
3	DSP	Lecture 42 **(Unit-3 Completed)**
4	ESD	Lecture 39
5	e-CAD Lab	Lab session 8
6	AI	Lecture 23
7	Sports	-

17.06.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 40
2	FOME	Lecture 27
3	DSP	Lecture 43
4	ESD	Lecture 40
5	A&P	Lecture 45,46
6	LIB	-
7	Sports	-

18.06.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 41,42
2	AI	Lecture 24
3	LIB	-
4	SL Lab	Lab Session 8
5	ESD	Lecture 41,42

Week 11

21.06.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 25
2	ES	Lecture 26
3	A&P	Lecture 47
4	FOME	Lecture 28
5	DSP	Lecture 44,45
6	VLSID	Lecture 43
7	ESD	Lecture 43

22.06.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 46
2	A&P	Lecture 48,49**(Unit-4 Completed)**
3	FOME	Lecture 28
4	DSP Lab	Lab session 10
5	ES	Lecture 27
6	Sports	-

23.06.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 28
2	VLSID	Lecture 44
3	DSP	Lecture 47 **(Unit-4 Completed)**
4	ESD	Lecture 44 **(Unit-4 Completed)**
5	e-CAD Lab	Lab session 9
6	AI	Lecture 26
7	Sports	-

24.06.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 45
2	FOME	Lecture 29
3	DSP	Lecture 48
4	ESD	Lecture 45
5	A&P	Lecture 50,51
6	LIB	-
7	Sports	-

25.06.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 46,47 **(Unit-4 Completed)**
2	AI	Lecture 27
3	LIB	-
4	SL Lab	Lab Session 9
5	ESD	Lecture 46,47

Week 12

28.06.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 28 **(Unit-4 Completed)**
2	ES	Lecture 29
3	A&P	Lecture 52
4	FOME	Lecture 30
5	DSP	Lecture 49,50
6	VLSID	Lecture 48
7	ESD	Lecture 48

29.06.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 51
2	A&P	Lecture 53,54
3	FOME	Lecture 31 **(Unit-3 Completed)**
4	DSP Lab	Lab session 11
5	ES	Lecture 30
6	Sports	-

30.06.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 31
2	VLSID	Lecture 49
3	DSP	Lecture 52
4	ESD	Lecture 49
5	e-CAD Lab	Lab session 10
6	AI	Lecture 29
7	Sports	-

01.07.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 50
2	FOME	Lecture 32
3	DSP	Lecture 53
4	ESD	Lecture 50
5	A&P	Lecture 55,56
6	LIB	-
7	Sports	-

02.07.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 51,52
2	AI	Lecture 30
3	LIB	-
4	SL Lab	Lab Session 10
5	ESD	Lecture 51,52

Week 13

05.07.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 31
2	ES	Lecture 32
3	A&P	Lecture 57
4	FOME	Lecture 33
5	DSP	Lecture 54,55
6	VLSID	Lecture 53
7	ESD	Lecture 53

06.07.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 56
2	A&P	Lecture 58,59
3	FOME	Lecture 34
4	DSP Lab	Lab session 12
5	ES	Lecture 33
6	Sports	-

07.07.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 34
2	VLSID	Lecture 54
3	DSP	Lecture 57
4	ESD	Lecture 54
5	e-CAD Lab	Lab session 11
6	AI	Lecture 32
7	Sports	-

08.07.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 55
2	FOME	Lecture 35
3	DSP	Lecture 58
4	ESD	Lecture 55
5	A&P	Lecture 60,61
6	LIB	-
7	Sports	-

09.07.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 56,57
2	AI	Lecture 33
3	LIB	-
4	SL Lab	Lab Session 11
5	ESD	Lecture 56,57

Week 14

12.07.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 34
2	ES	Lecture 35
3	A&P	Lecture 62
4	FOME	Lecture 36 **(Unit-4 Completed)**
5	DSP	Lecture 59,60 **(Unit-5 Completed)**
6	VLSID	Lecture 58
7	ESD	Lecture 58

13.07.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 61
2	A&P	Lecture 63,64
3	FOME	Lecture 37
4	DSP Lab	Lab session 13
5	ES	Lecture 36
6	Sports	-

14.07.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 37
2	VLSID	Lecture 59
3	DSP	Lecture 62
4	ESD	Lecture 59
5	e-CAD Lab	Lab session 12
6	AI	Lecture 35
7	Sports	-

15.07.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 60
2	FOME	Lecture 38
3	DSP	Lecture 63
4	ESD	Lecture 60 **(Unit-5 Completed)**
5	A&P	Lecture 65,66 **(Unit-5 Completed)**
6	LIB	-
7	Sports	-

16.07.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 61,62
2	AI	Lecture 36
3	LIB	-
4	SL Lab	Lab Session 12
5	ESD	Lecture 61,62

Week 15

19.07.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 37 **(Unit-5 Completed)**
2	ES	Lecture 38
3	A&P	Lecture 67
4	FOME	Lecture 39
5	DSP	Lecture 64,65
6	VLSID	Lecture 63 **(Unit-5 Completed)**
7	ESD	Lecture 63

20.07.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 66
2	A&P	Lecture 68,69
3	FOME	Lecture 40
4	DSP Lab	Lab session 14
5	ES	Lecture 39
6	Sports	-

21.07.2021– Wednesday

Holiday - Bakrid

22.07.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 64
2	FOME	Lecture 41
3	DSP	Lecture 67
4	ESD	Lecture 64
5	A&P	Lecture 70,71
6	LIB	-
7	Sports	-

23.07.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 65,66
2	AI	Lecture 38
3	LIB	-
4	SL Lab	Lab Session 13
5	ESD	Lecture 65,66

Week 16

26.07.2021– Monday

S. No.	Subject	Lecture No
1	AI	Lecture 39
2	ES	Lecture 40
3	A&P	Lecture 72
4	FOME	Lecture 42 **(Unit-5 Completed)**
5	DSP	Lecture 68,69
6	VLSID	Lecture 67
7	ESD	Lecture 67

27.07.2021– Tuesday

S. No.	Subject	Lecture No
1	DSP	Lecture 70
2	A&P	Lecture 73,74
3	FOME	Lecture 43
4	DSP Lab	Lab session 15
5	ES	Lecture 41
6	Sports	-

28.07.2021– Wednesday

S. No.	Subject	Lecture No
1	ES	Lecture 42
2	VLSID	Lecture 68
3	DSP	Lecture 71
4	ESD	Lecture 68
5	e-CAD Lab	Lab session 13
6	AI	Lecture 40
7	Sports	-

29.07.2021– Thursday

S. No.	Subject	Lecture No
1	VLSID	Lecture 69
2	FOME	Lecture 44
3	DSP	Lecture 72
4	ESD	Lecture 69
5	A&P	Lecture 75,76
6	LIB	-
7	Sports	-

30.07.2021– Friday

S. No.	Subject	Lecture No
1	VLSID	Lecture 70,71
2	AI	Lecture 41
3	LIB	-
4	SL Lab	Lab Session 14
5	ESD	Lecture 70,71

02.08.2021 (Monday) - 07.08.2021 (Saturday)

II MID Examinations

09.08.2021 (Monday) - 14.08.2021 (Saturday)

Preparation Holidays & **Practical Examinations**

16.08.2021 (Monday) - 28.08.2021 (Saturday)

End Semester Examinations

ANTENNAS AND PROPAGATION

SYLLABUS

EC601PC: ANTENNAS AND PROPAGATION

B.Tech. III Year II Semester L T P C 3 1 4

Pre-requisite: Electromagnetic Theory and Transmission Lines

Course Objectives:

The course objectives are:

1. To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.

2. To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.

3. To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.

4. To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.

5. To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

Course Outcomes:

Upon completing this course, the student will be able to explain the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations.

1. Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF, UHF and Microwave antennas and also antenna arrays.

2. Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.

3. Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.

UNIT - I

Antenna Basics: Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

UNIT – II

Antenna Arrays: Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays. Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

UNIT - III:

VHF, UHF and Microwave Antennas - I: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat’s Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

UNIT - IV

VHF, UHF and Microwave Antennas - II: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip R18 B.Tech. ECE Syllabus JNTU HYDERABAD 74 Antennas.

Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

UNIT - V:

Wave Propagation - Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections. Space Wave Propagation –Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation. Sky Wave Propagation –Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

TEXT BOOKS:

1. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. 2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

REFERENCE BOOKS:

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.

2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.

3. Radio Engineering Handbook- Keith henney, 3rd edition TMH. 4. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007

SESSION PLAN

B.Tech III Year II Sem -ANTENNAS AND PROPAGATION - Session Plan - with ITL Methods

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
UNIT-1							
Antenna Basics							
1	22.03.2021	Introduction	Introduction to antenna and its types	Lecture	L1		T1 – 2.1 R2- 6.1
2	23.03.2021	Basic Antenna Parameters	Radiation Pattern	Seminar	L2	LG1	T1- 2.3 R2- 6.3
	23.03.2021		Beam area, Radiation intensity, Beam Efficiency	Lecture	L3		T1- 2.4 to 2.6 R2- 6.5, 6.6, 6.13
	25.03.2021		Gain-Directivity-Resolution	Lecture	L4		T1- 2.7 to 2.8 R2- 6.11
	25.03.2021		Antenna Aperture, Effective antenna height	Lecture	L5		T1- 2.9 to 2.10 R2- 6.14, 6.16
	30.03.2021		Illustrative problems	Lecture	L6		
3	30.03.2021	Fields from Oscillating Dipole, Front to Back Ratio, Antenna Field Zones	Propagation of Electric field, FBR ratio, Different Antenna regions	Lecture	L7		T1- 2.12, 2.21, 2.13
4	01.04..2021	Antenna Theorems	Different antenna theorems and its applications	Group Discussion	L8	LG2,LG3,LG4.LG5	T1- 2.22 R2- 6.17

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
5	01.04.2021	Radiation	Basic Maxwell's equations, Retarded potentilas-Helmholtz theorem	Lecture	L9		T1- 4.1 to 4.3
Thin Linear Wire Antennas							
6	05.04.2021	Short Electric Dipole	Current distributions, Field components	Lecture	L10		T1- 6.2 R2- 5.32
	06.04.2021		Radiation resistance, HPBW, Directivity, Antenna Aperture, Effective height, Beam area		L11		T1- 6.4 R2- 5.34
7	06.04.2021	Half Wave Dipole	Current distributions, Field components	Lecture	L12		T1- 4.6 R2- 8.10
	08.04.2021		Radiation resistance, HPBW, Directivity, Antenna Aperture, Effective height, Beam area		L13		T1- 6.6
8	08.04.2021	Quarter Wave Monopole	Current distributions, Field components, Measurement of different antenna parameters	Lecture	L14		T1- 6.7
9	15.04.2021	Natural current distribution, Far fields and patterns of Thin linear antennas	Current distribution , far field components and radiation pattern for different antenna of various lengths	Lecture	L15		T1- 6.5
10	15.04.2021	Loop Antennas	Introduction, Field		L16	LG6,LG7	T1- 7.1 to 7.2

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
			components of Small loop	Roleplay			
	19.04.2021		Radiation resistance, directivity		L17		T1- 7.7 to 7.8
	20.04.2021		Comparison of different types of antennas, illustrative problems		L18		T1- 7.3
UNIT-2							
Antenna Arrays andAntenna Measurements							
11	20.04.2021	Point sources	Introduction, Definition, Patterns	Lecture	L19		T1 – 5.1 to 5-3
	22.04.2021		Arrays of two isotropic point sources with different cases		L20		T1- 5.9
12	22.04.2021	Uniform Linear Arrays	Principle of Pattern Multiplication	Lecture	L21	LG8,LG9,LG10,LG 11	T1- 5.10
	26.04.2021		Introduction, applications, advantages	Lecture	L22		T1- 5.13
	27.04.2021		Broadside arrays	Lecture	L23		T1- 5.13 R2- 7.7
	27.04.2021		End Fire Arrays	Lecture	L24		T1- 5.13 R2- 7.8

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
	29.04.2021		EFA with increased directivity	Lecture	L25		T1- 5.13 R2- 7.9
	29.04.2021		Derivations of their Characteristics and Comparison	Lecture	L26		T1- 5.13
	03.05.2021		General considerations and Binomial arrays	Group Discussion	L27		T1- 5.15 R2- 7.13
	04.05.2021		Illustrative problems	Lecture	L28		
13	04.05.2021	Antenna Measurements	Introduction to antenna measurement, basic concepts	Lecture	L29	Lg2,LG13	T1- 21.1 to 21.2
	06.05.2021		Reciprocity	Lecture			T1- 21.2a
			Near and Far fields	Lecture			T1- 21.2b
			Coordinate system, Sources of errors	Case Study	L30		T1- 21.2c, T1- 21.3
			Patterns to be measured, Directivity measurement	Lecture			T1- 21.5a R2- 9.22, 9.29
UNIT-3							
VHF, UHF, Microwave antennas- I							
14	06.05.2021	Array with parasitic elements	Basic concepts, Dipole arrays with parasitic elements	Lecture	L31		T1 – 8.7

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
15	10.05.2021	Yagi- Uda array	Introduction, design and characteristics	Lecture	L32		T1- 8.8 R2- 9.3
	11.05.2021	Folded Dipoles and	Introduction, Impedance, Bandwidth compensation, Uses and advantages	Seminar	L33	LG14,LG15	T1-6-24 R2- 9.2
	11.05.2021 13.05.2021 13.05.2021		Helical geometry, Helix modes Design consideration for monofilar helical antennas in axial & normal modes		L34 L35 L36		T1- 8.4 to 8.5 R2- 9.6
	07.06.2021		Types, Fermat's principle, Optimum Horn		L37		T1- 7.19 R2- 9.7
16	08.06.2021 10.06.2021	Horn Antenna	Design considerations of pyramidal horns, Illustrative problems	Case study	L38-L40		T1- 7.19
UNIT-4							
VHF, UHF, Microwave antennas- II							
17	10.06.2021	Microstrip antennas	Introduction, Features, Advantages and Limitations	Seminar	L41	LG16	T1 – 14.1 to 14.3b
18	14.06.2021 15.06.2021	Rectangular Patch antennas	Geometry and Parameters, Characteristics of Microstrip antennas	Lecture	L42-L44		T1 – 14.4, T1 - 14.6
19	17.06.2021	Reflector antennas	Introduction, Flat sheet	Lecture	L45		T1 – 9.1 to 9.2

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
					L46-47		
	17.06.2021 21.06.2021		Corner reflector, Passive corner reflector, radiation patterns				T1 – 9.3 to 9.4 R2- 9.5
20	22.06.2021	Paraboloidal Reflectors	Geometry, Pattern Characteristics	Group Discussion	L48	LG17,LG18,LG19	T1 – 9.7 to 9.8 R2- 9.18
	22.06.2021		Feed methods, Reflector types		L49		T1 – 9.9 to 9.10
UNIT-5							
Wave Propagation							
21	24.06.2021	Introduction	Introduction, Definition , Classification, Different modes, Ray/Mode concepts	Lecture	L50		T1 – 22.1 to 22.8
22	24.06.2021	Ground Wave Propagation	Introduction, Plane Earth reflections	Lecture	L51		T1 – 23.1 to 23.2
	28.06.2021		Space and Surface waves, Wave Tilt		L52		T1 – 23.3 to 23.5
	29.06.2021		Curved earth reflections		L53		T1 – 23.10
23	29.06.2021	Space Wave Propagation	Introduction, Field Strength Relation	Lecture	L54		T1- 24.1 to 24.2
	01.07.2021		Effect of Earth's Curvature, Absorption		L55		T1- 24.4, 24.7 R2- 11.17
	01.07.2021		Super Refraction, M- Curves		L56		T1- 24.9

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
			and Duct Propagation				R2- 11.20
	05.07.2021		Scattering Phenomena, Tropospheric Propagation		L57		T1- 24.11 to 24.12
24	06.07.2021	Sky Wave Propagation	Introduction, Structure of Ionosphere	Seminar	L58	LG20	T1- 25.1 to 25.2 R2- 11.7
	06.07.2021		Refraction and Reflection of Sky waves by Ionosphere		L59		T1- 25.4
	08.07.2021		Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance		L60		T1- 25.5 R2- 11.12
	08.07.2021		Relation between MUF and Skip Distance, Multi- Hop Propagation		L61		T1- 25.6, 25.8

TEXTBOOKS:

1. Antennas and Wave Propagation- J. D. Kraus, R.J. Marhefka and Ahmad S. Khan, M.C. GRAW HILL EDUCATION, New Delhi, 4th ed., (Special Indian Edition), 2010.
2.Electromagnetic Waves and Radiating Systems- E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

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1. Antenna Theory- C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
2. Antennas and Wave Propagation- K.D. Prasad, SatyaPrakashan, Tech India Publications, New Delhi,
2001.

ASSIGNMENT QUESTIONS :

UNIT I :

1. Find the effective length of a l/2 antenna.

2. The maximum radiation intensity of a 90% efficiency antenna is 200mw/unit solid angle. Find the directivity and gain in dB when the
   i. Input is 125.66 mw
   ii. Radiated power is 125.66 mw

3. Write short notes on effective length of an antenna

4. Derive the relation between gain and radiating efficiency.

5. Write short notes on
   i. Radiation pattern
   ii. Beamwidth

6. Evaluate the directivity of
   i. An isotropic source, and
   ii. Source with bi-directional cos è power pattern.

7. i. Define and explain the significance of terms:Radiation intensity,Beam area,Beam efficiency, effective height and resolution.
   ii. A source has a constant power pattern limited to top half of the hemisphere only. find its directivity and effective area.

8. As related to antennas, define and explain the following terms:
   i. Gain
   ii. Directivity
   iii. Radiation resistance
   iv. Effective area
   v. Effective length
   vi. Wficiency
   vii. Beam width
   viii. Bandwidth.
9. Define gain and effective aperture of an antenna. Derive the relationship between the same. Determine the effective aperture of a dipole antenna.

10. i. Define and explain : Directivity and power gain for an antenna. What is the relation between the two? Prove that the directivity of a /2 aerial is 0.39dB more than that of a short dipole.
    ii. What are principal planes? How the antenna beamwidth are defined in such plane?

11. Explain the significance of principal planes in the description of radiation pattern of antennas. Hence define and distinguish between: Horizontal and vertical plane patterns, E and H plane patterns.

12. As related to antennas, define and explain the following terms:
    i. Gain
    ii. Directivity
    iii. Radiation resistance
    iv. Effective area
    v. Effective length
    vi. Efficiency
    vii. Beam width
    viii. Bandwidth

13. Estimate the total power radiated and evaluate the radiation resistance for
    i. A uniform, and
    ii. Triangular current distributions

14. What are short antennas? Estimate the radiation resistance of short dipoles and shot monopoles. Explain their current distributions wtith neat sketches.

15. i. Explain the terms with suitable sketches; radiation intensity,beam efficiency, directivity,gain and beam solid angle.
    ii. Show that the directivity of a small current element is 1.5

16. The average power of an omni directional antenna varies as the magnitude of cosq is the azimuthally angle. Calculate the maximum Directive Gain of the antenna and the angles at which it occurs.

17. An antenna has a power of 40 watts and an efficiency of 90%. The radiation intensity has been found to have a maximum value of 150 watts/unit solid angle. Determine:
    i. Directivity, and
    ii. Gain of the antenna in dB

18. i Explain effective area an effective aperture of an antenna. How it is related to directive gain compute the effective area of a half wave dipole.
    ii. Write a note on radiation pattern of antennas.

19. For a source with radiation intensity u = 6 Cosq , find the directivity and HPBW, when its pattern is uni directional.

20. i. Define and explain retarded potentials.
    ii. Starting from Maxwell's equations for time-varying fields, derive wave equations for scalar and vector potentials. What is Lorentz gauge condition?

UNIT II :

1. Explain the phenomena of traveling wave radiators.
2. Distinguish between standing wave and traveling wave antennas.
3. Derive the expressions for traveling wave antennas.
4. Explain v antennas.
5. Explain the designing of rhombic antenna from v antenna.
6. What is a helical antenna?
7. Describe the axial mode of helical antenna.
8. Draw the basic geometry of helical antenna.
9. What are the advantages of helical antenna.
10. Explain the traveling wave and standing wave current distribution.
11. Explain design considerations of rhombic.
12. Explain the significance of the following terms in a Rhombic antenna.
    i. Leg length and tilt angle
    ii. Effect of earth on its pattern.
    iii. Terminating resistance
13. Sketch the current distributions on a folded dipole, and account for its input impedance when the two legs have unequal diameters.
14. Compare the requirements and radiation characteristics of resonant radiators?
15. i. Explain the difference between driven and parasitic elements in an array.
    ii. "Most of the long wire antennas are resonant" state true or false and explain.
    iii. Explain the reasons why the lengths of a traveling wave radiator is multiple of half wave lengths.
16. Draw the sketch of a Rhombic antenna and write its applications.
17. What are the advantages and disadvantages of a travelling wave antenna.
18. Draw a neat sketch of Rhombic antenna . and explain its working.
19. What is an optimum horn? Draw a neat sketch of E-plane sectoral horn. Discuss the application and advantages of a horn **.**
20. What are the advantages of Rhombic antennas over a single wire antenna.

UNIT III :

1. Define broadside & end fire array.

2. Derive the expressions for HPBW for broad side array.

3. Derive the expressions for HPBW for end fire array.
4. What is an array.

5. What is a uniform linear array?

6. What is meant by pattern multiplication?

7. Obtain the resultant pattern for 8 element array.

8. Define directivity.

9. Compare broad side and end fire array.

10. What is tapering?

11. What are the advantages of arrays?

12. Why we require tapering?

13. What are the advantages of pattern multiplication?

14. What is meant by binomial array?

15. Advantages of binomial array over pattern multiplication.

16. What is the disadvantage of binomial array?

17. Obtain the resultant pattern for 4 element array.

18. i. A linear broad side array consists of four equal in phase point sources with l/3 spacing. Calculate and plot the field pattern. Also find directivity and beam width.
    ii. Distinguish between ordinary EFA and an EFA with increased directivity and compare them
19. For an array of two identical infinitesimal dipoles oriented with a separation od D and phase excitation difference of the array occur. The magnitude of excitation of the element is same.

20. i Sketch the radiation pattern of a two element array with l spacing, and a = 180°and fed with equal amplitudes. Derive the expression used.
    ii What are the conditions for obtaining a Hansen-Wood yard EFA? Describe its characteristics.

1. Explain the basic operation of TV antennas.

2. What is a folded dipole?

3. What is the role of folded dipole in yagi uda array?

4. What is radiation resistance?

5. What is meant by director and reflector?

6. What is meant by spill over?

7. What is meant by cassegranian feed?

8. What are the design considerations of parabolic reflector?

9. What are the types of feeds ?

10. Advantages and disadvantages of parabolic reflector.

11. Discuss about offset paraboloid.

12. Derive the f/d ratio.

13. What is meant by aperture blocking?

14. What is meant by offset feed?

15. Establish the voltage -current relations in the parasitic elements of a 3-element Yagi-Uda Array and acount for its Zin**.**

16. Evaluate the power gain directing and the required diameter of a paraboloid having a null beam width of 10 degrees at 3 GHz

17. With neat schamatics,describe the principle of working of a 3-element yagi antenna ,listing out its length and spacing requirements.

18. Explain how a Yagi-Uda antenna is analyzed as an EFA ,listing and the necessasry mathematical relations. Why it it called a super gain antenna**.**

19. i Establish and explain the gain and beam width relations for a parabolic reflector and account for its beam shaping considerations.
    ii. Write short notes on: cassegrainian antennas.

20. A parabolic owlish provides a power gain of 75 dB at 15 GHz,with 65% efficiency. Find its BWFN, HPBW and diameter.

UNIT IV :

UNIT V:

1. With neat diagrams, explain the important features of different types of space wave propagation of electromagnetic waves over long distance even beyond the horizon.

2. For what frequency range this is applicable and why?

3. Discuss the advantages and disadvantages of communication at ultra high frequencies.

4. How does the field strength of UHF signals depend on the heights of the transmitting and receiving antennas? Derive the relation and explain its variation with distance

5. Explain the formation of an "Inversion layer" in the troposphere in the phenomenon of "Duct propagation". What factors help in the formation of duct. For what frequency range 'Duct' can be used and why.
6. Discuss the theory of formation of ionospheric regions. Describe the properties of different ionospheric regions with special reference to seasonal variations.
7. Both very long waves and short waves can be used for world wide radio communication. Give general account of the propagation phenomena involved in the two cases and discuss the advantages and disadvantages of the two systems.
8. Write short notes on:
   a) Whistlers
   b) Magneto ionic equation
   c) Fading of radio wave
   d) Super refraction
   e) Line of sight propagation.
9. Obtain the expression for the field strength at the receiving point for space wave propagation

10. A VHF communication is established with 35 watt transmitter as 90 MHz. Determine the distance up to which LOS communication may be possible if the height of the transmitting and receiving antenna are 40 meters and 25 meters respectively. Evaluate field strength at the receiving point
11. Write short notes on the following;
    a) Impedance measurement of antenna
    b) MUF

12. Obtain the expression for the field strength at the receiving point for space wave propagation

13. A VHF communication is established with 35 watt transmitter as 90 MHz. Determine the distance up to which LOS communication may be possible if the height of the transmitting and receiving antenna are 40 meters and 25 meters respectively. Evaluate field strength at the
    receiving point.

14. Impedance measurement of antenna

15. Compare and contrast ground wave and sky wave

16 . Explain how propagation takes place through ionosphere

17. Explain the terms ray path, skip distance and maximum unable frequency as applied to ionosphere propagation.

18. Explain the cause for duct propagation
19. Explain the effect of atmosphere on space wave propagation

20. Explain what is meant by troposphere propagation. Mention its applications.

QUESTION BANK:

UNIT I:

1. (a) Explain and specify the ranges of frequencies for propagation,
   (i) Ground wave
   (ii) Surface wave and
   (iii) Space wave and sky wave.
   (b) Write short notes on,
   (i) Virtual height
   (ii) Skip distance and(ii) MUF (**JNTU May/June2012)**

2.Give a neat sketch of a helical antenna and explain its radiation characteristics. (b) Explain the working of a microwave horn antenna with neat sketches. (**JNTU May/June2012)**

3.(a) Mention different frequency bands of RF spectrum starting from VLF to UHF including their wavelengths andfrequencies bands. frequencies bands.
   (b) Define 'MUF', critical frequency 'f ' and skip distance and their relationship. (**JNTU May/June2012)**

4. (a) Define "radiation" and evaluate the Radiation fields of an alternating electric dipole.
   (b) Determine the power radiated by the above. Hence calculate the "Radiation Resistance" of a small dipole oflength l and a grounded monopole height 'h' above ground (**JNTU May/June2012)**

5.Define the following terms as applicable to antennas and explain their significance:
   1) Beamwidth
   2) Antenna efficiency
   3) Radiation resistance

(JNTU June 2012)

6.(a) What are parasitic antennas? Explain with reference to Yagi-Uda array(a) What are parasitic antennas? Explain with reference to Yagi-Uda array
   (b) Explain the working of "BALUN" in the operation of a folded dipole **(JNTU June 2012)**

7.(a) Name the typical antennas used in VHF, UHF and microwave ranges and explain
   (b) Describe the working of a parabolic reflector and explain the gain and beam width in terms of its dimensions **(JNTU June 2012)**

8.(a) What are long wire or traveling wave antennas? Explain.
   (b) Distinguish between "Binomial arrays" and "linear arrays" **(JNTU June 2012)**

9. (a) what do you understand by the terms 'Gain' and 'Efficiency' of an antenna?
(b) Derive the relation between Directivity and Effective Aperture. **(JNTU June 2013)**
(c) What is radiation resistance ?

10. (a) How the antennas are classified based on radiation pattern ? Give examples.

(b) Show that radiation resistance of a half wave dipole is 73 ohms**. (JNTU June 2013)**

11. (a) Explain the following terms

i) Figure of merit ii) front – to –back ratio iii) Half power beam width iv) Antenna input impedance.

(b) Show that the radiation resistance of $\lambda/2$ antenna is 73Ω. **(JNTU June 2014)**

12. (a) derive the expression for power radiated and radiation resistance of alternating current element.

(b) A short antenna with a uniform current distribution in free space has Idl=3 X 10^{-4} Am. Calculate the far field Eθ component for θ = 90deg . , Φ =0deg ,λ =10cm and r= 200cm. **(JNTU JUN 2014)**

(c) Obatin the relative amplitude of radiation ,induction and electro –static fields at a distance of 2λ from a short current element having an uniform current of 1mA aling its length .

13. (a) Derive the friss transmission equation and discuss the terms isotropic , omni-directional and principle patterns.

(b) Derive the expression for power radiated and radiation resistance of short dipole.

(JNTU Jun 2014)

14. The electric field of an antenna is given by E = **aθsin(4π cosθ) / 4π cosθ**

Calculate

i. the direction of the maximum radiation

ii. the 3dB beam width,

iii. the direction and level of the first side lobe and

iv. the number of nulls in the pattern.

(JNTU NOV 2015)

15. Give the current distribution and radiation pattern of a folded dipole antenna. Explain how the radiation pattern will be modified with the addition of a reflector and two directors with such an antenna.

(JNTU NOV 2015)

16. (a) Define beam efficiency.

(b)An elliptically polarized wave traveling in the positive z direction in air has x and y components :

Ex =3 sin(wt-βx)

Ey=sin(wt-βx+75°) **(JNTU March 2016)**

Find the average power per unit area conveyed by the wave.

17. (a) show that the radiation resistance of $\lambda/2$ antenna is 73Ω.

(b) Obtain the relative amplitude of radiation, induction and electro static fields at a distance of 2λ from a short current element having an uniform current of 1mA along its length.

(JNTU March 2016)

18. A) Define terms beam area, radiation intensity and distinguish between directive gain and power gain.

B) Calculate the electric field (Erms) due to isotropic radiator radiating 3KW at a distance of 2Km from it. **(JNTU Nov/Dec 2016)**

19. A) An antenna has radiation resistance of 73ohms and a lossy resistance of 7 ohms. If the power gain is 20, calculate the directivity and efficiency antenna.
B)Sketch and compare radiation pattern of horizontal half wave dipole and those of vertical half wave dipole. **(JNTU Nov/Dec 2016)**

20. A)what is meant by beam area?
B)Find radiation resistance of elementary dipole with linear current distribution.
(JNTU Nov/Dec 2016)

21. Derive the expression for far field components of a small loop antenna.
(JNTU Nov/Dec 2016)

UNIT II :

1. (a) Name the different methods of feeding a parabolic reflector antennas and explain their working.
(b) From the dimensions or the parabolic reflector, evaluate the directivity of the same.
(JNTU June 2012)

2.(a) Elaborate the terms "Antenna" and "Radiation" clearly.
(b) How the term retarded vector magnitude potential plays a key role in radiation process? Explain by deriving necessary expressions **(JNTU June 2012)**

3.Name the different types of waveguide horns with sketches and give their radiation properties **(JNTU June 2012)**

4.(a) Explain the process of refraction and reflection of radio waves via ionospheric layers.
(b) Two points on earth are 1000 km apart and are to communicate by means of HF. This is to be done by a single hop transmitter and the critical frequency is 7 MHz. Calculate the MUF if the height of the ionospheric layer is 200km.
(JNTU June 2012)

5. (a) Draw the structure of helical antenna and explain its working in axial mode.
(b) How Rhombic antenna has high directivity? Explain by means of its geometrical structure.
(JNTU June 2013)

6. (a) Explain design considerations of pyramidal horns.
(b) A pyramidal horn antenna has an aperture of 20cm X 15 cm. Assuming the field distribution to be uniform over the aperture(phase = constant all over the aperture), estimate the maximum directivity and the beam width of the antenna.
(JNTU June 2014)

7. Explain about cassegrain feed, paraboloidal reflectors, spherical reflectors.
(JNTU June 2014)

8. (a) What are the three important characteristics of UHF and microwave antennas?
(b) Explain the geometry of the parabolidal reectors?
(JNTU Nov 2015)

9. (a) Discuss the design characteristics of pyramidal and sectorial horns?
(b) With neat sketch explain how gain measurement is carried out using direct comparison method?
(JNTU Nov 2015)

10. (a) Expalin important features of a loop antenna.

(b)Why are wide band antennas required?name any two wide band antennas.

(JNTU June 2016)

11. (a) Explain radiation resistance of loops.

(b) A plane wave is incident on a short dipole, assume the wave is linearly polarized with E in the y direction. The current on the dipole is assumed constant and in the same phase over its entire length , and the terminating resistance Rt is assumed equal to the dipole radiation resistance Rr. The antenna loss resistance Rl is assumed equal to zero. What is (i) the dipoles maximum effective aperture and (ii) its directivity ?

(JNTU June 2016)

12. A) For a 2element linear antenna array separated by a distance of d= 3λ/4, derive the field quantities and draw its radiation pattern for the phase difference of 45º.

B) Define effective area and compare broadside and end fire array.

(JNTU Nov/Dec 2016)

13. A)Draw and explain the function of helical antenna and various modes of radiation .list its applications.

B) Explain in detail design considerations of pyramidal horns.

(JNTU Nov/Dec 2016)

14. A)Why folded dipole antenna is used in yagi antenna?

B) What is yagi uda antenna? Explain the construction and operation of yagi uda antenna. Also explain its general characteristics.

(JNTU Nov/Dec 2016)

15. Explain the half wavelength folded dipole.

(JNTU Nov/Dec 2016)

UNIT III :

1. (a) Name different types of horn antennas and compare their performance with sketches

(b) Design a simple pyramidal horn to work in 10.0 GHz range. **(JNTU June 2012)**

2.(a) What are finite length antennas? Explain their properties.

(b) Determine the Radiation Resistance of a "Half-wave" Dipole. **(JNTU June 2012)**

3.(a) Assuming the required current distribution in a half-wave dipole, derive the expressions for radiation fields

(b) What is the radiation resistance of, i) Half-wave dipole(ii) Quarter wave monopole.

(JNTU June 2012)

4.(a) Define the frequency ranges of VHF, UHF and microwaves with 'λ' and suitable types of antennas.

(b) Explain the working and construction of a helical antennas at 'X' band of frequencies.

(JNTU June 2012)

5.(a)List out different feeding systems that are associated with parabolic reflectors and compare.

(b) what is folded dipole ? Where it is used ?

(JNTU June 2013)

6.(a) How to design a pyramidal horn ? explain it with neat constructional diagram.

(b) With the help of a neat block diagram, explain how the gain of an antenna is measured.

(JNTU June 2013)

7. (a) Expalin about non metallic dielectric lens antenna.
(b) How the measurement of gain is obtained by direct comparison method.

(JNTU June 2014)

8. (a) Distinguish between sectoral, Pyramidal and Conical Horns, with neat sketches. List out their utility and applications.
(b) With neat set up, explain the absolute method of measuring the gain of an antenna.

(JNTU May 2015)

9. (a) Establish and explain the gain and beam width relations for a parabolic reflector and account for its beam shaping considerations.
(b) Write short notes on: Cassegrain antennas. **(JNTU Nov 2015)**

10. (a) Derive the conditions for the linear array of N isotropic elements to radiate in end fire and broad side modes, and find the first two side lobe levels.
(b) What is a uniform linear array and what are its applications?

(JNTU Nov 2015)

11. (a) what are the limitations of microstrip antenna?
(b) List different types of reflectors.

(JNTU June 2016)

12. (a) with neat illustrations, explain the geometry and requirements for a helical antenna radiating into axial mode, and give the relevant design relations.
(b) Describe the requirements, performance characteristic and applications of Yagi- Uda antenna.

(JNTU June 2016)

13. (a) Explain the design considerations of pyramidal horns.
(b) What is folded dipole ? List its characteristics and its applications.

(JNTU June 2016)

14. A) Explain the cassegrain mechanism in transmission mode. List out the advantages and disadvantages of cassegrain feed.
B) With necessary illustrations explain the radiation characteristics of microstrip antenna and lit its applications.

(JNTU Nov/Dec 2016)

15. A) what is axial mode of radiation ?
B)Describe the parabolic reflector used at micro frequencies.

(JNTU Nov/Dec 2016)

16.What are the various feeds used in reflectors.

(JNTU Nov/Dec 2016)

UNIT-IV

1. (a) Explain the terms radiation intensity, beam area, beam efficiency and directivity.
(b) Draw the radiation patterns of a few examples of antennas such as broadside, end fire and elementary dipole3. **(JNTU June 2012)**

2. Write short notes on,

(a) Directivity
(b) Beam width
(c) Dielectric lenses **(JNTU June 2012)**

3.(a) Explain the terms radiation intensity and directivity of an antenna
(i) A source with unidirectional cosine squared power pattern and
(ii) A source with sine power pattern (Doughnut) **(JNTU June 2012)**

4.(a) What are "ducts" and explain wave propagation through "Ducts".
(b) Explain the terms "fading", "fade out" and "fade margin". **(JNTUJune2012)**

5. (a) Explain the effects of polarization of EM fields in ground wave propagation.
(b) In respect of tropospheric propagation discuss the effects of,
(i) Earth's radius
(ii) Earth's curvature and
(iii) Curvature of the path. **(JNTU June 2012)**

6.(a) What is meant by tropospheric surface wave propagation and troposcatter propagation?
(b) On what parameters does the 'E' field strength due to ground wave radiation depend? Write expression and discuss **(JNTU June 2012)**

7. (a) What are "Lens" antennas? Give a neat sketch of the above for concave and convex shapes.
(b) What are "Dielectric Lenses" in antennas? What are Artificial Dielectric lenses using metallic sheets? **(JNTU June 2012)**

8. In order to measure the radiation pattern of a radiating antenna, gives an experimental arrangement and explain measurement techniques used in polar coordinates. **(JNTU June 2012)**

9.(a) what are the advantages of antenna arrays ?Explain the types of antenna arrays.
(b) Use principle of pattern multiplication and draw the radiation pattern with 8 element array with d= $\lambda/2$. **(JNTU June 2013)**

10. design a 4 element broad side array of $\lambda/2$ spacing between elements. The pattern is to be optimum with a side lobe level 26 dB down the main lobe maximum. **(JNTU June 2014)**

11. (a) What are the "Broadside" and "End-fire" antenna arrays.
(b) Determine the expression for the gain and beam width of the broadside array of 'n' elements and compare with that of end-fire one. **(JNTU Nov 2015)**

12. (a)What is Huygens principle?
(b)Use the principle of pattern multiplication and draw the radiation pattern with 8 element array with d=$\lambda/2$. **(JNTU June 2016)**

13. Explain typical sources of error in antenna measurement. **(JNTU June 2016)**

14. (a) With a neat block diagram, explain the method of measurement of radiation pattern of an antenna.
(b)For a 16 element broadside arrady with $\lambda/2$ spacing, derive the arrady factor and hence calculate its BWFN, first side lobe level, directivity and effective area. **(JNTU June 2016)**

15.A) What is Lunenburg lens?
B)Define isotopic source.

(JNTU Nov/Dec 2016)

16. State reciprocity theorem for antennas.Prove that the self impedance of an antenna in transmitting and receiving antenna are same.

(JNTU Nov/Dec 2016)

17. what is linear array ? Compare broad side array and endfire array.

(JNTU Nov/Dec 2016)

18.A) Describe the non metallic dielectric lens antennas in detail.

B) Calculate minimum distance required to measure the field pattern of an antenna of diameter 2m at a frequency of 3GHz. Derive the necessary equations.

(JNTU Nov/Dec 2016)

UNIT-V :

1. (a) Define radiation intensity, beam efficiency, directivity and patterns and explain
   (b) Determine the directivities of,
   (i) A source with cosine power pattern
   (ii) A source with unidirectional sine power pattern. **(JNTU June 2012)**

2. (a) Explain how sky wave propagation takes in terms of the structure and layers of ionosphere
   (b) Derive an expression for the refractive index of the ionospheric layer based on 'f' and 'N'. **(JNTU June 2012)**

3. (a) Explain the effects of radio wave propagation near the earth and discuss the types of modes in the process.
(b) What is polorisation and show how vertical polarization is used in ground wave propagation **(JNTU June 2012)**

4. (a) Name different types of reflector antennas and explain their working
   b. Draw the diagram of parabolic reflector dish antenna and obtain an expression for the gain "G" and beam width "BW" in terms of the diameter 'D' and wavelength 'λ'. Determine 'G' and 'BW' for a dish antenna with D=15 λ

(JNTU June 2012)

5. (a) What are antenna arrays and explain the working of a two element array? (b) Calculate and plot the field radiation patterns for,
   (i) $d = 0.5\lambda \quad \Psi = 0$
   (ii) $d = 0.5\lambda \quad \Psi = \frac{\pi}{2}$
   (iii) $d = 0.25\lambda \quad \Psi = \left(-\frac{\pi}{2}\right)$
   (iv) $d = \lambda \qquad \Psi = 0.$

$$E = a_\theta \frac{\sin(4\pi\cos\theta)}{4\pi\cos\theta}.$$

(JNTU June 2012)

6. The radiation field of an array antenna is. Calculate,
   (a) The direction of max radiation

(b) The 3db beam width
(c) The direction and level of the first side lobe and
(d) The number of nulls in the pattern. **(JNTU June 2012)**

7. (a) What is "scalar electric potential" and "vector magnetic potential"? Explain their existence and their use in Radiation process.
(b) Write maxwells equations and obtain the Radiation fields from an elementary dipole using the above and retarded vector magnetic potential

(JNTU June 2012)

8.(a) What is ionosphere . Explain how the refractive index of ionosphere changes with height of its region.
(b) Derive the expression for critical frequency and maximum usable frequency.

(JNTU June 2013)

9.(a) Derive expression for the field strength of a space wave propagated EM wave.
(b) write short notes on Duct Propagation.

(JNTU June 2013)

10. (a) Derive the conditions for the linear array of N isotropic elements to radiate in end fire and broad side modes.
(b)What is a uniform linear array and what are its applications?

(JNTU June 2014)

11. (a) Derive an array factor of an uniform linear array of N identical elements.
(b) Discuss the merits and demerits of traveling wave antenna.

(JNTU June 2014)

12. Describe the structure of the ionosphere and the part played by each layer in it in the long distance transmission of radio signals in the HF band. **(JNTU Nov 2015)**

13. Write explanatory notes on:
(a) Selective fading and interference fading
(b) Optimum working frequency and LUHF.
(c) Field strength calculation for radio AM broadcast waves.
(d) Ionosphere abnormalities. **(JNTU Nov 2015)**

14. (a) Explain the salient features of tropospheric scatter propagation.

(JNTU JUNE 2016)

15. (a)Write the expression for relation between MUF and skip distance.
(b) Obtain the roughness factor at 3MHZ for an earth having $\sigma = 0.5$, with $\theta = 30$deg. Calculate the ratio of roughness factors for the same earth and same θ if frequency is doubled.

(JNTU JUNE 2016)

16. A) Define Wave Tilt and explain field strength variation with distance and height.
b)What are the different types of wave propagations and explain M-Curves.

(JNTU Nov/Dec 2016)

17.A)Explain the terms (i) Maximum usable frequency (ii) Virtual height (iii) Ray path (iv) Critical frequency.
B)Discuss the reasons for reduction of field strength in sky wave propagation.

(JNTU Nov/Dec 2016)

18. A) What are the types of Ground wave?
B) What are the factors that affect the propagation of radio waves?

(JNTU Nov/Dec 2016)

19.Deduce an expression for the critical frequency of an ionized region in terms of its maximum ionization density.

(JNTU Nov/Dec 2016)

20. Describe the troposphere and explain how ducts can be used for microwave propagation.

(JNTU Nov/Dec 2016)

Objective questions

UNIT -1

1. Antennas convert ---------- to---------- [C]
   a) Photons to electrons b) electrons to photons
   c) Both a and b d) none
2. Antennas are of --------- types [C]
   a) Two b) four
   c) Infinite d) none
3. Which of the following is true [C]
   a) Time changing current radiates b) accelerated charges radiates
   c) Both a and b d) none
4. Radiation pattern is ---------- dimensional quantity [B]
   a) Two b) three
   c) Single d) none
5. --------- is also called as 3-dB bandwidth [B]
   a) FNBW b) HPBW
   c) Both a and b d) none
6. One steradian is equal to ---------- square degrees [C]
   a) 360 b) 180
   c) 3283 d) 41,253
7. -------- is independent of distance [B]
   a) Poynting vector b) radiation intensity
   c) Both a and b d) none
8. The minimum value of the directivity of an antenna is……. [A]
   a) Unity b) zero
   c) Infinite d) none
9. Directivity is inversely proportional to…… [C]
   a) HPBW b) FNBW
   c) Beam area d) Beam width
10. Gain is always -------- than directivity [B]
   a) Greater b) lesser
   c) Equal to d) none
11. Directivity and Resolution are---------- [B]
   a) Different b) same
   c) Both a and b d) none
12. Effective aperture is always ---------- than Physical aperture. [B]
   a) Higher b) lower
   c) Both a and b d) none
13. -------- Theorem can be applied to both circuit and field theories [D]
   a) Equality of patterns b) Equality of impedance
   c) Equality of effective lengths d) Reciprocity theorem
14. Antenna temperature considers-------- parameter into account [B]
   a) Directivity b) gain
   c) Beam area d) beam efficiency
15. Radiation resistance of antenna is---------- [B]
   a) Physical resistance b) Virtual Resistance
   c) Both a and b d) none

16. Antenna aperture is same as---------- [C]

a) Length b) width

c) Area d) volume

17. The source of scalar potential is [A]

a) Charge density b) Current density

c) Both a and b d) none

18. The source of vector potential is [B]

a) Charge density b) Current density

c) Both a and b d) none

19. R/v is called---------- [C]

a) Radiation to voltage ratio b) resistance to velocity ratio

c) Propagation delay d) none

20. Which condition makes coupled equations into uncoupled equations [C]

a) Retarded b) Helmholtz

c) Lorentz gauge d) none

21.Alternating current element is given by [B]

a)I dl b) I dl cosωt

c) I dl sinωt d) I

22. ---------potential is used to find the field components of current element [B]

a) Scalar Potential, V b) Vector Potential, A

c) Both a and b d) None

23. -------- is basic building block for any practical antenna [A]

a) Current element b) Monopole

c) Dipole d) Loop

24. The H_Φ Component will consists of----------
field. [C]

a) Radiation b) Induction

c) Both a and b d) All

25. The E_θ Component will consists of---------- [D]

a) Radiation b) Induction

c) Electro static d) All

26. The E_r Component will consists of---------- [C]

a) Induction b) Electro static

c) Both a and b d) All

27. The induction and radiation fields of current element are equal at distance of -----
- [C]

a) λ/2 b) λ/4

c) λ/6 d) λ/10

28. The radiation resistance of current element is given by [A]

a) $R_r = 80\Pi^2(dl/\lambda)^2$ b) $R_r = 20\Pi^2(dl/\lambda)^2$

c) $R_r = 10\Pi^2(dl/\lambda)^2$ d) None

29. The radiation resistance of short dipole is
given by [B]

a) $R_r = 80\Pi^2(dl/\lambda)^2$ b) $R_r = 20\Pi^2(dl/\lambda)^2$

c) $R_r = 10\Pi^2(dl/\lambda)^2$ d) None

30. The radiation resistance of short monopole is given by [C]

a) $R_r = 80\Pi^2(dl/\lambda)^2$ b) $R_r = 20\Pi^2(dl/\lambda)^2$

c) $R_r = 10\Pi^2(dl/\lambda)^2$ d) None

31. The radiation resistance of current element is applicable to dipoles up to height of λ/8 only. [FALSE]

32. The radiation resistance of current element is applicable to mono poles up to height of λ/4 only. [FALSE]

33. The radiation resistance of current element is applicable to dipoles up to height of λ/2 only. [FALSE]

34. The radiation resistance of λ/2 dipole is 36.5 Ω [FALSE]

35.The radiation resistance of λ/4 Monopole is 73 Ω [FALSE]

36. The E_θ Component of current element is given by $E_\theta = \frac{I\,dL\sin\theta}{4\pi\varepsilon}\left[\frac{-\omega\sin\omega t'}{v^2 r}+\frac{\cos\omega t'}{vr^2}+\frac{\sin\omega t'}{\omega r^3}\right]$

37. The E_r Component of current element is given by $E_r = \frac{2\,I\,dL\cos\theta}{4\pi\varepsilon}\left[\frac{\cos\omega t'}{vr^2}+\frac{\sin\omega t'}{\omega r^3}\right]$

38. The H_Φ Component of current element is given by $H_\phi = \frac{I\,dL\sin\theta}{4\pi}\left[\frac{-\omega\sin\omega t'}{rv}+\frac{\cos\omega t'}{r^2}\right]$

39. The main application of Loop Antenna is Direction Finding

40. The Directivity of Loop Antenna is 1.5

41. If an antenna draws 12 A current and radiates 4 kW, then what will be its radiation resistance 27.77 ohm

42. Sterdian is a measurement unit of Solid angle

43. Which antenna radiating region/s has/have independent nature of angular field distribution over the distance from the antenna Fraunhofer region?

44. What is the nature of radiation pattern of an isotropic antenna? Spherical

45. In a non-isotropic directional antenna, which radiating lobe axis makes an angle of 180° w.r.t. major beam of an antenna? Back lobe

46. Under which conditions of charge does the radiation occur through wire antenna? For a charge oscillating in time motion.

47. Power density is basically termed as Radiated _power per unit area

48. In which kind of waveform is the phase velocity defined? Sinusoidal

49. Wavefront is basically a locus of points acquiring similar Phase

50. The concept of magnetic vector potential finds its major application in deriving expression of magnetic field intensity especially for Complex fields

UNIT 2

1. If the individual antennas of the array are spaced equally along a straight line.
Then It is ----------array. [A]
a) Linear. b) Non-Linear.
c) Both a and b. d) None.

2. Linear array is a system of ------spaced elements. [B]
a) Un equally. b) equally.
c) Both a and b. d) None.

3. In a Uniform Linear array all elements are fed with a current of ----------
amplitude [A]
a) Equal. b) Unequal.
c) Both a and b. d) None.

4. In a Broad side array the radiation is along---------- [B]
a) X-direction. b) Y-direction.
c) Both a and b. d) None.

5. In a end- fire array the radiation is along ---------- [A]
a) X-direction. b) Y-direction.
c) Both a and b. d) None.

6. In increased end- fire array the radiation is along---------- [A]
a) X-direction. b) Y-direction.
c) Both a and b. d) None.

7. Which array is also called as Hansen-Woodyard array. [C]
a) Broad side. b) End-fire.
c) Increased End-Fire . d) Binomial.

8. Which array is also called as Stone's array. [D]
a) Broad side. b) End-fire.
c) Increased End-Fire. d) Binomial.

9. Hansen-Wood yard array is a --------array [A]
a) Linear. b) Non-Linear.
c) Both a and b. d) None.

10. Stone's array is a --------array [B]
a Linear. b) Non-Linear.

)
c) Both a and b. d) None.

11. All antenna measurements are accurate. [FALSE]

12. All antenna measurements will be done in the far field [TRUE]

13. Cylindrical coordinate system will be choosed for all antenna measurements. [FALSE]

14. For better antenna measurements the tolerance value must be as large as possible. [FALSE]

15. Anechoic chamber can be preferred for antenna measurements. [TRUE]

16. Frii's transmission formula is $P_R=P_TG_TG_R(\lambda/4\Pi R)^2$

17. Comparision method for measurement of antenna gain is also called as Gain-Transfer

18. The formula for gain using comparision method is GAUT= (PAUT/Pref) Gref

19. In two antennas method the assumption is $G_R=G_T$

20. In the case of circular or elliptical polarizations the the total antenna gain is given by $G_{AUT}=G_H+G_V$

21. If the individual antennas of the array are spaced equally along a straight line.
Then It is ----------array. [A]
a) Linear. b) Non-Linear.
c) Both a and b. d) None.

22. Linear array is a system of ------spaced elements. [B]
a) Un equally. b) equally.
c) Both a and b. d) None.

23. In a Uniform Linear array all elements are fed with a current of ----------
amplitude [A]
a) Equal. b) Unequal.
c) Both a and b. d) None.

24. In a Broad side array the radiation is along---------- [B]
a) X-direction. b) Y-direction.
c) Both a and b. d) None.

25. In a end- fire array the radiation is along ---------- [A]
a) X-direction. b) Y-direction.
c) Both a and b. d) None.

26. In increased end- fire array the radiation is along---------- [A]

a) X-direction. b) Y-direction.

c) Both a and b. d) None.

27. Which array is also called as Hansen-Woodyard array. [C]

a) Broad side. b) End-fire.

c) Increased End-Fire . d) Binomial.

28. Which array is also called as Stone's array. [D]

a) Broad side. b) End-fire.

c) Increased End-Fire. d) Binomial.

29. Hansen-Wood yard array is a --------array [A]

a) Linear. b) Non-Linear.

c) Both a and b. d) None.

30. Stone's array is a --------array [B]

a) Linear. b) Non-Linear.

c) Both a and b. d) None.

31. The radiation pattern of broad side is array is along the normal direction Of array axis. [TRUE]

32. The Binomial array is a linear array. [FALSE]

33. All coefficients of elements in Binomial array are same [FALSE]

34.Minor lobes will exist in Linear antennas. [TRUE]

35. In resulatant or total radiation pattern The phases will be multiplied using Multiplication of patterns Principle. [FALSE]

36. Hansen-Wood yard Array is a linear array.

37. The currents in Non linear are out of phase.

38. Binomial array was invented by stone

39. The amplitudes will be multiply in the resultant pattern using principle of multiplication of Patterns.

40. The phases will be addup in the resultant pattern using principle of multiplication of Patterns.

41.In broadside array, all the elements in the array should have similar ___Phase____excitation along with similar amplitude excitation for maximum radiation.

42. In which kind of array configuration, the element locations must deviate or adjust to some nonplaner surface like an aircraft or missile? Conformal

43. A beam of light is propagating in the x direction. The electric field vector perpendicular

to the direction of propagation. But it can be in any direction in that plane)

44. Which region of the ionosphere has little effect in bending the paths of highfrequency radio waves? a. F1
    b. F2
    c. E
    d. D
45. The chief factor that controls long distance communication is the _____ of the ionized layer.
    a. location
    b. density
    c. size
    d. color
46. Which two layers of the ionosphere are the most highly ionized?
    a. D and E
    b. D and F
    c. E and F
    d. D and F2
47. Why is it better to horizontally polarize antennas at high frequencies?
    a. They can be made to radiate effectively at high angles.
    b. They are omni-directional.
    c. Vertically radiated waves cannot be refracted from the ionosphere.
    d. Vertically polarized antennas have inherent directional properties.
48. At the very-high and ultra-high frequency bands, which type(s) of antenna polarization should be used?
    a. Vertical polarization only
    b. Horizontal polarization only
    c. Neither vertical nor horizontal
    d. Either vertical or horizontal
49. A conductor that transfers radio frequency energy from the transmitter to the antenna is called a _____ line.
    a. repeater
    b. carrier
    c. transmission
    d. pulse
50. Standing waves result in
    a. a fire hazard in the area below the antenna.
    b. a power loss and poor antenna efficiency.
    c. improved reception and greater power output.
    d. a perfect antenna and transmission line match.

UNIT 3

1. Microwave frequency range is---- [C]

---

a) above 30MHZ b) above 300MHZ

C) above 200MHZ d) above 2000MHZ.

2. Yagi-Uda antenna consists of----- [D]

a) Folded Dipole b) Reflector

C) Director d) All above

3. The radiation resistance of folded dipole of equal radii is---------- [B]

a) 657Ohms b) 292 Ohms

C) 300 Ohms d) 277 Ohms

The radiation resistance of folded dipole of unequal radii ($r_2=2r_1$) is-----

4. ----- [A]

a) 657Ohms b) 292 Ohms

C) 300 Ohms d) 277 Ohms

5. The helix is having the geometry of ---------- [D]

a) straight wire b) cirle

C) cylinder d) All above.

6. The radiation pattern of helix in Axial mode is---------- [B]

a) Bi directional b) Uni directional

C) 4 lobed d) Omni directional

7. The radiation pattern of helix in Normal mode is---------- [A]

a) Bi directional b) Uni directional

C) 4 lobed d) Omni directional

8. In Normal mode of operation the length of the helix is---------- [B]

a) $>\lambda$ b) $<\lambda$

C) $=\lambda$ d) none

9. In Axial mode of operation the length of the helix is---------- [C]

a) $>\lambda$ b) $<\lambda$

C) $=\lambda$ d) none

10. Horn antennas used in the frequency range of---------- [D]

a) VHF b) UHF

C) SHF d) MW

11. Yagi_Uda array is a parasitic

array. [TRUE]

12. The reflector is longer than the folded dipole in Yagi-Uda antenna. [TRUE]

13. The director is shorter than the Folded dipole in Yagi-Uda antenna. [TRUE]

14. Stone invented Helical Antenna. [FALSE]

15. Mushaike invented Horn

antenna. [FALSE]

16. Radiation pattern of Yagi-Uda array is Unidirectional

17. Helical antenna was invented by John.D.Kraus

18. The path difference in horn antennas must be small

19. The horn antennas are used in the frequency range of MW
20. The impedance of wave guides will be higher than Transmission lines.
21. Which mode of radiation occurs in an helical antenna due to smaller dimensions of helix as compared to a wavelength Normal ?
22. By how many times is an input impedance of a folded dipole at resonance greater than that of an isolated dipole with same length as one of its sides 4 ?

23. A dipole carries r.m.s. current of about 300A across the radiation resistance 2 Ω. What would be the power radiated by an antenna 180KW?

24. A rectangular horn antenna operating at 4GHz has the wavelength of 0.075m and gain of about 13dBi. What will be its required capture area 0.0149 m^2?

25. Which conversion mechanism is performed by parabolic reflector antenna ?Spherical to plane wave

26. Which type of wire antennas are also known as dipoles? Linear

27. According to the directivity of a small loop, which value of 'θ' contributes to achieve the maximum value of radiation intensity (U_{max})? 90°

28. From the radiation point of view, small loops are Poor radiators

29. On which factor/s do/does the radiation field of a small loop depend? Area

30. In an electrically small loops, the overall length of the loop is __Less than____ one-tenth of a wavelength.

31. Which pattern is generated due to plotting of square of amplitude of an electric field? Power Pattern

32. Which waveform plays a crucial role in determining the radiation pattern of the dipole/wire antennas? Current

33. Which operations are performed by vector potentials (A, F) over the radiated fields (E & H)? Differentiation

34. Which auxiliary functions assist in solving the radiation problem by evaluation of E & H using sources J & M? Vector potentials

35. What is the functioning role of an antenna in receiving mode? Sensor

36. The purpose of a radio transmitter is to generate,

a. modulate, and radiate a radio frequency (RF) signal.
b. demodulate, and radiate a radio frequency (RF) signal.
c. modulate, and collect a radio frequency (RF) signal.
d. modulate, and amplify a radio frequency (RF) signal.

37. Which is a function of a radio receiver?

a. Modulates an RF signal
b. Radiates an RF signal
c. Demodulates an RF signal
d. Generates an RF signal

38. In the receiving process, an antenna's purpose is to

a. radiate RF energy into space.
b. demodulate received RF signals.
c. intercept RF signals radiated by the distant end radio.
d. extract the desired electro-magnetic waves from the air.

39. Which mathematical calculation is used to find the wavelength when the frequency of a radio wave is known?

a. Divide frequency by velocity
b. Multiply frequency by velocity
c. Divide velocity by frequency
d. Divide wavelength by velocity

40. The wave upon which all information is attached or superimposed for transmission defines the

a. radio wave.
b. carrier wave.
c. propagated wave.
d. electro-magnetic wave.

41. When intelligence has been applied to a carrier, the carrier is said to be

a. amplified.
b. demodulated.
c. propagated.
d. modulated.

42. The process of shifting the phase of the carrier wave defines

a. demodulation.

b. amplitude modulation.

c. frequency modulation.

d. phase shift keying

43. What is the polarization of a discone antenna?

a. Vertical

b. Horizontal

c. Circular

d. Spiral

44. If the antenna increases 3.3 times how much does the radiated power increase?

a. 3.3 times
b. 10.89 times
c. 9.9 times
d. 6.6 times

45. A device that converts high frequency current into electromagnetic wave.

a. Antenna
b. Loudspeaker
c. Microphone

d. Transducer

46. Which is a non-resonant antenna?

a. Rhombic antenna
b. Folded dipole
c. End-fire array
d. Yagi-Uda antenna

47. Very low signal strength in antenna.

A. Minor lobes
B. Null
C. Antenna patterns
D. Major lobes

48. What is the gain of the Hertzian dipole over isotropic antenna?

A. 1.64 dB

B. 2.15 dB

C. 1.76 dB
D. 1.55 dB

49. All elements in a beam _____ antennas are in line

A. collinear
B. yagi
C. broadside array
D. log-periodic

50. What determines antenna polarization?

A. The frequency of the radiated wave
B. The direction of the radiated wave
C. The direction of the magnetic field vector
D. The direction of the electric field vector

Unit -4

1.Micro strip antenna was first introduced by Munson

2.The widely used shape for patch antennas is Rectangular

3.The efficiency of Micro strip antenna is Low

4.For square corner reflector the flaring angle is90 degrees

5.The no. of images formed for a square corner reflector, using method of images are 3

6.The no. of images formed for a 30 degrees corner reflector, using method of Images are…7

7.The no. of images formed for a 60 degrees corner reflector, using method of images are……5

8. A single narrow beam of radiation results in square corner reflector for spacing of s=…… $\lambda/2$

9. Two narrow beams of radiation results in square corner reflector for

spacing of s= λ

10. Three narrow beams of radiation results in square corner reflector for [spacing of s=3λ/2

11. The first Rotman lens was designed in 1963

12.The focal length of metal plate lens antenna is Directly proportional of to its diameter

13. Lens antennas are mostly used in the frequency range of above 3 GHz

14. A metal plate lens antenna function only in E plane

15. Lens antenna function on principle of Equality of path lengths

16. Operating bandwidth of zonal lens antenna is found to be 10%

17. Parabolic and lens antenna used at Microwave frequency

18. In H plane metal plate lens the travelling wave front is retarded

19. A wave guide operated below cutoff frequency can be used as an attenuator

20. The minimum height of outer atmosphere is 400km

21. The radiation pattern of parabola antenna is highly directional

22. The radiation pattern of loop antenna is cardoid or Limacon

23. A loop antenna is a commonly used for Direction finding

24. Lens antenna is used convert spherical wavefront into plane wavefront.

25. In all channels for TV sound IF is 5.5MHZ

26.The impedance of 3 element yagi receiving antenna is around 300ohms.

27. The TV broadcasting in india is done in VHF band I and III

28. The directivity of the paraboloid is $9.87(d/\lambda)^2$

29. The generally used feed antenna for paraboloids is HORN ANTENNA

30. The horn and hyperbola are used in CASSEGRAIN feed of dish antennas.

31. The disadvantage (draw back) of parabolic reflector is SPILLOVER EFFECT

32.The parabolic antenna operates in the frequency range of MW OR GHZ

33. Which antennas are renowned as patch antennas especially adopted for space craft applications? Micro strip

34. Helical antenna R often used for satellite tracking at VHF due to faraday effect

35. Helical antenna is circularly polarized

36.Log periodic Not a omni directional antenna.

37.The wavelength of a wave in a waveguide is greater than in free space.

38.When EM wave are reflected at an angle from a wall , their wavelength along the wall is greater in the actual direction of propagation.

39.A convenient method of determining antenna impedance Stub matching

40.Top load is used in antenna in order to increase its effective height

41. Harmonic suppressor connected to an antenna lower filter

42. Azimuth is the horizontal pointing angle of an antenna.

43. Hertz is a flexible vertical rod antenna commonly used on mobiles.

44. What is a driven element of an antenna? The element fed by the transmission line

45. Antenna which is not properly terminated Resonant

46. A parabola is a three dimensional curve. FALSE

47. A paraboloid is a three dimensional curve. TRUE

48. Fermat's principle must be followed to get a plane wave front from the dish antenna. TRUE

49. In any dish antenna arrangement the parabolic reflector will acts as primary antenna FALSE

50. In any dish antenna arrangement the parabolic reflector will acts as secondary antenna TRUE

Unit -5

1) The troposphere is extends up to a height of ---------- [C]

A) 5km B) 10km

C) 15km D) 20km

2) For small distances the earth can be considered as ----------region [A]

A) flat B) curved
C) conductor D) dielectric

3) For large distances the earth can be considered as ----------region [B]
A) flat B) curved
C) conductor D) dielectric

4) In general the earth will acts as a ----------
--- [C]
A) leaky resistor B) leaky inductor
C) leaky capacitor D) leaky transistor

5) According to Rayleigh if R>10, the reflecting surface will be considered as…….. [B]
A) smooth region B) rough region
C) both a &b D) none

6) According to Rayleigh if R<0.1, the reflecting surface will be considered as…….. [A]
A) smooth region B) rough
C) both a &b D) none

7) The line of sight (LOS) distance is the distance travelled by the …….wave. [D]
A) diffracted B) scattered
C) reflected D) direct

8) The phenomenon of reduction of signal strength due to variation in refractive index is called…….. [B]
A) wave tilting B) fading
C) diffraction D) scattering

9) The E-Layer of Ionosphere exists between [B]
A) 40 to 90 km B) 90 to 140 km
C) 140 to 250 km D) 250 to 400 km

10) The F2-Layer of Ionosphere exists between [D]
A) 40 to 90 km B) 90 to 140 km
C) 140 to 250 km D) 250 to 400 km

11) Critical frequency is the lowest frequency that returns from Ionosphere at vertical frequency. [FALSE]

12) Maximum Usable Frequency (MUF) is the highest frequency that returns from Ionosphere Other than vertical frequency. [TRUE]

13) The frequency below which the entire power gets absorbed is referred to as the Maximum Usable Frequency (MUF).
[FALSE]

14) The frequency at which there is optimum return of wave energy is called the Optimum Frequency
(OF). [TRUE]

15) Virtual height is always lesser than the Actual height. [FALSE]

16) Which ionization layer exists during day time & usually vanishes at night due to highest recombination rate D-region?

17) What is the wavelength of Super high frequency (SHF) especially used in Radar & satellite communication 1 cm – 10 cm?

18) A rectangular horn antenna operating at 4GHz has the wavelength of 0.075m and gain of about 13dBi. What will be its required capture area 0.0149 m^2 ?

19) How do the elements of an active region behave Resistive?

20) Which mechanism/s is/are likely to occur in mid-frequency operation corresponding to ionospheric region Partial reflection & refraction?

21. According to Snell's law in optics, if a ray travels from dense media to rarer media, what would be its direction w.r.t the normal? Away

22. By which name/s is an ionospheric propagation, also known as? Sky wave propagation

23. After which phenomenon/phenomena do the waves arrive at the receiving antenna in ionospheric propagation? Reflection or Scattering

24. Which type of ground wave travels over the earth surface by acquiring direct path through air from transmitting to receiving antennas? Space wave

25. In an electrical circuit,which nature of impedance causes the current & voltages in phase? Resistive

26. Which equations are regarded as wave equations in frequency domain for lossless media? Helmholtz

27. If the tower antenna is not grounded, which method of excitation is/are applicable for it? Series

28. For which band/s is the space wave propagation suitable over 30 MHz? VHF, SHF, UHF

29. Which mode of propagation is adopted in HF antennas? Ionospheric

30. In flared transmission line, the radiation phenomenon increases due to ___Increase_____ in flaring

31. If an observation point is closely located to the source, then the field is termed as ____Induced____

32. At which angles does the front to back ratio specify an antenna gain? 0° & 180°

33. F_2 layer of appleton region acts as a significant reflecting medium for ___ High __ frequency radio waves

34. What is the possible range of height for the occurrence of sporadic E-region with respect to normal E-region? 90 km – 130 km

35. What is the wavelength of Super high frequency (SHF) especially used in Radar & satellite communication? 1 cm – 10 cm

36.The "D" region of the ionosphere has little effect on which type of radio waves?

a. Sky waves

b. Skip waves

c. Low frequency

d. High frequency

37.The "F" region of the ionosphere is

a. present only during daylight hours.

b. ionized at all hours of day and night.

c. comprised of three separate layers.

d. rendered useless during the night.

38.The range of long distance radio transmissions is determined by the _____ of each ionospheric layer.

a. height

b. location

c. temperature

d. ionization density

39.What are the three components of the ground wave?

a. Ground wave, sky wave, and skip wave

b. Direct wave, ground refracted wave, and skip wave

c. Direct wave, ground reflected wave, and surface wave

d. Direct wave, ground wave, and sky wave

40.Signal paths between the transmitter and receiver in sky wave propagation are provided by

a. troposphere.

b. ionosphere.

c. atmosphere.

d. stratosphere.

41.Waves of frequencies higher than that of the MUF will

a. encounter high levels of atmospheric noise.

b. be most useful for daytime communications.

c. penetrate the ionosphere and escape into space.

d. be reflected by the "F" region of the ionosphere.

42.The four types of fading are interference, polarization,

a. absorption, and switch.

b. antenna, and skip.

c. absorption, and skip.

d. reflection, and skip.

43.What wave propagation is useful for communications at low frequencies?

a. Ground wave

b. Sky wave

c. Direct wave

d. Skip wave

44.What propagation wave or component of a propagation wave provides the best communication in the very-high-frequency band?

a. Ground wave

b. Sky wave

c. Surface wave

d. Skip wave

45.Which component of the ground wave provides the best communication in the ultrahigh-frequency band?

a. Sky wave

b. Skip wave

c. Ground wave

d. Direct wave

46.The function of a transmitting antenna is to convert the transmitter output power into a(n)

a. electro-magnetic field.

b. induction field.

c. magnetic field.

d. radiation pattern.

47.Which of the two fields set up by fluctuating energy is radiated out into space?

a. Induction

b. Convection

c. Radiation

d. Electron

48. The radiation field is composed of a(n) _____ component and a _____ component.

a. induction--convection

b. electric--magnetic

c. induction--magnetic

d. induction—radiation

49. The direct wave component of the ground wave is the only reliable propagation path available when transmitting in the _____ frequency band.

a. HF

b. ELF

c. ULF

d. UHF

50. What kind of antenna polarization should you use when working with low and medium frequencies? a. Induction

b. Horizontal

c. Electrical

d. Vertical

DIGITAL SIGNAL PROCESSING

EC602PC:DIGITALSIGNALPROCESSING

B.Tech. IIIYearIISemester

L	T	P	C
3	1	0	4

Prerequisite: Signalsand Systems

CourseObjectives:

1. To provide background and fundamental material for the analysis and processing of digital signals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications.
4. To acquaintain Multi-rate signal processing techniques and finite word length effects**.**

CourseOutcomes: Uponcompletingthiscourse, thestudentwillbeableto

1. Understand the LTI system characteristics and Multirate signal processing.
2. Understand the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Understand the significance of various filter structures and effects of round off errors.

UNIT-I:

Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency**,** Linear Shift Invariant Systems, Stability and Causality, linear differential equation to difference equation**,** Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems

Multirate Digital Signal Processing: Introduction, DownSampling, Decimation, Upsampling, Interpolation, Sampling Rate Conversion.

UNIT-II:

Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transformrelation**,** DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, DiscreteFourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation ofDFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT)-Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

UNIT-III

IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

UNIT-IV

FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filter susing Window Techniques, Frequency Sampling Technique, Comparison of IIR &FIR filters.

UNIT-V

Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters– Direct, Canonic, Cascade and Parallel

Forms.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round-Off Noise, Methods to Prevent Overflow, Trade Off Between Round Offand Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, DeadBand Effects.

TEXTBOOKS:

T1: Proakis, J.Gard and D.G.Manolakis"Digital Signal Processing: Principals, Algorithms and Applications", 3rdEdn., PHI, 2007.

T2: "Discrete Time Signal Processing" – A.V. Oppenheim and RW schaffer, PHI, 2009

T3:LoneyLuderman"Fundamentals of Digital Signal Processing". John wiley, 2009

REFERENCE BOOKS:

R1:Li Tan, ""Fundamentals and Applications Digital Signal Processing" Elsevier, 2008.

R2: T Robert J Schilling, Sandra L Harris, "Fundamentals of Digital Signal Processing" Using Matlab, Thomson, 2007

R3:S. Salivahanan "Digital Signal Processing" TMH, 2000

R4:Taan S. Elaali, "Discrete systems and Digital Signal Processing with MATLAB" CRC

R5: "Digital Signal Processing" –A. Anand Kumar,PHI,2013

R6: Digital Signal Processing" -RAMESH BABU Ed- 4thedition, Scitech Publications

Session Plan - with ITL Methods

S. No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
1.	22.03.2021	Overview, Introduction and Requirement of DSP and Application	An overview of the course, application. Discussion of Syllabus and books.	Lecture	L1		T1: 1.1, 2.1; T2: 2.1 R2: 1.2.1; R3: 1.2
2.		**UNIT -I: Introduction and MultirateDigitalSignalProcessing**					
3.	22.03.2021	Discrete time signals and Sequences	Signal Definition , Classification and Representation	Lecture	L2		T1: 2.2 ; T2:2.2 R2:1.2.2 ; R3: 1.5
4.	23.03.2021	conversionofcontinuoustodiscretesignal, NormalizedFrequency	Conversion from analog to discrete Sampling Concept, Normalization	Lecture	L3		T1: 1.4
5.	24.03.2021 25.03.2021	Linear Shift Invariant Systems	System Definition, Different types of Systems LTI system	Lecture	L4, L5		T1: 2.2; T2: 2.3 ;T1:2.3.5 ; T2: 2.2
6.	30.03.2021	Stability and Causality	Causal and Non Causal Systems and Stable and Unstable Equations	Lecture	L6		T1:2.2.6 ; T2: 2.2; R1: 1.3 ;T2: 2.5; T2:2.4.2 ;
7.	31.03.2021 01.04.2021	Linear Constant Coefficient Difference Equations	Solution of Difference Equations	Lecture	L7 L8		T1: 2.4.3 ; T2: 2.5

S. No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
8.	05.04.2021	Response of Stable System	Impulse and Step Response, System Function	Lecture	L9 ,L10		T1: 4.2.1 , 4.2.3 ; T2: 2.6 ; R1: 1.5
9.	06.04.2021		, Frequency Response	Lecture	L11		
10.	07.04.2021	Introduction	Introduction and application of Multirate DSP	Lecture	L12		T1: 10.1 ; R6:8.1; R3: 11.1
11.	08.04.2021	Down sampling: Decimation	Concept and Formulation of Decimation	Lecture	L13		T1:10.2 ; R6: 8.2
12.	15.04.2021	Up sampling: Interpolation	Concept and Formulation of Interpolation	Lecture	L14		T1: 10.3 ; R6: 8.4
13.	19.04.2021	Sampling Rate Conversion, conversion of band pass signals	Nyquist Rate, Up Sampling and Down Sampling, Sampling rate conversion of band pass signals by a rational factor I/D	Lecture	L15		T1: 10.4 ; R6: 8.8 ; R3: 11.3 ;
14.	19.04.2021	concept of resampling, Application of multi rate signal processing	Design of phase splitter, Interfacing of digital systems, sub band coding of speech signals	Seminar	L16	LG1,LG2	T1:10.9
15.		**UNIT -II: Discrete Fourier Series and Fast Fourier Transform**					
16.	20.04.2021	Fourier Series, Fourier Transform, Laplace Transform and Z-Transformrelation	Fourier Series, Fourier Transform, Laplace Transform and Z-Transform	Lecture QUIZ	**L17**	All	R5: 6.4
17.	22.04.2021	DFS Representation of Periodic Sequences	DFS Representation of Periodic Sequences	Lecture	L18		T2: 8.2; R1:3.2 ; R6: 3.3
18.	26.04.2021	Properties f Discrete Fourier Series	Linearity Shifting	Lecture	L19		T2: 8.3 ; R6: 3.2 ; R2: 3.3
19.	26.04.2021	Discrete Fourier Transforms	DFT Definition, Discrete Fourier Transforms of some Functions	Lecture	L20		T1: 7.1 ; T2: 8.6 ; R3: 6.3: R6: 3.4
20.	27.04.2021	Properties of DFT	Linearity , Shifting Property	Lecture	L21		T1: 7.2; T2:8.7; R6: 3.6 ; R3: 6.3.2
21.	28.04.2021	Linear Convolution of Sequences using DFT	Linear Convolution – Problems	Lecture	L22		T2: 8.9; R6: 3.7
22.	29.04.2021	Computation of DFT, Relationship between DTFT,DFS,DFT& Z-transform	Problems in DFT ,overlap Add method	Lecture QUIZ	L23	All	R6: 3.10
23.	03.05.2021	Fast Fourier Transforms (FFT)	Introduction to FFT Overlap Save method	Lecture	L24		R6: 3.10 T1: 6.1; T2: 9.0 ; R6: 4.1- 4.3 ; R1:6.0
24.	03.05.2021	Radix-2 Decimation in frequency and FFT Algorithms	Concept of Butterfly Diagram, Solution using Butterfly Diagram to compute FFT	Seminar	L25	LG3,LG4	T1: 6.1.3 ; T2: 9.3; R6:4.4 ; R1:6.2
25.	04.05.2021	Inverse FFT	Solution using Butterfly Diagram to Compute FFT, Decimation in Frequency	Lecture	L26		T1: 6.1.3 ; T2: 9.4 ; R1: 4.6 ; R1:6.3

S. No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
26.	05.05.2021	FFT with General Radix	Overview of the Different Algorithms on FFT	Lecture	L27		T1: 6.1.5,6.1.6 ; T2: 9.5; R6: 4.5,4.7 ; R1: 6.2,6.3
27.	06.05.2021		Formula for inverse FFT , Problems and FFT with Radix N	Lecture	L28		T2: 9.3,9.4 ; T1: 6.1.3 ; R6: 4.9; R3: 3.6 T2: 9.6 ; R1: 6.4 ;
28.		**UNIT -III: IIR Digital Filters**					
29.	10.05.2021	Applications of Z-Transform	Z Transform Definition and its Applications	Lecture	L29		T1: 3.1,3.2 ; T2: 4.1,4.2; R6: 2.1,2.2 ; R3: 4.2
30.	10.05.2021	Solution of Difference Equations of Digital Filters	Explanation for the use of Difference Equation to Realize Digital Filters Solution for DE using Z-Transform and inverse Z – Transform	Lecture	L30		T1: 3.5.2 ; T2: 4.5 ; R6: 2.15; R3: 4.4
31.	11.05.2021	System Functions, Stability Criterion	Transfer Function derivation, Derivation for Stability Condition	Lecture	L31		T1: 3.6.1 ;R6: 2.9 T1: 3.6.4 ; R6: 2.11;
32.	12.05.2021	Frequency Response of Stable Systems	To compute and Plot Amplitude and Phase	Lecture	L32		R6: 2.9
33.	13.05.2021	Direct and Canonical Forms	Realization of Digital Filter using Form I and Form II	Lecture	L33		T1: 7.3.1 ; R6: 5.14.1;
34.	07.06.2021	Cascade Form and parallel form	Realization of Digital FILTER Using Cascade Form. and Parallel Form	Lecture	L34		T1: 7.3.3 ; R6: 5.14.2 T1: 7.3.4 ; R6: 5.14.6
35.	07.06.2021	Analog Filter Approximation	Introduction to Filter Classification – FIR,IIR	Lecture	L35		R3: 8.1; R6:5.1
36.	08.06.2021	Butter worth Filter	Design of IIR Filter using Butterworth Filter	Seminar	L36	LG5,LG6	R3:8.5 ; R6: 5.5
37.	09.06.2021	Chebishev Filter	Design of IIR Filter using Chebishev Filter	Lecture	L37		R3:8.6 ; R6: 5.7
38.	10.06.2021	Design of IIR Filter from Analog Filters	Need to convert in Digital Domain , Overview of different techniques	Lecture	L38		R6:5.12
39.	14.06.2021	Bilinear Transformation Method	Mathematical Representation	Lecture	L39		R6: 5.12.3 ; T1: 8.3.3
40.	14.06.2021	Step & Impulse Invariance Techniques	Backward Derivative, Forward Derivative	Lecture	L40		R6: 5.12.4 ; T1: 8.3.1
41.	15.06.2021	LTI	Impulse Invariance Techniques	Lecture	L41		R6: 5.12.2 ; T1: 8.3.2
42.	16.06.2021	Spectral Transformations	Low Pass to High Pass , Low Pass to Band Pass and Inter Conversion	Lecture	L42		R6: 5.13 ; T1: 8.4

S. No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
43.		**UNIT -IV: FIR Digital Filters**					
44.	17.06.2021	Characteristics of FIR Digital Filters	Filter – Definition , Classification, Characteristics of FIR Digital Filters	Seminar	L43	LG7,LG8	T1: 8.2.1 ; R6: 6.1-6.2 ;
45.	21.06.2021	Frequency Response	Frequency Response	Lecture	L44		R3: 7.3; R6: 6.3;
46.	21.06.2021	Design of FIR Digital Filters using Window Techniques	Rectangular, Triangular	Lecture	L45		T1: 8.2.2 ; T2: 7.4 ; R6: 6.6
47.	22.06.2021		Hamming and Hanning Window and overview of Keiser Window	Seminar	L46	LG9,LG10	
48.	23.06.2021	Frequency Sampling Technique, Comparison of IIT and FIR Filters	Design of FIR Filter using Frequency Sampling Technique, Comparison of IIR and FIR Filters	Lecture	L47		T1: 8.2.3 ; R6: 6.9 ; R3: 7.4, R6: 6.9
49.		**UNIT -V: Realization of Digital Filters: & Finite Word Length Effects:**					
50.	24.06.2021	Applications of Z-Transform	Z Transform Definition and its Applications	Lecture	L48		T1: 3.1,3.2 ; T2: 4.1,4.2; R6: 2.1,2.2 ; R3: 4.2
51.	28.06.2021	Solution of Difference Equations of Digital Filters	Explanation for the use of Difference Equation to Realize Digital Filters	Lecture	L49		T1: 3.5.2 ; T2: 4.5 ; R6: 2.15; R3: 4.4
52.	28.06.2021		Solution for DE using Z-Transform and inverse Z – Transform	Lecture	L50		
53.	29.06.2021	System Functions	Transfer Function derivation	Lecture	L51		T1: 3.6.1 ; R6: 2.9 ;
54.	30.06.2021	Stability Criterion	Derivation for Stability Condition	Seminars	L52	LG11, LG12	T1: 3.6.4 ; R6: 2.11;
55.	01.07.2021	Frequency Response of Stable Systems	To compute and Plot Amplitude and Phase	Lecture	L53		R6: 2.9
56.	05.07.2021	Direct and Canonical Forms	Realization of Digital Filter using Form I and Form II	Lecture	L54		T1: 7.3.1 ; R6: 5.14.1;
57.	05.07.2021	Cascade Form	Realization of Digital FILTER Using Cascade Form, Parallel Form	Lecture	L55		T1: 7.3.3 ; R6: 5.14.2 T1: 7.3.4 ; R6: 5.14.6
58.	06.07.2021	Parallel Form	Realization of Digital FILTER using Parallel Form	Lecture	L56		
59.	07.07.2021	Trade between Round off and Overflow Noise	Trade between Round off and Overflow Noise	Lecture	L57		R3: 10.5
60.	08.07.2021	Measurement of Coefficient Quantization effects through Pole – Zero Movement, Dead band effects	Measurement of Coefficient Quantization effects through Pole – Zero Movement	Lecture	L58		R6: 7.9,7.15 R6: 7.10
61.	12.07.2021	Measurement of Coefficient Quantization effects through Pole – Zero Movement, Dead band effects	Measurement of Coefficient Quantization effects through t, dead band effects	Lecture	L59, L60		R6: 7.9,7.15 R6: 7.10

Descriptive Questions

UNIT - 1 :Introduction: Multirate Digital Signal Processing:

SR.NO	QUESTION	THE
1	Define various elementary discrete time signals. Write notes on them and explain about their properties.	10
2	Calculate the total response of the system described by y(n)-4y(n-1)-12y(n-2)= x(n), y(-1)=1, y(-2)=2.	5
3	Calculate the transfer fucntion of the system defined by y(n)-2y(n-1)= x(n)	5
4	Represent discrete time signal and systems in frequency domain	5
5	Determine and sketch the magnitude plot of y(n)=1/2 [x(n)+ x(n-2)]	10
6	What are the properties of LTI system? Explain them.	10
7	Find the impulse response of the system described by the the following differnce equation. Assume all initial conditions are zero. y(n)-2y(n-1)+4y(n-2)=x(n)+ x(n-1)	10
8	A LTI system is described by y(n)-3/4 y(n-1)+ 1/8 y(n-2)=x(n) Determine the frequency response of the system	5
9	Check whether the system defined by the following difference equation satisfy the conditions Linearity, Time Invariant, Stable and Causal y(n) = 2 x(n)-4 x(n-1) + 6n x(n-2) +y(n-1).	10
10	Determine whether the given systems are stable or not. i) y(n)=x(2n) ii) y(n)=x(-n)	10
11	Check y(n)=3x(n-2)+ 3x(n+2) is causal linear system.	5
12	Define causality and stability of LSI system and state the conditions for stability.	5
13	A system is represented by the difference equation y(n)=3y2(n-1)-nx(n)+4x(n-1)-2x(n+1), n>=0. Find whether the system is linear , Time invarient or causal	10
14	Determine whether the following systems are time invariant or not a) y(n)=ex(n) b) y(n)=x(n2) c) y(n)=x(n) -x(n-1) d) y(n)=nx(n) e)y[n]=x[n]+nx[n-3] f)y[n]=sin(x[n]). $y(n) = e^{x(n)}$	10
15	Identify linear system in the following: a) b) $y(n) = x(n)^2$ c) d) y(n)= ax(n)+b $y(n) = x(n^2)$	10
16	Determine the impulse response and the unit step response of the systems described by the difference equation y(n) = 0.6y(n-1)-0.08 y(n-2) + x(n).	10
17	Briefly introduce the concepts of Multirate Digital Signal Processing.What are the applications of multirate system?	5
18	Explain about sampling rate conversion by a factor I/D.	5
19	Explain in detail with mathematical equations ,Interpolation and decimation with examples.	10

UNIT - 2 :Discrete Fourier series: Fast Fourier Transforms:

SR.NO	QUESTION	MARKS
1	Derive the following properties of DFS. i)Time Shifting ii) Time reversal iii) Convolution	10
2	Draw the butterfly diagram for DITFFT algorithm.	5
3	Calculate the 8 point DFT of the sequence x(n)={1,-2,3,1,-1,2} using DIF-FFT and DIT-FFT.	10
4	Find 8-point DFT X(K) of the real sequencex(n)={0.707,1,0.707,0,-0.707,-1,-0.707,0} by using DIF radix-2 FFT.	10
5	Find the N-point DFT of $x_{x(n)} = b^n \cos(an)$ using the linearity property.	5
6	State and Prove any four properties of Discrete Fourier Series.	10
7	Given $x(n) = 2^n$ and N=8, find X(K) using DIT-FFT algorithm.	10
8	Given $x(n) = (-2)^n$ and N=4, find X(K) using DIT-FFT algorithm	10
9	Calculate the 8 point DFT of the sequence x(n)={11,2,2,3,3,4,4}. State and prove the circular shift of a sequence.	10
10	Obtain the output response y(n), if h(n)={1,2,2,1}; x(n)={1,-1,1,-1} without using DFT.	5
11	How can we calculate IDFT using FFT algorithm	5
12	Determine the DFT of a sequence i)X(n)={1,1,0,0} ii)X(n)={1,0,0,0}	10
13	Prove time shifting and frequency shifting properties of Discrete Fourier Transform.	5
14	Determine the DFT of a sequence x(n)={1,0,0,0} using FFT algorithm.	10
15	Determine 4-point IDFT of the sequence x[k]={1,-j,0,j} using DIT-FFT algorithm.	10
16	A sequence is given by x(n)={1,1,1,1,2,2,2,2} compute 8 point DFT of x(n) by using radix-2 FFT	10
17	Find the Discrete Time Fourier Transform of the following : x(n)=(2)^(-2n)	10
18	Determine the 8 point IDFT of the sequence x(n)={5,0,1,-j,0,1,0+j,0}	10
19	Derive relation between fourier transform and z-transform	5
20	Find the output y(n) of a filter whose impulse response is h(n) = {1 11} and input signal x(n) = {3 -1 0 1 3 2 0 1 2 1}. Using Overlap add method	10

UNIT - 3 :IIR Digital Filters:

SR.NO	QUESTION	MARKS
1	Given the specification αp=1dB, αs=30dB,Ωp=200rad/sec, Ωs=600rad/sec. Determine the order of the filter	5
2	Design a chebyshev filter with a maximum pass band attenuation of 2.5dB at Ω p=20rad/sec and the stopband attenuation of 30dB at Ωs=50rad/sec.	10
3	Design a digital low pass filter using Chebyshev filter that meets the following specificatrions: Passband magniture characteristics that is constant to with in 1dB for recurremces below w=0.2*π and stop band attenuation of atleast to within 15dB for frequencies between w=0.3π and π. Use bilinear transformation	10
4	Derive the relation between digital and analog frequencies in bilinear transformation.	5
5	What is warping effect? What is its effect on magnitude of phase response? Write a short note on prewrapping?	5
6	For the given specification design an analog Butterworth filter $0.9\leq \lvert H(j\Omega)\rvert \leq 1$ for $0 \leq \Omega \leq 0.2\pi$ $\lvert H(j\Omega)\rvert \leq 0.2\pi$ for $0.4\pi \leq \Omega \leq \pi$	10
7	Design an analog butter worth filter that has αp=0.5dB, αs=22dB, fp=10KHz, fs=25KHz Find the pole location of a 6th order butter worth filter with Ωc=1 rad/sec	10
8	For the given specifications find the order of butter worth filter αp=3dB, αs=18dB, fp=1KHz, fs=2KHz.	10
9	Design a butter worth low pass filter satisfying the following specifications fp = 0.1 Hz, α = 0.5 dB, fs = 0.15 Hz, αs = 15dB, F= 1Hz	10
10	Design a band stop butter worth and chebyshev type – I filter to meet the following specifications. Stop band 100-600 Hz 20dB attenuation at 200 & 400 HZ. The gain at W=0 is unity. The pass band ripple for the chebyshev filter is 1.1 dB. The pass band ripple attenuation for butter worth filter is 3 dB.	10
11	11. Design a chebyshev type – I band reject filter with the following specifications. Pass band dc to 275Hz & 2KHZ to ∞ Stop band 550 HZ to 1000HZ.	10
12	Design a ChebyShev Filter for the following specifications using i) Bilinear Transformation ii)Impulse Invariance Method $0.8\leq\lvert H(w)\rvert\leq 1$ $0\leq W\leq 0.2\pi$ $\lvert H(w)\rvert\leq 0.2$ $0.6\pi\leq W\leq\pi$	10
13	Design butterworth highpass filter for the given specifications: αp = 3dB, αs = 15dB, Ωp =1000rad/sec , Ωs = 500rad/sec	10
14	Forthe analog transfer function $H(s)= 2/((s+1)(s+2))$ Determine H(z) using i) impulse invariance method . ii) Bilinear Transformation . Assume T=1sec	10
15	Discuss magnitude characterises of an analog Butterworth filter and give its pole locations	5

UNIT - 4 :FIR Digital Filters:

SR.NO	QUESTION	MARKS
1	Design an ideal differentiator with frequency response H (e ^jώ) = jw $-\pi \le \omega \le \pi$ using hamming window for N=8 and find the frequency response.	10
2	Using a Rectangular Window technique, Design a LOwpass filter with pass band gain of unity, cut off frequency of 1000 HZ and working at a sampling frequency of 5 KHZ . The length of impulse response should be 7.	10
3	Design a FIR filter whose frequency response H (e jώ) = 1 $\pi/4 \le \omega \le \pi/4$ 0 $\lvert \omega \rvert \le 3\pi/4$. Calculate the value of h(n) for N=11 and hence find H(z).	10
4	Design an ideal band reject filter with a frequency respose Hd(ejw)=1 for $\lvert \omega \rvert \le$ and $\lvert \omega \rvert \ge 0$ for otherwise Find the values of h(n) for N=11.Find H(z).plot magnitude response.	10
5	A) Compare various windowing functions B)Compare FIR and IIR Filters?	10
6	Design a low pass digital filter using Kaiser window satisfying the specifications given below. Pass band cutoff freq=100hz Stopband cutoff freq=200hz Passband ripple=0.1 db Stopband attenuation= 20 db Sampling freq=1000hz	10
7	List the design steps of FIR filters using fourier method	5
8	Prove that an FIR filter has linear phase if the unit sample response satisfies the condition h(n)= ± h(M-1-n), n =0,1,….. M-Also discuss symmetric and anti symmetric cases of FIR filter.	10
9	Explain the principle and procedure for designing FIR filter using rectangular window	5
10	Explain the design of FIR filter using frequency sampling Technique	5

UNIT - 5 : Realization of Digital Filters

SR.NO	QUESTION	MARKS
1	Find the input x(n) of the system if the impulse response h(n) and output y(n) are shown below h(n)={ 1 2 3 2} y(n)={ 1 3 7 10 10 7 2}	5
2	Determine the transfer function and impulse response of the system y(n) –(3/4) y(n – 1) + (1/8) y(n – 2) = x(n) + (1/3)x(n – 1)	10
3	Obtain the cascade and parallel form realizations for the following system y(n) = -0.1(n-1) + 0.2 y (n-2) + 3x (n) +3.6 x (n-1) +0.6 x (n-2)	10
4	Obtain the Direct form II y (n) = -0.1(n-1) + 0.72 y(n-2) + 0.7x(n) -0.252 x(n 2)	5
5	(i). Derive the signal to quantization noise ratio of A/D converter. (ii). Compare the truncation and rounding errors using fixed point and floating point representation.	10
6	Obtain the i) Direct forms ii) cascade iii) parallel form realizations for the following systems y (n) = 3/4(n-1) – 1/8 y(n-2) + x(n) +1/3 x(n-1)	10
7	The step response of an LTI system is S(n)= (1/3^(n-1) u(n+2) find the system function H(z).	5
8	Obtain the i) Direct forms ii) parallel form realizations for the following systems y (n) = x(n) +1/3 x(n-1)-1/5 x(n-2)	10
9	Find the response of y(n)+y(n+1)-2y(n-2)=u(n-1)+2u(n-2) due to y(-1)=0.5;y(-2)=0.25.	5
10	Explain the finite word length effects in digital filter.	5
11	Short notes on a) Limit Cycles b) Overflow Oscillations c) Dead band effects	10
12	Discuss in detail the errors resulting from rounding and truncation.	10

Objective Questions

UNIT - 1 :Introduction: Multirate Digital Signal Processing: Multirate Digital Signal Processing:

SR. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION
1	A signal can be represented in	time domain	frequency domain	both (a) and (b)	none of these	3
2	$\delta(n) =$	$u(n) + u(n-1)$	$u(n)\,u(n-1)$	$u(n) - u(n-1)$	$u(n-1) - u(n)$	2
3	A deterministic signal has	no uncertainty	uncertainty	partial uncertainity	none of these	1
4	A random signal has	no uncertainty	uncertainity	partial uncertainity	none of these	2
5	The fundamental period of a discrete-time complex exponential sequence is $N =$	$\frac{2\pi}{\omega_0}$	$\frac{2\pi}{m}\omega_o$	$\frac{2\pi}{\omega_0}m$	$2\pi m\omega_0$	3
6	The fundamental period of a sinusoidal sequence is $N =$	$2\pi m$	$\frac{\omega_0}{2\pi m}$	mw_0	$\frac{2\pi}{\omega_0}m$	4
7	A signal is an energy signal if	E = 0, P = 0	E = ∞, P = finite	E = finite, P = 0	E = finite, P = ∞	3
8	A signal is a power signal if	P = finite, E = 0	P = finite, E = ∞	P = finite, E = finite	P = ∞, E = ∞	2
9	The signal $\alpha^n u(n)$ is a power signal if	$\lvert\alpha\rvert < 1$	$\lvert\alpha\rvert > 1$	$\lvert\alpha\rvert = 1$	$\lvert\alpha\rvert = 0$	1
10	A system whose output depends on future inputs is a	static system	dynamic system	non-causal system	both (b) and (c)	4
11	y(n) = x(n + 2) is for a	linear system	dynamic system	both linear and dynamic system	non-linear system	3
12	y(n) = x(n) + nx(n – 1) is for a	dynamic system	causal system	linear system	all of these	4
13	A system which has a unique relation between its input and output is called	linear system	causal system	time-invariant system	invertible system	4
14	The commutative property of convolution states that	x(n) * h(n) = h(n) * x(n)	[x(n) * h1 (n)] * h2 (n) = x(n) *[h1 (n) * h2 (n)]	x(n) *[h1(n) + h2 (n)] = x(n) * h1(n) + x(n) * h2 (n)	none of these	1
15	The distributive property of convolution states that	x(n) * h(n) = h(n) * x(n)	[x(n) * h1 (n)] * h2 (n) = x(n) *[h1 (n)	x(n) *[h1(n) + h2 (n)] = x(n) * h1(n) + x(n) * h2	none of these	3
16	For a non-causal system h(n) excited by a non-causal input x(n), the output y(n) is given by	$y(n) = \sum_{k=0}^{\infty} x(k)h(n-k)$	$y(n) = \sum_{k=-\infty}^{\infty} x(k)h(n-k)$	$y(n) = \sum_{k=-\infty}^{n} x(k)\,h(n-k)$	$y(n) = \sum_{k=0}^{n} x(k)\,h(n-k)$	1
17	For a causal system h(n) excited by a causal input x(n), the output y(n) is given by	$y(n) = \sum_{k=-\infty}^{\infty} x(k)h(n-k)$	$y(n) = \sum_{k=0}^{\infty} x(k)h(n-k)$	$y(n) = \sum_{k=-\infty}^{n} x(k)\,h(n-k)$	$y(n) = \sum_{k=0}^{n} x(k)\,h(n-k)$	3
18	If x(n) = {1, 2, 3, 0} and h(n) = {3, 1, 0, 0, 0}, the length of y(n) = x(n) * h(n) is	8	7	9	none of these	1
19	x(n) = {1, 2, 3, 0, 4, 0, 6}, then circularly shifted signal x(n – 2) =	{0, 6, 1, 2, 3, 0, 4}	{0, 0, 1, 2, 3, 0, 4}	{0, 0, 1, 2, 3, 0, 4, 0, 6}	{-1, 0, 1, 0, 2, 0, 4}	1
20	Decimation results in	decrease in sampling rate	increase in sampling rate	no change in sampling rate	random change in sampling rate	1
21	Interpolation results in	decrease in sampling rate	increase in sampling rate	no change in sampling rate	random change in sampling rate	2

22	The down-sampled signal is obtained by multiplying the sequence x(n) with	impulse function	unit step function	train of impulses	unit sample function	3
23	Anti-aliasing filter is to be kept	before down sampler	after down sampler	before up sampler	after up sampler	1
24	Up sampler and down sampler are	time-varying systems	time-invariant systems	unpredictable systems	may be time-varying or time-	1
25	Up sampling by a factor of I introduces	I zeros between samples	I – 1 zeros between samples	no zeros	I/2 zeros between samples	2
26	Down sampling by a factor of D skips	D samples	D - 1 samples	no samples	D/2 samples	2
27	A delay of D sample periods before a down sampler is the same as a delay of how many sample periods after the down sampler.	D	1	D/2	D - 1	2
28	A delay of one sample period before up sampling leads to a delay of how many sample periods after up sampling.	I	I - 1	I/2	I	1
29	A cascade of a factor of D down sampler and a factor of I up-sampler is interchangeable with no change in the input and output relation if	D and I are integers	D and I are co-prime	D and I are rational	D and I are finite	1
30	If x(n) = {1, 2, 3, 4, 5, 6, 7, ...}, then x(2n) =	{2, 4, 6, 8, 10, ...}	{1, 0, 2, 0, 3, 0, 4, 0, 5, 0, 6, 0, ...}	{1, 3, 5, 7, ...}	{1, 0, 0, 2, 0, 0, 3, 0, 0, 4, 0, 0, 5, 0, 0 ...}	1
31	If x(n) = {1, 2, 3, 4, 5, 6, 7, ...}, thenx(n/2)=	{1, 0, 2, 0, 3, 0, 4, 0, 5, 0, 6, 0, ...}	{1/2, 2/2, 3/2, 4/2, 5/2, 6/2, 7/2,....}	{1, 3, 5, 7, ...}	{2, 4, 6, 8, 10, ...}	3
32	The total solution of the difference equation is given as	yp(n)-yh(n)	yp(n)+yh(n)	yh(n)-yp(n) $c(-a)^n$	None of the mentioned $c(-a)^{-n}$	2
33	What is the homogenous solution of the system described by the first order difference equation	$c(a)^n$(where 'c' is a constant)	$c(a)^{-n}$			3
34	The solution obtained by assuming the input x(n) of the system is zero is	General solution	Particular solution	Complete solution	Homogenous solution	4
35	Zero-state response is also known as	Free response	Forced response	Natural response	None of the mentioned	2
36	If the system is initially relaxed at time n=0 and memory equals to zero, then the response of such state is called as	Zero-state response	Zero-input response	Zero-condition response d	None of the mentioned	1
37	x(n)*δ(n-n0)=?	x(n+n0)	x(n-n0)	x(-n-n0)	x(-n+n0)	2
38	FIR Filter is one whose impulse response is	Zero	One	Finite	Infinite	3
39	The necessary and sufficient condition for causality of an LTI system is	h(n) =0 for n=0	h(n) =0 fo r n> 0	h(n) =0 for n<0	none	3
40	A System is said to be stable if and only if	The poles lies on unit circle	The poles lies outside the unit	The poles lies inside the unit circle	Pole=0	3
41	For Recursive Realization the current output y(n) is a function of	Past outputs, present input &past	Past inputs, Present &past	Present & past outputs	None	1
42	Sampling Theorem states that	$f_s \geq 2f_m$	$f_s \geq f_m$	. $f_s \leq 2f_m$	$f_s \leq f_m 4$	1
43	Which of the following is done to convert a continuous-time signal into discrete-time	Modulating	Sampling	Differentiating	Integrating	2
44	The solution that we obtain when we assume the input x(n) of a system = 0 is _____.	Homogenous solution	Complete solution	Particular solution	General solution	1
45	In the Overlap save method in case of the long sequence filtering, then how many zeros do we	L-1	. L+1	L	L+M	1

46	If x(n) is a discrete-time signal, then the value of x(n) at non integer value of 'n' is?	Zero	Positive	Negative	Not defined	4
47	What is the condition for a signal where to be called as an	0<r<∞	0<r<1	r>1	r<0	2
48	Which of the following is the disadvantage of sampling rate conversion by converting the	Signal distortion	Quantization effects	New sampling rate can be arbitrarily selected	Signal distortion & Quantization	4
49	In which of the following, sampling rate conversion are used?	Narrow band filters	Digital filter banks	Quadrature mirror filters	All of the mentioned	4
50	x(-n+2) is obtained by which of the following operatio n	x(-n) is shifted left by 2 samples	x(-n) is shifted right by 2 samples	x(n) is shifted left by 2 samples	none	2

UNIT - 2 :Discrete Fourier series: Fast Fourier Transforms:

SR. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION
1	DTFT is a periodic function with a period of	∏	0	2∏	Infinity	1
2	DFT performs filtering operation in	time domain	frequency domain	both time and frequency domains	none of these	2
3	The DFT of x(n), i.e. X(k) is defined as X(k) =	$X(\omega)\|_{\omega=\frac{2\pi k}{N}}$	$X(\omega)\|_{\omega=2\pi k}$	$X(\omega)\|_{\omega=\frac{2\pi n}{N}}$	$X(\omega)\|_{\omega=2\pi n}$	1
4	The DTFT is the Z-transform evaluated along the	imaginary axis of z-plane	real axis of z-plane	unit circle in z-plane	entire z-plane	3
5	DFT {δ(n)} =	2∏	∏	$\frac{1}{N}$ 1	$\frac{1}{N}$ 0	3
6	The IDFT of X(k) is given by x(n) =	$\frac{1}{N}$ [DFT{X*(k)}]*	$\frac{1}{N}$ [IDFT{X*(k)}]*	[DFT{X(k)}]*	[IDFT{X(k)}]*	2
7	$DFT\ [x_1(n)x_2(n)]$ =	$\frac{1}{N}[X_1(k)X_2(k)]$	$\frac{1}{N}[X_1(k) \oplus X_2(k)]$	N $[X_1(k)X_2(k)]$	N $[X_1(k) \oplus X_2(k)]$	2
8	For radix-2 FFT , N must be a power of _____	2	4	8	1	1
9	Appending zeros to a sequence in order to increase the size or length of the sequence is called _____	Zero padding	Zero adding	Zero deleating	none	1
10	DIT algorithm divides the sequence into	Positive and negative values	Even and odd samples	Upper higher and lower spectrum	Small and large samples	2
11	The computational procedure for Decimation in frequency algorithm takes	Log2 N stages	Log2 N2 stages	Log2 N/2 stages	2Log2 N stages	1
12	The similarity between the Fourier transform and the z transform is that	Both convert frequency spectrum domain to discrete time domain	Both convert discrete time domain to frequency spectrum domain	Both convert analog signal to digital signal	Both convert digital signal to analog signal	2
13	The overlap save method is used to calculate	The discrete convolution between a sampled signal and a finite impulse response (FIR) filter	The discrete convolution between a sampled signal and an infinite impulse response (IIR) filter	The discrete convolution between a very long signal and a finite impulse response (FIR) filter	The discrete convolution between a very long signal and a infinite impulse response (IIR) filter	3
14	If x(n) and X(k) are an N-point DFT pair, then X(k+N)=	X(-k)	-X(k)	X(k)	-X(-k)	**3**
15	DFT is applied to	Infinite sequences	Finite discrete sequences	Continuous infinite signals	Continuous finite sequences	2
16	Role of the Anti-aliasing filter is to remove	low frequency	high frequency	medium frequency	All frequency	2
17	The circular convolution of two sequences in time domain is equivalent to	Multiplication of DFTs of two sequences	Summation of DFTs of two sequences	Difference of DFTs of two sequences	Square of multiplication of DFTs of two sequences	1

18	Which of the following is true in case of Overlap add method?	M zeros are appended at last of each data block	M zeros are appended at first of each data block	M-1 zeros are appended at last of each data block	M-1 zeros are appended at first of each data block	3
19	The methods used to find the circular convolution of two sequences are	Concentric circle	Matrix multiplication	Both a&b	none of these	1
20	The number of stages for N=16 in DIT-FFT are	8	4	2	16	2
21	For DIT-FFT the input sequence is _____ & the output sequence is in _____ order	Natural, Bit Reversal	Bit Reversal,Natural	Bit Reversal, Bit Reversal	Natural,Natural	2
22	Applications of FFT Algorithm	Linear Filtering	Correlation	Spectrum Analysis	all of the above	4
23	In radix – 2 FFT, the total no. of complex additions are reduced to	$\log_2^N$	N $\log_2^N$	m $\log_2^N$	N log2m	2
24	In direct computation of DFT, the total no. of complex multiplications are given by	N	N^2	$2N^2$	N/2	2
25	Circular convolution between two finite length sequence is equal to-_____ of their	Sum	Linear Convolution	Product	Difference	2
26	DFT performs filtering operation in	time domaun	frequency domain	both the time and frequency domain	none	2
27	Twiddle factor is W_N=	$e^{j2\pi/N}$	$e^{j\pi/N}$	$e^{-j2\pi/N}$	$e^{-j\pi/N}$	3
28	The DTFT of the z transform evaluated along the	imaginary axis of z-plane	real axis of Z-Plane	Unit circle in Z-Plane	entire Z-Plane	3
29	The no.of complex multiplications involved in the direct evoluation 8-point DFT	8	64	16	56	2
30	Which of the following is true regarding the number of computations required to compute an N-point DFT?	N^2 complexmultiplications and N(N-1) complex additions	N^2 complexadditions and N(N-1) complex multiplications	**N^2 complexmultiplications and N(N+1) complex additions**	N^2 complexadditions and N(N+1) complex multiplications	3
31	Which of the following is true regarding the number of computations required to compute DFT at any one value of 'k'?	4N-2 real multiplications and 4N real additions	4N real multiplications and 4N-4 real additions	4N-2 real multiplications and 4N+2 real additions	4N real multiplications and 4N-2 real	4
32	$W_N^{k+N/2}$=	W_N^k	$-W_N^k$	W_N^{-k}	None	2
33	The computation of XR(k) for a complex valued x(n) of N points requires:	$2N^2$ evaluations of trigonometric functions	$4N^2$ real multiplications	4N(N-1) real additions	All of the mentioned	4
34	If the arrangement is of the form in which the first row consists of the first M elements of x(n), the second row consists of the next M elements of x(n), and so on, then which of the following mapping represents the above arrangement?	n=l+mL	n=Ml+m	n=ML+l	None	2
35	If N=LM, then what is the value of W_N^{mqL}?	W_M^{mq}	W_L^{mq}	W_N^{mq}	None	1
36	How many complex multiplications are performed in computing the N-point DFT of a sequence using divide-and-conquer method if	N(L+M+2)	N(L+M-2)	N(L+M-1)	N(L+M+1)	4

37	How many complex additions are performed in computing the N-point DFT of a sequence using divide-and-conquer method if N=LM?	N(L+M+2)	N(L+M-2)	N(L+M-1)	N(L+M+1)	2
38	If we store the signal row wise and compute the L point DFT at each column, the resulting array must be multiplied by which of the following factors?	W_N^{lq}	W_N^{pq}	W_N^{lq}	W_N^{pm}	4
39	Convolution of long sequences can be done using _____ convolutions					sectioned
40	The two methods of section convolution are _____ method and _____ method.					overlap add,overlap save
41	The Direct computation of DFT requires _____ real multiplications and _____ real additions					N^2, N(N-1)
42	The FFT may be defined as an _____ or computing DFT.					algorithm
43	The basic FFT algorithms are ____ and _____.					DIT FFT, DIF FFT
44	For DIT FFT the input is in _____ order and the output is in _____ order.					Bit Reversal, Natural
45	For DIF FFT the input is in _____ order and the output is in _____.					Natural, Bit Reversal
46	The computation 64 point DFT by radix-2 DIF FFT involves _____stages of computation.					six
47	The number of complex additions involved in direct computation of 8-point DFT is _____.					64
48	In radix-2 DFT ___ butterflies per stage are required to present the computational process.					N/2
49	The signal flow graph for computing DFT by radix-2 FFT is also called-_____ diagram					BUTTERFLY
50	The expansion of FFT is _____					fast fourier transform

UNIT - 3 :IIR Digital Filters

SR. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION
1	In the Frequency Transformations of the analog domain the transformation is	Low Pass to Lowpass	Lowpass to Highpass	Lowpass to Bandpass	Lowpass to Bandreject	2
2	In the Frequency Transformations of the analog domain the transformation is	Low Pass to Lowpass	Lowpass to Highpass	Lowpass to Bandpass	Lowpass to Bandreject	4
3	The magnitude response of the following filter decreases monotonically as frequency increases	Butterworth Filter	Chebyshev type - 1	Chebyshev type - 2	FIR Filter	1
4	The transition band is more in	Butterworth Filter	Chebyshev type - 1	Chebyshev type - 2	FIR Filter	1
5	The poles of Butterworth filter lies on	sphere	circle	ellipse	parabola	2
6	I I R digital filters are of the following nature	Recursive	Non Recursive	Reversive	Non Reversive	1
7	In I I R digital filter the present output depends on	Present and previous Inputs only	Present input and previous outputs only	Present input only	Present Input, Previous input and output	4
8	Which of the following is best suited for I I R filter when compared with the FIR filter	Lower sidelobes in stopband	Higher Sidelobes in stopband	Lower sidelobes in Passband	No sidelobes in stopband	1
9	In the case of I I R filter which of the following is true if the phase distortion is tolerable	More parameters for design	More memory requirement	More memory requirement	Higher computational complexity	3
10	A causal and stable I I R filter has	Linear phase	No Linear phase	Linear amplitude	No Amplitude	2
11	Neither the Impulse response nor the phase response of the analog filter is Preserved in the digital filter in the following method	The method of mapping of differentials	Impulse invariant method	Bilinear transformation	. Matched Z - transformation technique	3
12	Out of the given I I R filters the following filter is the efficient one	Circular filter	Elliptical filter	Rectangular filter	Chebyshev filter	2
13	What is the disadvantage of impulse invariant method	Aliasing	one to one mapping	anti aliasing	warping	1
14	Which of the I I R Filter design method is antialiasing method?	The method of mapping of differentials	Impulse invariant method	Bilinear transformation	Matched Z - transformation technique	3
15	The nonlinear relation between the analog and digital frequencies is called	aliasing	warping	prewarping	antialiasing	2
16	The most common technique for the design of I I R Digital filter is	Direct Method	In direct method	Recursive method	non recursive method	2
17	In the design a IIR Digital filter for the conversion of analog filter in to Digital domain the desirable property is	The axis in the s - plane should map outside the unit circle in the z - Plane	The Left Half Plane(LHP) of the s - plane should map in to the unit circle in the Z - Plane	The Left Half Plane(LHP) of the s-plane should map outside the unit circle in the z-Plane	The Right Half Plane(RHP) of the s-plane should map in to the unit circle in the Z - Plane	2
18	In the IIR filter Design method by approximation of derivatives as Ω varies from to ∞ , the corresponding locus of a point in the zplane is a circle with radius and center	0,0	1,1	1,-1	none	4
19	The I I R filter design method thatovercomes the limitation of applicability to only Lowpass filter and a limited class of bandpass filters is	Approximation of derivatives	Impulse Invariance	Bilinear Transformation	Frequency sampling	2
20	_____ is more in Butterworth filter when compared to chebyshev filter	Pass band	Stop band	Transition Band	Both a&b	1

21	For Recursive Realization the current output y(n) is a function of	Past outputs, present input &past input	Past inputs, Present &past outputs	Present & past outputs	None	1
22	Filters designed by considering _____ samples of the impulse response are called IIR filters.					all the infinite
23	The physically realizable IIR filters donot have _____.					linear phase
24	The IIR filter specification includes the desired characteristics for the _____ response only					magnitude
25	Filters designed by considering_____ samples of the impulse response are called FIR filters.					all the finite
26	The impulse response is obtained by taking the inverse fourier transform of_____					ideal frequency response
27	The bandwidth of the discrete signal is limited by _____					sampling frequency
28	The popular methods for design of IIR digital filters uses the techniques of _____ an analog filter in to an _____ digital filter					transforming, equivalent
29	The bandwidth of the real discrete signal is _____ the sampling frequency.					half
30	The three techniques used to transform an analog filter to digital filter are _____					approximation of derivatives, impulse invariant transformation and bilinear transformation.
31	The two properties which are to be preserved in analog to digital transformation are_____					causality and stability.
32	The tolerance in the passband and stopband are called _____.					ripples
33	In _____ transformation the impulse response of digital filter is the sampled version of the impulse response of analog filter					impulse invariant
34	In impulse invariant transformation , _____ poles of s-plane are mapped into the _____ of unit circle in z-plane.					the left half, exterior
35	In impulse invariant transformation ,_____ poles of s-plane are mapped into the exterior of unit circle in z-plane					the right half, exterior
36	In impulse invariant transformation , any strip of width _____ in s-plane are mapped into the entire z-plane					2π/T
37	The phenomenon of high frequency components acquiring the identity of low frequency components is called					aliasing
38	_____ is higher frequencies impersonating low frequencies.					Aliasing
39	Aliasing occurs only in _____ transformation					impuse invarient
40	The impulse invariant mapping is _____ mapping, whereas bilinear mapping is a _____ mapping.					many to one, one to many
41	The _____ due to nonlinear relationship between analog and digital frequencies is called frequency warping.					distortion in frequency axis
42	In bilinear transformation , the effect of warping on _____ can be eliminated by _____ the analog filter.					magnitude response, pre wraping

43	A linear phase analog filter cannot be transformed into a linear phase digital filter using _____ transfer function.					bilinear
44	the two popular techniques used to approximate the ideal frequency response are _____ and _____.					butterwoth,chebyshev
45	In _____ approximation ,the magnitude response is maximally flat at the origin and monotonically dicreases with increase in frequency.					butterworth
46	at the cutoff frequenc the magnitude of the butterworth filter is _____ times the maximum value.					1/√2
47	In _____ approximation ,the magnitude response is equiripple in the passband and monotonic in the stopband.					type-1 chebyshev
48	In _____ approximation ,the magnitude response is monotonic in the passband and equiripple in the stopband.					type-2 chebyshev
49	IIR Filters are _____ type.					recursive
50	Butterworth filters have _____ region.					wide band transition

UNIT - 4 : FIR Digital Filters

SR. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION
1	The ideal filters are:	causal	non-causal	may be causal or may not be causal	none of these	2
2	In Fourier series method to get the transfer function of realizable filter, H(z) is to be multiplied by	$z^{-(N-1)/2}$	$z^{(N-1)/2}$	$z^{-(N-1)}$	$z^{(N-1)}$	1
3	The abrupt truncation of Fourier series results in oscillations in	stop band	pass band	both pass band and stop band	none of these	3
4	The frequency response of a digital filter is	periodic	non periodic	may be periodic or non periodic	none of these	1
5	For rectangular window the main lobe width is equal to	2∏/N	4∏/N	8∏/N	12∏/N	2
6	For Hanning window, the width of the main lobe is equal to	2∏/N	4∏/N	8∏/N	12∏/N	3
7	For Hamming window, the width of the main lobe is equal to	2∏/N	4∏/N	8∏/N	12∏/N	3
8	For Blackman window, the width of the main lobe is equal to	2∏/N	4∏/N	8∏/N	12∏/N	4
9	For Kaiser window, the width of the main lobe is	4∏/N	8∏/N	12∏/N	Adjustable	4
10	For rectangular window, the peak side lobe magnitude in dB is	-13	-31	-41	-58	1
11	For Hanning window, the peak side lobe magnitude in dB is	-13	-31	-41	-58	2
12	For Hamming window, the peak side lobe magnitude in dB is	-13	-31	-41	-58	3
13	For Blackman window, the peak side lobe magnitude in dB is	-13	-31	-41	-58	4
14	The phase of a linear phase FIR filter of length N = 13 is	6ω	13ω	.-6ω	.-13ω	3
15	The approximate transition width of main lobe of the frequency response of a rectangular window of length M-1 is _____.	12∏/M	6∏/M	8∏/M	4∏/M	4
16	FIR stands for ____	Finite Impulse Filter	Infinite Impulse Filter	Finite Impedance Filter	Finite Impulse Fire	1
17	Filters are classified in to ___ number of types?	2	4	5	6	1
18	Which of the following is the impulse response of FIR filter?	Infinite	Finite	Zero	Negitive	2
19	FIR filters operate on ___ type of input values?	Present	Past	Next	Both a and b	4
20	FIR filter is also called ____?	Recursive filter	Non-recursive	Higher resistance	Lower resistance	2
21	The output obtained from FIR filter is _____ form?	Linear	Nonlinear	Abrupt	Both b and c	1
22	FIR filter implements _____ transfer function?	Zero	Uni	Bi	Multi	1
23	Which of the following are the special type of FIR filter?	Boxcar	Hilbert Transformer	Differentiator	All of the above	4
24	Which of the following is the impulse response of Nth order discrete time FIR filter before it reaches to zero?	N+1 samples	N-1 samples	N samples	2N samples	1
25	A filter allows _____ component of signal?	AC	DC	Zero	Both a and b	1
26	A filter does not allows _____ component of signal?	AC	DC	Zero	Both a and b	2
27	Which of the following is the formula of symmetric impulse response of FIR filter?	h(n)= h(N-1-n)	h(n)= -h(N-1-n)	h(n)= h(N-1+n)	h(n)= h(N-1/n)	1

28	Which of the following are requirements for designing a FIR filter?	Implementation	Specification	Components used	All the above	4
29	Which of the following software is used for designing filter?	MATLAB	GNU octave	Scilab	All the above	4
30	Which of the following are the properties of FIR?	Zero Feedback	Inherent Stability	Phase is linear	All of the above	4

Unit 5: Realization of Digital Filters

SR. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION
1	A system whose output y(n) at time n depends on any number of past output values is called a	recursive system	non-recursive system	causal system	non-causal system	1
2	A system whose output y(n) at time n depends only on present and past input values is called a	recursive system	non-recursive system	causal system	non-causal system	2
3	The structure which uses less number of delay elements is	direct form-I	direct form-II	cascade form	parallel form	2
4	The number of multipliers required for the realization of FIR systems is reduced if we choose	direct form	cascade form	parallel form	linear phase realization	4
5	The basic elements used to construct the block diagram of a discrete-time system are _____,_____ ,_____ .	adder	constant multiplier	unit delay	all of the above	4
6	_____ refers to the number of memory locations required to store the system parameters, past inputs and outputs and any intermediate computed values.	memory requirements	address lines	data lines	multipliers	1
7	_____ refer to the quantization effects that are inherent in any digital implementation of the system, either in hardware or in software.	Ininite word length effects	Quantization	dead aband	Finite word length effects	4
8	_____ structure provides a direct relation between time domain and z-domain equations.	direct form-I	direct form-II	cascade	parallel	1
9	Direct form-II realization of discrete-time systems uses less number of _____ than direct form-I realization.	subtractor	delay elements	adder	multipliers	2
10	In FIR systems, for linear phase response, the _____ should be symmetrical.	impulse response	step response	Sine response	non of the above	1
11	Linear phase results in reduction of the number of _____ required for the realization of FIR system.	subtractor	delay	adder	multipliers	4
12	In recursive systems, which of the following is caused because of the nonlinearities due to the finite-precision arithmetic operations?	Periodic oscillations in the input	Non-Periodic oscillations in the input	Non-Periodic oscillations in the output	Periodic oscillations in the output	4
13	Limit cycles in the recursive are directly attributable to which of the following?	Round-off errors in multiplication	Overflow errors in addition	Both of the mentioned	None of the mentioned	3
14	What is the range of values called as to which the amplitudes of the output during a limit cycle ae confined to?	Stop band	Pass band	Live band	Dead band	4
15	Which of the following is true when the response of the single pole filter is in the limit cycle?	Actual non-linear system acts as an equivalent non-linear system	Actual non-linear system acts as an equivalent linear system	Actual linear system acts as an equivalent non-linear system	Actual linear system acts as an equivalent linear system	2
16	What is the set of all values of z for which X(z) attains a finite value?	Radius of convergence	Radius of divergence	Feasible solution	None of the mentioned	1
17	What are the values of z for which the value of X(z)=∞?	Poles	Zeros	Solutions	None of the mentioned	1
18	What are the values of z for which the value of X(z)=0?	Poles	Zeros	Solutions	None of the mentioned	2
19	If all the poles of H(z) are outside the unit circle, then the system is said to be _____	Only causal	Only BIBO stable	BIBO stable and causal	None of the mentioned	2
20	If one or more poles are located near the unit circle, then the rate of decay of signal is _____	Slow	Constant	Rapid	None of the mentioned	1
21	How is the sensitivity of filter coefficient quantization for FIR filters?	Low	High	Moderate	Unpredictable	1
22	For recursive filterswith a zero or constant input, this nonlinearity can cause spurious oscillations called _____	limit cycles	truncation error	multipliers	delay elements	1
23	_____ is introduced when the number is represented by reduced no.of bits.	quantization	truncation error	limit cycles	addition	2
24	If all the poles of H(z) are outside the unit circle, then the system is said to be	Only causal	Only BIBO stable	BIBO stable and causal	BIBO Unstable	4

VLSI DESIGN

EC603PC: VLSI DESIGN

B.Tech. III Year II Semester

L	T	P	C
3	1	0	4

UNIT-I:
Introduction: Introduction to IC Technology-MOS, PMOS, NMOS, CMOS and BICMOS.
Basic Electrical Properties: Basic Electrical Properties of MOS and BICMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit wo, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT-II:
VLSI Circuit Design Processes: VLSI Design flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT-III:
Gate Level Design: Logic Gates and Other complex gates, switching logic, alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan-in, Fan-out, Choice of layers.

UNIT-IV:
Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, comparators, Zero/One Detectors, Counters.
Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT-V:
Programmable Logic Devices: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.
CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test techniques.

TEXT BOOKS:
1.Essentials of VLSI circuits and systems- Kamran Eshraghian, Eshraghian Douglas and A. Pucknell , PHI, 2005 Edition.
2. CMOS VLSI Design- A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.
3. VLSI Design- M.Micheal Vai, 2001, CRC Press.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective- Ming-BO- Lin, CRC, Press, 2011.
2. CMOS logic circuit Design- John.P.Uyemura, Springer, 2007.
3. Modern VLSI Design-Wayne Wolf, Pearson education, 3rd Edition, 1997.
4. VLSI Design –K.Lal Kishore, V.S.V.Prabhakar, I.K International, 2009.
5. Introduction to VLSI- Mead and Convey, BS Publications, 2010.

B.Tech III Year II Sem – VLSI Design - Session Plan

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
1	22.03.2021	Introduction to IC Technology	Introduction to IC and levels of integration and Moore's Law	Lecture	L1		**T1**:1.1-1.3 **T2**: 2.1
2	24.03.2021	MOS, PMOS, NMOS, CMOS and Bi -CMOS Technologies Number Systems, Storing Integer and Real Numbers Computing Environments, Computer Languages	MOS working	Lecture	L2		**T1**:1.4- 1.6
3	25.03.2021		NMOS Fabrication, PMOS Fabrication	Lecture	L3		**T1:**1.7 **T2:**3.2 **R3**:2.2-2.4
4	26.03.2021		CMOS in n-well and p-well	Lecture	L4		**T1** : 1.8,1.8.1-1.8.2 **T2:** 3.1.1,3.1.2 **R2:** 4.1 to 4.3
5	26.03.2021		CMOS in Twin-tub	ITL(Case Study)	L5	LG1,LG2	**T1** : 1.8.3
6	31.03.2021		BICMOS Fabrication, Comparison of Bipolar and CMOS technologies	Lecture	L6		**T1** : 1.10
7	01.04.2021	Basic electrical properties of MOS and Bi- CMOS Devices	Working and I_D vs V_D characteristics of MOS and Bipolar devices	Lecture	L7		**T1:** 2.1 **T2 :** 2.2 **R3 :**3.3
8	05.04.2021		Derivation of I_D for MOSFET	Lecture	L8		**T1:** 2.1

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
			in various operating regions				**T2 :** 2.2.1 **R3 :**3.3.1,3.3.2
9	07.04.2021		MOS transistor threshold voltage equation, gm, gds, figure of merit, MOS models, secondary effects in MOS	Lecture	L9		**T1:** 2.2 to 2.4, 2.11,2.12.1.1,2.12.2 **T2 :** 2.2.1-2.3.4 **R3 :**3.3.2
10	08.04.2021	Pass transistor	Pass transistor logic with its working, advantages and disadvantage.	Lecture	L10		**T1 :** 2.5 **R3 :**6.2.3
11	09.04.2021	NMOS inverter, various Pull ups	Inverter using only NMOS devices, Resistor used as pull up, Enhancement and depletion NMOS as pull up, Depletion PMOS as pull up	Lecture	L11		**T1 :** 2.6, 2.9, 2.10 to 2.12 **T2 :** 2.4
12	09.04.2021		Pull up and Pull down ratios of NMOS inverter	Lecture	L12		**T1 :** 2.7-2.8
13	15.04.2021	CMOS inverter analysis & Design	Circuit working and transfer characteristics of CMOS inverter	ITL(Seminar)	L13	LG3,LG4	**T1 :** 2.10 **T2:** 2.3
14	16.04.2021		Design of inverter in terms of pull up and pull down sizes	Lecture	L14		**R3** :5.2,5.3
15	16.04.2021	Bi-CMOS inverters	Various circuits for Bi CMOS inverters with their comparisons	Lecture	L15		**T1 :** 2.12.3 **T2 :** 2.8.3

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
16	19.04.2021	VLSI Design flow, MOS layers, layers of abstraction	Various stages for designing VLSI circuits, layers in MOS devices and abstraction layers in MOS,	Lecture	L16		**T1 :** 3.1, 3.2 **R2 :** 4.4 **R4 :** 2.2
17	22.04.2021	Stick diagrams	Stick diagrams for AND, OR, NAND, NOR gates	Lecture	L17		**T1 :** 3.2.1, 3.2.2 **R4 :** 2.6.2
18	23.04.2021		Stick diagrams for XOR and XNOR gates	Lecture	L18		**T1 :** 3.2.1, 3.2.2 **R4 :** 2.6.2
19	23.04.2021		2µm CMOS layout design rules for transistors, wires, contacts etc.	ITL(Seminar)	L19	LG5,LG6	**T1 :** 3.3 to 3.6 **T2 :** 3.4 **R4 :** 2.5
20	26.04.2021		Examples of stick diagrams	Lecture	L20		**T1 :** 3.7
21	28.04.2021	Layout diagrams	Layout diagrams for inverter, XOR gates	Lecture	L21		**T1 :** 3.7, 3.8, 5.1 to 5.6 **T2 :** Plates 1 to 13 **R4 :** 2.6
22	29.04.2021		Layout diagrams for NAND, NOR, XOR gates	Lecture	L22		
23	30.04.2021		Layout diagrams for XNOR gate, Scaling of MOS circuits, Limitations of scaling	Lecture	L23		
24	30.04.2021		Layout diagrams for gates using various pull ups	Lecture	L24		
25	03.05.2021		Design examples of logic	ITL(Case Study)	L25	LG7,LG8	**T1 :** 6..3.1 to

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
		Logic gates and other complex gates, Other complex gate design, switch logic, alternate gate circuits	gates using CMOS				6.3.4.5 **R3 :** 4.3 **R4 :** 3.2, 3.3.1
26	05.05.2021		Dynamic CMOS logic: working and drawbacks, alternate gates CMOS logic	ITL(Group Discussion)	L26	LG9,LG10,LG11	
27	06.05.2021		Domino logic with example, Switch logic: Transmission gate With example	ITL(Group Discussion)	L27	LG12,LG13,LG14	**T1 :** 6.2.1 **T2:** 2.6 **R3 :** 6.2.3
28	07.05.2021	Basic circuit concepts	Sheet Resistance Rs and its concept to MOS, area capacitance unit, calculation of Time delays, driving large capacitive loads	Lecture	L28		**T1 :** 4.1 to 4.9 **T2 :** 4.3 to 4.5 **R2 :** 8.1, 8.2 to 8.3 **R4 :** 3.7
29	07.05.2021	Wiring capacitances	Wiring capacitances, fan in & fan out, choice of layers.	Lecture	L29		**T1 :** 4.10-4.12 **T2 :** 5.2
30	10.05.2021	Subsystem design: Shifters	Design of Barrel shifter, logarithmic shifter	Lecture	L30		**T2 :** 11.5 **R4 :** 6.3
31	12.05.2021	Adders	Ripple carry adder, Carry look ahead adder	Lecture	L31		**T1 :** 8.3.1, 8.3.1.1,8.4.1, 8.4.2
32	13.05.2021		Carry save adder, Carry propagate	Lecture	L32		**R3 :** 11.3 **R4 :** 6.4

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
			adder, carry skip adder				
33	07.06.2021	ALU	Design of ALU	Lecture	L33		Multipliers
34	09.06.2021	Multipliers	Array multiplier: Series parallel multiplier	ITL(Seminar)	L34	LG15,LG16	**T1:** 8.5.1 **T2 :** 8.2.7.1 **R4 :** 6.6
35	10.06.2021		Wallace tree multiplier	Lecture	L35		**T1 :** 8.5.6 **T2:** 8.2.7
36	11.06.2021		Booth's multiplier	Lecture	L36		**T1 :** 8.5.5
37	11.06.2021	Parity generators	Design parity generator	Lecture	L37		**T1 :** 6.4.1 **T2 :** 8.2.2
38	14.06.2021	Comparators	Designing comparators	Lecture	L38		**T2 :** 8.2.4
39	16.06.2021	Zero / one detectors	Understanding the working principle and designing the zero/one detector	Lecture	L39		**T2 :** 8.2.4
40	17.06.2021	Counters	Synchronous and asynchronous Counters	ITL(Case Study)	L40	LG17,LG18	**T2 :** 8.2.5
41	18.06.2021	High density memory elements	Classification of memories, ROMs, PROMs: basic structure	Lecture	L41		**T2 :** 8.3.2 **R3 :** 12.1, 12.2.1 **R4 :** 6.7,6.7.1
42	18.06.2021	High density memory elements (contd.)	SRAMs: Working of six transistor (6T) SRAM cell	Lecture	L42		**T1 :** 9.2.5 **T2 :** 8.3.1 **R3 :** 12.2.3

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
							R4 : 6.7.2
43	21.06.2021	High density memory elements (contd.)	DRAMs: Working of 3T and 1T DRAM cell, Serial Access Memories.	Lecture	L43		**T1 :** 9.2.2, 9.2.3 **R3 :** 12.2.3 **R4 :** 6.7.3,6.7.4
44	23.06.2021	PLAs	Full custom and semi custom design, basic structure of PLA	Lecture	L44		**T2 :** 6.3.1-6.3.3 **R4 :** 6.9
45	24.06.2021	FPGAs	Types of FPGAs, Basic architecture of FPGA	ITL(Seminar)	L45	LG19	**R4**:6.8
46	25.06.2021	FPGAs	Types of FUSE technology used and structure of SPARTAN II FPGA	Lecture	L46		**T2 :** 6.3.4
47	25.06.2021	CPLDs	Basic structure of CPLD, inter connect structure in CPLD	Lecture	L47		**T2 :** 6.3.4 **R5 :** 1.1.2
48	28.06.2021	Standard cells	Need of standard cells and their basic structure, gate array logic	Lecture	L48		**T2 :** 6.3.6 **R3 :** 8.4.1 **R5 :** 1.1.2
49	30.06.2021	PALs	Basic structure of Programmable array logic and its families	ITL(Seminar)	L49	LG20	**R5 :** 1.1.2
50	01.07.2021	Design Approach	Design Approach, Parameters influencing low	Lecture	L50		**R5 :** 1.1.3

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
			power design.				
51	02.07.2021	CMOS testing, need for testing	Need for testing, Manufacturing test principles	Lecture	L51		**T1 :** 10.13.1, 10.13.2 **T2 :** 7.1
52	02.07.2021	Design strategies for test	Basic design strategies, types of tests for combinational and sequential circuits	Lecture	L52		**T1 :** 10.13.4 **T2 :** 7.2 **R4 :** 11.6
53	05.07.2021–	Design strategies for test	Practical design for test guidelines	Lecture	L53		**T1 :** 10.13.7 **T2 :** 7.3
54	07.07.2021	System level test techniques	Scan design techniques, Automatic test pattern generation	Lecture	L54		**T1 :** 10.13.8, 10.13.9 **T2 :** 7.4, 7.5
55	08.07.2021	Layout design for improved testability	Measures to be taken and strategies to be followed for optimized design	Lecture	L55		**T2 :** 7.6

S. No	Case Studies	Seminars	Role Plays	Debates	Group Discussions	Quizzes
1	CMOS in twin-tub					2.5 Units, before I mid
2		CMOS Inverter				2.5 Units, before II mid
3		2μm CMOS layout design rules for transistors, wires, contacts etc.				
4	Design examples of logic gates using CMOS					
5					Alternate Gate Circuits	
6		Multipliers(Wallace Tree and Booth's multiplier)				
7	Synchronous and Asynchronous Counters					
8		Types of FPGAs, Basic architecture of FPGA				
9		Basic structure of Programmable array logic and its families				
10		System Level Test Techniques				

Assignment Questions

UNIT-1

1. Explain with neat diagrams the various NMOS fabrication technology
2. Discuss the MOS transistor characteristics in depletion and enhancement modes.
3. Explain Twin-Tub CMOS Fabrication process
4. Explain the BICMOS Fabrication process.
5. a. Compare the CMOS and Bipolar Technologies.
   b. Determine the pull-up and pull down ratio if an NMOS Inverter is driven by another NMOS inverter
6. Find the drain-to-source current versus voltage relationship of IDS vs VDS of NMOS Transistor
7. a. Determine the pull-up and pull down ratio if an NMOS Inverter is driven by one or more pass transistors.
   b. Explain about different level of integration.
8. a. Explain different forms of pull-ups used as load in CMOS and in enhancement and depletion modes of nMOS.
   b. Define i. Photolithography ii. Oxidations iii. Photoresist
9. Derive the expression for transfer characteristics of CMOS Inverter
10. Draw and explain the operation of BICMOS inverter

UNIT-2

1. Draw the flowchart o VLSI design flow and explain the operation of each step in detail.
2. a. Draw the stick diagram for the following boolean expression using CMOS F=A(B+C).
   b. Draw the stick diagram for the following boolean expression using CMOS F=AB+CD
3. Draw the circuit diagram, stick diagram and layout of 2-input CMOS NAND gate.
4. Draw the circuit diagram, stick diagram and layout of 2-input CMOS NOR gate.
5. Draw the circuit diagram, stick diagram and layout for CMOS inverter.
6. a. Compare the Stick diagram and Layout diagram.
   b. Define VLSI and write the advantages and applications of it

7. Draw the circuit diagram, stick diagram and layout of 3-input CMOS NAND gate.
8. What is scaling? Explain the importance and advantages of it.
9. Explain the different scaling parameters in detail.
10. Explain about the limitations of Scaling.

UNIT-3

1. a. Explain about the working operation of CMOS inverter.
   b. Explain about Clocked CMOS logic.
2. a. Explain about the working operation of CMOS NOR gate.
   b. Explain about the working operation of CMOS NAND gate
3. Explain the operation of AOI and OAI logic functions with an example each.
4. Design and explain the operation of XOR and XNOR gates using CMOS logic.
5. a. Explain in detail about the Pass transistors.
   b. Explain about n-p CMOS logic.
6. Explain in detail about the Transmission gates with examples.
7. a. Explain the working operation of Dynamic CMOS logic.
   b. Explain the working operation of Domino CMOS logic.
8. a. How we can drive the large capacitive loads and explain how the cascaded inverters are used as drivers?
   b. Explain about Super Buffers.
9. a. Explain in detail about the Wiring Capacitance.
   b. Define Fan-in and fan-out.
10. a. How the BiCMOS is used as driver?
    b. Explain in detail about the Propagation delay.

UNIT-4

1. a. Explain in brief about the different Subsystems.
   b. Explain about 4*4 Crossbar switch.

2. a. Why is Barrel shifter is very useful in the designing of arithmetic circuits.
   b. Draw the circuit diagram of 4*4 Barrel shifter and explain its shifting operation.
3. a. Discuss in detail about the Carry-select adder.
   b. Explain the operation of Carry Look Ahead adder.
4. a. What is Booth's algorithm?
   b. Explain the operation of Booth multiplication with suitable example.
5. a. With a neat diagram explain the working operation of Wallace Tree multiplier.
   b. Design a 4-bit magnitude Comparator.
6. a. Draw the structure of Static RAM and explain its operation.
   b. Draw the structure of Dynamic RAM and explain its operation.
7. Explain about Serial Access memories.
8. a. Compare Synchronous and Asynchronous Counters.
   b. Design and implement the 1-bit Full adder.
9. Explain the operation of 4-bit parallel adder.
10. a. Explain the working operation of 6T SRAM cell and also write its merits and demerits.
    b. Compare SRAM and DRAM.

UNIT-5

1. a. Why low power VLSI circuits are needed and implement 2*1 Mux using PAL.
   b. What is a PLD and write the different types of PLDs? Compare PAL and PLAs.
2. Draw the architecture of PAL and explain the operation of it.
3. With a neat diagram explain the structure of FPGA and also write its advantages and applications.
4. a. Explain in detail about CPLD.
   b. Compare FPGA and CPLD.
5. a. Explain Stuck-At-1(SA1) and Stuck-At-0(SA0) fault.
   b. Explain about different fault models in VLSI testing.
6. Explain the Scan-based Test Techniques.
7. Explain about self-test testing.
8. a. Explain the terms Controllability, Observability and Fault Coverage.

b. Explain in brief about ATPG.

9. Explain the different categories of DFT techniques.
10. What are the drawbacks of PLAs? How PLAs are used to implement combinational and sequential logic circuits?

OBJECTIVE QUESTIONS

UNIT-1

1. nMOS devices are formed in _____
   a) p-type substrate of high doping level
   b) n-type substrate of low doping level
   c) p-type substrate of moderate doping level
   d) n-type substrate of high doping level

2. Source and drain in nMOS device are isolated by _____
   a) a single diode
   b) two diodes
   c) three diodes
   d) four diodes

3. What is the condition for non saturated region?
   a) Vds = Vgs – Vt
   b) Vgs lesser than Vt
   c) Vds lesser than Vgs – Vt
   d) Vds greater than Vgs – Vt

4. What is the condition for saturated region?
   a) Vds = Vgs – Vt
   b) Vgs lesser than Vt
   c) Vds lesser than Vgs – Vt
   d) Vds greater than Vgs – Vt

5. What is the condition for linear region?
   a) Vds = Vgs – Vt
   b) Vgs lesser than Vt
   c) Vds lesser than Vgs – Vt
   d) Vds greater than Vgs – Vt

6. In enhancement mode, device is in _____ condition.
   a) conducting
   b) non conducting
   c) partially conducting
   d) insulating

7. In depletion mode, device is in _____ condition.
   a) conducting
   b) non conducting
   c) partially conducting
   d) insulating

8. nMOS is _____
   a) donor doped
   b) acceptor doped
   c) all of the mentioned
   d) none of the mentioned

9. pMOS is _____
   a) donor doped
   b) acceptor doped
   c) all of the mentioned
   d) none of the mentioned

10. MOS transistor structure is _____
    a) symmetrical
    b) non symmetrical
    c) semi symmetrical
    d) pseudo symmetrical

11. As source drain voltage increases, channel depth _____
    a) increases
    b) decreases
    c) logarithmically increases
    d) exponentially increases

12. Electronics are characterized by _____
    a) low cost
    b) low weight and volume
    c) reliability
    d) all of the mentioned

13. In MOS transistors _____ is used for their gate.
    a) metal
    b) silicon-di-oxide
    c) polysilicon
    d) gallium

14. Electrical charge flows from _____
    a) source to drain
    b) drain to source
    c) source to ground
    d) source to gate

15. In N channel MOSFET which is the more negative of the elements?
    a) source
    b) gate
    c) drain
    d) source and drain

16. Enhancement mode device acts as ____ switch, depletion mode acts as _____ switch.
    a) open, closed
    b) closed, open
    c) open, open
    d) close, close

17. Depletion mode MOSFETs are more commonly used as _____
    a) switches
    b) resistors
    c) buffers
    d) capacitors

18. Enhancement mode MOSFETs are more commonly used as _____
    a) switches
    b) resistors
    c) buffers
    d) capacitors

19. In n channel MOSFET _____ is constant.
    a) channel length
    b) channel width
    c) channel depth
    d) channel concentration

20. Depletion mode transistor should be
    a) small
    b) medium
    c) large
    d) none

21. If the gate is given sufficiently large charge, electrons will be attracted to _____
    a) drain region
    b) channel region
    c) switch region
    d) bulk region

22. MOS transistors consist of which of the following?
    a) semiconductor layer
    b) metal layer
    c) layer of silicon-di-oxide
    d) all of the mentioned

23. The gate region consists of _____
    a) insulating layer
    b) conducting layer
    c) lower metal layer
    d) p type layer

24. Medium scale integration has _____
    a) ten logic gates
    b) fifty logic gates
    c) hundred logic gates
    d) thousands logic gates

25. _____ architecture is used to design VLSI.
    a) system on a device
    b) single open circuit
    c) system on a chip
    d) system on a circuit

26. nMOS fabrication process is carried out in _____
    a) thin wafer of a single crystal
    b) thin wafer of multiple crystals
    c) thick wafer of a single crystal
    d) thick wafer of multiple crystals

27. The photoresist layer is exposed to _____
    a) Visible light
    b) Ultraviolet light
    c) Infra red light
    d) LED

28. Heavily doped polysilicon is deposited using _____
    a) chemical vapour decomposition
    b) chemical vapour deposition
    c) chemical deposition
    d) dry deposition

29. CMOS technology is used in developing which of the following?
    a) microprocessors
    b) microcontrollers
    c) digital logic circuits
    d) all of the mentioned

30. P-well is created on _____
    a) p substrate
    b) n substrate
    c) p & n substrate
    d) none of the mentioned

31. N-well is formed by _____
    a) decomposition
    b) diffusion
    c) dispersion
    d) filtering

32. N-well is created on _____
    a) p substrate
    b) n substrate
    c) p & n substrate
    d) none of the mentioned

33. CMOS has _____
    a) high noise margin
    b) high packing density
    c) high power dissipation
    d) high complexity

34. In CMOS fabrication, the photoresist layer is exposed to _____
    a) visible light
    b) ultraviolet light
    c) infra red light
    d) fluorescent

35. What are the advantages of BiCMOS?
    a) higher gain
    b) high frequency characteristics
    c) better noise characteristics
    d) all of the mentioned

36. BiCMOS can be used in _____
    a) amplifyig circuit
    b) driver circuits
    c) divider circuit
    d) multiplier circuit

37. Transit time can be given by _____
    a) L / v
    b) v / L
    c) v x L
    d) v x d

38. When the channel pinches off?
    a) Vgs > Vds
    b) Vds > Vgs
    c) Vds > (Vgs-Vth)
    d) Vgs > (Vds-Vth)

39. What is the mobility of proton or hole at room temperature?
    a) 650 cm^2/V sec
    b) 260 cm^2/V sec
    c) 240 cm^2/V sec
    d) 500 cm^2/V sec

40. Transconductance gives the relationship between _____
    a) input current and output voltage
    b) output current and input voltage
    c) input current and input voltage
    d) output current and output voltage

41. Pass transistors are transistors used as _____
    a) switches connected in series
    b) switches connected in parallel
    c) inverters used in series
    d) inverter used in parallel

42. What is the ratio of Zp.u/Zp.d if the inverter is driven by another inverter?
    a) 1/4
    b) 4/1
    c) 1/2
    d) 2/1

43. What is the ratio of Zp.u/Zp.d if the inverter is driven by pass transistors?
    a) 1/4
    b) 8/1
    c) 1/2
    d) 4/1

44. In complementary transistor pull-up, current flows when?
    a) Vin = 1
    b) Vin = 0
    c) current doesn't flow
    d) Vout = Vin

45. In nMOS inverter configuration depletion mode device is called as _____
    a) pull up
    b) pull down
    c) all of the mentioned
    d) none of the mentioned

46. In nMOS inverter configuration enhancement mode device is called as _____
    a) pull up
    b) pull down
    c) all of the mentioned
    d) none of the mentioned

47. CMOS inverter has _____ regions of operation.
    a) three
    b) four
    c) two
    d) five

48. If $\beta n = \beta p$, then Vin is equal to _____
    a) Vdd
    b) Vss
    c) 2Vdd
    d) 0.5Vdd

49. CMOS inverter has _____ output impedance.
    a) low
    b) high
    c) very high
    d) none of the mentioned

50. The BiCMOS are preferred over CMOS due to _____
    a) Switching speed is more compared to CMOS
    b) Sensitivity is less with respect to the load capacitance
    c) High current drive capability
    d) All of the mentioned

UNIT-2

1. VLSI technology uses _____ to form integrated circuit.
   a) transistors
   b) switches
   c) diodes
   d) buffers

2. _____ is used in logic design of VLSI.
   a) LIFO
   b) FIFO
   c) FILO
   d) LILO

3. Physical and electrical specification is given in _____
   a) architectural design
   b) logic design
   c) system design
   d) functional design

4. Which is the high level representation of VLSI design?
   a) problem statement
   b) logic design
   c) HDL program
   d) functional design

5. Y-chart was introduced by
   a) Bob Munson
   b) D.Gajski
   c) J D Thomson
   d) Stephenson

6. Abbrevation of ASIC is
   a) Application Specific Integrated Circuit
   b) Application Specific Integrated Chip
   c) Applied Specific Integrated Circuit
   d) None

7. _____ is to specify behavior, in terms of input, output and timing of each unit, without specifying its internal structure.

a) Logic design
b) Functional design
c) High level design
d) Physical design

8. _____ is a graphical representation of a system showing the system's processes and theflows of data into and out of the processes.
   a) Logic design
   b) Functional design
   c) High level design
   d) Physical design

9. A _____ is the process of placing blocks/macros in the chip/core area, thereby determining the **routing** areas between them.
   a) floorplanning
   b) partioning
   c) placement
   d) none

10. High performance design is also known as
    a) Semi custom design
    b) full custom design
    c) none

11. Stick diagrams are those which convey layer information through?
    a) thickness
    b) color
    c) shapes
    d) layers

12. Which color is used for implant?
    a) red
    b) blue
    c) green
    d) yellow

13. Which color is used for n-diffusion?
    a) red
    b) blue
    c) green
    d) yellow

14. Which color is used for polysilicon?
    a) brown
    b) red
    c) white
    d) orange

15. n and p transistors are separated by using _____
    a) differentiation line
    b) separation line
    c) demarcation line
    d) black line

16. When two or more cuts of same type cross or touch each other, that represents _____
    a) contact cut
    b) electrical contact
    c) like contact
    d) cross contact

17. Design rules does not specify _____
    a) linewidths
    b) separations
    c) extensions
    d) colours

18. The width of n-diffusion and p-diffusion layer should be?
    a) 3λ
    b) 2λ
    c) λ
    d) 4λ

19. What should be the width of metal 1 and metal 2 layers?
    a) 3λ, 3λ
    b) 2λ, 3λ
    c) 3λ, 4λ
    d) 4λ, 3λ

20. Which type of contact cuts are better?
    a) buried contacts
    b) butted contacts
    c) butted & buried contacts
    d) none of the mentioned

21. Which gives scalable design rules?
    a) lambda rules
    b) micron rules
    c) layer rules
    d) thickness rules

22. Which design method occupies or uses lesser area?
    a) lambda rules
    b) micron rules
    c) layer rule
    d) source rule

23. What should be the spacing between two diffusion layers?
    a) 4λ
    b) λ
    c) 3λ
    d) 2λ

24. Circuit designers need _____ circuits.
    a) tighter
    b) smaller layout
    c) decreased silicon area
    d) all of the mentioned

25. Circuit design concepts can also be represented using a symbolic diagram.
    a) true
    b) false

26. Which layer is used for power and signal lines?
    a) metal
    b) polysilicon
    c) n-diffusion
    d) p-diffusion

27. Minimum n-well width should be _____ micro meter.
    a) 2
    b) 3
    c) 4
    d) 6

28. What are the advantages of design rules?
    a) durable
    b) scalable
    c) portable
    d) all of the mentioned

29. Contact cuts should be ____ apart.
    a) 2λ
    b) 3λ
    c) 4λ
    d) λ

30. Minimum diffusion space is _____
    a) 2λ
    b) 3λ
    c) 4λ
    d) λ

31. What is the relationship between channel resistance and sheet resistance?
    a) R = Rs
    b) R = Z*Rs
    c) R = Z/Rs
    d) R = Rs/Z

32. The sheet resistance of the conducting material is
    a) RS = resistivity/width
    b) RS = resistivity*length
    c) RS = resistivity*width
    d) RS = resistivity/length

33. The inverter pair delay for inverters having 4:1 ratio is?
    a) 4Ƭ
    b) Ƭ
    c) 5Ƭ
    d) 2Ƭ

34. The ratio of rise time to fall time can be equated to _____
    a) βn/βp
    b) βp/βn
    c) βp*βn
    d) βp/2βn

35. Which quantity is slower?
    a) rise time
    b) fall time
    c) all of the mentioned
    d) none of the mentioned

36. The value µn is equal to _____
    a) µp
    b) 0.5µp
    c) 1.5µp
    d) 2.5µp

37. Buffer is used because _____
    a) it increases the speed
    b) decreases sensitivity to noise
    c) decreases speed
    d) does not affect speed

38. Which contributes to the wiring capacitance?
    a) fringing fields
    b) interlayer capacitance
    c) peripheral capacitance
    d) all of the mentioned

39. Interlayer capacitance occurs due to _____
    a) separation between plates
    b) electric field between plates
    c) charges between plates
    d) parallel plate effect

40. Peripheral capacitance is given in _____ eper unit length.
    a) nano farad
    b) pico farad
    c) micro farad
    d) farad

41. The amount of gate oxide capacitance is determined by _____
    a) Charges present on the gate
    b) Polarity of the gate
    c) Charges present on the substrate
    d) Area of the gate

42. The value of standard unit of capacitance is?
    a) 0.01pF
    b) 0.0032pF
    c) 0.0023pF
    d) All of the mentioned

43. The capacitance that exist between Gate and Bulk is called as _____
    a) Oxide parasitic capacitance
    b) Metal oxide capacitance
    c) MOS capacitance
    d) None of the mentioned

44. In cut-off mode, the value of gate to substrate capacitance is equal to _____
    a) Cox .(W- L)
    b) Cox W/ L
    c) Cox* W*L
    d) 0

45. Which model is used for scaling?
    a) constant electric scaling
    b) constant voltage scaling
    c) costant electric and voltage scaling
    d) costant current model

46. α is used for scaling
    a) linear dimensions
    b) vdd
    c) oxide thickness
    d) non linear

47. β is used for scaling
    a) linear dimensions
    b) vdd
    c) oxide thickness
    d) both b and c

48. The scaling factor of Gate delay in Constant field model is
    a) 1/α2
    b) 1
    c) 1/α
    d) β/α

49. In Constant Voltage model, the scaling factors β and α are related as
    a) $\beta = \alpha$
    b) $\alpha = 1$
    c) $\alpha = 1/\beta$
    d) $\beta = 1$

50. Gate area can be given as
    a) L/W
    b) L * W
    c) 2L/W
    d) L/2W

UNIT-3

1. In Pseudo-nMOS logic, n transistor operates in
a) cut off region
b) saturation region
c) resistive region
d) non saturation region

2. The power dissipation in Pseudo-nMOS is reduced to about _____ compared to nMOS device.
a) 50%
b) 30%
c) 60%
d) 70%

3. In dynamic CMOS logic _____ is used.
a) two phase clock
b) three phase clock
c) one phase clock
d) four phase clock

4. In clocked CMOS logic, output in evaluated in
a) on period
b) off period
c) both periods
d) half of on period

5. In clocked CMOS logic, rise time and fall time are
a) faster
b) slower
c) faster first and then slows down
d) slower first and then speeds up

6. In CMOS domino logic _____ is used.
a) two phase clock
b) three phase clock
c) one phase clock
d) four phase clock

7. CMOS domino logic is same as _____ with inverter at the output line.
a) clocked CMOS logic
b) dynamic CMOS logic
c) gate logic
d) switch logic

8. CMOS domino logic occupies
a) smaller area
b) larger area
c) smaller & larger area
d) none of the mentioned

9. In CMOS domino logic _____ is possible.
a) inverting structure
b) non inverting structure
c) inverting and non inverting structure
d) very complex design

10. CMOS domino logic has
a) smaller parasitic capacitance
b) larger parasitic capacitance
c) low operating speed
d) very large parasitic capacitance

11.The CMOS inverter has _____ power dissipation.
a) low
b) more
c) no
d) very less

12. In CMOS NAND gate, p transistors are connected in
a) series
b) parallel
c) cascade
d) random

13. BiCMOS is used for ____ fan-out.
a) less
b) more
c) no
d) very less

14.Which gate is faster?
a) AND
b) NAND
c) NOR
d) OR

15. Propagation time is directly proportional to _____
a) x
b) 1/x
c) x^2

d) $1/x^2$

16.The total resistance can be given as _____
a) nRs
b) nrRs
c) rRs
d) Rs

17. Total capacitance can be given as _____
a) n(square Cg)
b) nc(square Cg)
c) c(square Cg)
d) square Cg

18. Overall delay is directly proportional to _____
a) n
b) 1/n
c) n^2
d) $1/n^2$

19. The number of pass transistors connected in series can be increased if _____
a) compressor is connected
b) buffer is connected
c) ground is connected
d) voltage regulator is connected

20. The overall delay is _____ to the relative resistance r.
a) directly proportional
b) inversely proportional
c) exponentially proportional
d) not dependent

21. In the PUN two pMOSFETs will be connected in

a.series

b.parallel

c.series-parallel

d.parallel-parallel

22. . In the PDN two nMOSFETs will be connected in

a.series

b.parallel

c.series-parallel

d.parallel-parallel

23. A _____ form occurs when the output of a two-level logic realization cannot be achieved using a single logic gate.

a. non-degenerative form

b. Degenerative form

c.set associative form

d.assosciative form

24. _____occurs when the output of a two-level logic realization can be achieved with only one logic gate.

a. non-degenerative form

b. Degenerative form

c.set associative form

d.assosciative form

25.The advantage of pseudo nMOS logic is

a.high power consumption

b.low power consumption

c.moderate power consumption

d.extremely high power consumption

26. Which contributes to the wiring capacitance?
a) fringing fields
b) interlayer capacitance
c) peripheral capacitance
d) all of the mentioned

27. What does the value d in fringing field capacitance measures?
a) thickness of wire

b) length of the wire
c) wire to substrate separation
d) wire to wire separation

28. Total wire capacitance is equal to _____
a) area capacitance
b) fringing field capacitance
c) area capacitance + fringing field capacitance
d) peripheral capacitance

29. Interlayer capacitance occurs due to _____
a) separation between plates
b) electric field between plates
c) charges between plates
d) parallel plate effect

30. Which capacitance must be higher?
a) metal to polysilicon capacitance
b) metal to substrate capacitance
c) metal to metal capacitance
d) diffusion capacitance

31. Peripheral capacitance is given in _____ eper unit length.
a) nano farad
b) pico farad
c) micro farad
d) farad

32. For greater relative value of peripheral capacitance _____ should be small.
a) source area
b) drain area
c) source & drain area
d) none of the mentioned

33. Diffusion capacitance is equal to _____
a) area capacitance
b) peripheral capacitance
c) fringing field capacitance
d) area capacitance + peripheral capacitance

34. Polysilicon is suitable for _____
a) small distance
b) large distance
c) all of the mentioned’
d) none of the mentioned

35. The capacitances in MOSFET occurs due to _____
a) Interconnects
b) Difference in Doping concentration
c) Difference in dopant materials
d) All of the mentioned

36. The parasitic capacitances found in MOSFET are _____
a) Oxide related capacitances
b) Inter electrode capacitance
c) Electrolytic capacitance
d) All of the mentioned

37. The capacitance that exist between Gate and Bulk is called as _____
a) Oxide parasitic capacitance
b) Metal oxide capacitance
c) MOS capacitance
d) None of the mentioned

38. Which of the following parameters are found using load capacitance?
a) Delay time
b) Power consumption
c) Speed of the CMOS logic
d) All of the mentioned

39. Switch logic is based on
a) pass transistors
b) transmission gates
c) pass transistors and transmission gates
d) design rules

40. The switch logic approach takes _____ static current.
a) low
b) more
c) no
d) very less

41. Power dissipation in switch logic is
a) less
b) more
c) high
d) very less

42. Pass transistor can be driven through _____ pass transistors.
a) one
b) no
c) more

d) two

43. Switch logic approach is fast for
a) large arrays
b) small arrays
c) very large arrays
d) not at all fast for any type

44. Switch logic is designed using
a) complementary switches
b) silicon plates
c) conductors
d) resistors

45. Gate logic is also called as
a) transistor logic
b) switch logic
c) complementary logic
d) restoring logic

46. _____ are the common forms of complex logic gates

- OR-AND-Invert (OAI)
- AND-OR-Invert (AOI)
- Both OAI and AOI
- None of the above

47. The logic Family which has the highest fan-out is
a.TTL
b.IIL
c.MOS
d.CMOS

48.If a logic circuit has a fanout of 4 then the circuit
a.4 input
b.has 4 outputs
c.can drive maximum of 4 inputs
d.gives output 4 times the input

49.The number of inputs to a gate is called

a.fan-out

b.fan-in

c.delay time

d.propagation time

50.The maximum number of similar gates that a gate can drive is called

a.fan-in

b.fan-out

c.switch logic

d.wiring capacitance

UNIT-4

1.The carry chain in adder is consist with
a. cross-bar swith
b. transmission gate
c. bus interconncection
d. pass transistors

2. VLSI design of adder element basically requires
a. EX-OR gate, Not and OR gates
b. multiplexers, inverter circuit and communication paths
c. multiplexers, EX-OR and NAND gates
d. inverter circuits and communication paths

3. Carry line in adder must be buffered after or before each adder element because
a. slow response of series pass transistors
b. slow response of parallel line
c. fast response of parallel pass transistors
d. fast response of series line

4. The ALU logical functions can be obtained by a suitable switching of the
a. carry line between adder elements
b. sum line between adder elements
c. carry line between shifter & buffer
d. sum line between shifter & buffer

5. To fast an arithmetic operations, the multipliers and dividers is to use architecture of
a. parallel
b.serial
c. pipelined
d.switched

6. The number of bits increases in comparator then the
a. height increases
b. width reduces linearly
c. width grows linearly
d.height reduces

7. The standard cell for an n-bit parity generator is
a. n-1 bit cell
b. two bit cell
c. one bit cell
d.n+1 bit cell

8. The parity information is passed from one cell to the next and is modified or not by a cell depending on the state of the

a. previous information
b. input lines
c. output line
d.next information

9. The parity information (pi) passed from one cell to the next is modified when the input line (Ai) is at the state of
a. zero
b.overline{A}i
c.one
d.independent of input line state

10. For the 4X4 bit barrel shifter, the regularity factor is given by
a. 8
b.4
c.2
d.16

11. The level of any particular design can be measured by
a. SNR c
b.Ratio of amplitudes
c. regularity
d.quality

12. In tackling the design of system the more significant property is
a.logical operations
b. topological properties
c.testability
d.nature of architecture

13. Any bit shifted out at one end of data word will be shifted in at the other end of the word is called
a. end-around
b.end-off
c.end-less
d.end-on

14. In the VLSI design the data and control signals of a shift register flow in
a. horizontally and vertically
b. vertically and horizontally
c. both horizontally
d. both vertically

15. . The subsystem design is classified as
a. first level
b. bottom level

c. top level
d.leaf-cell level

16. The larger system design must be partition into a sub systems design such that
a. minimum interdependence and inter connection
b. complexity of interconnection
c. maximum interdependence
d. arbitarily chosen

17. To simplify the subsystem design, we generally used the
a. interdependence
b. regular structures
c. complex interconnections
d.standard cells

18. System design is generally in the manner of
a. down-top
b.top-down
c.bottom level only
d.top level only

19. Structured design begins with the concept of
a. hierarchy
b. down-top design
c. bottom level design
d. complex function design

20. Any general purpose n-bit shifter should be able to shift incoming data by up to number of places are
a. n
b.2n
c.n-1
d.2n-1

21. For a four bit word, a one-bit shift right is equivalent to a
a. two bit shift left
b. one bit shift left
c. three-bit shift left
d.four-bit shift left

22. The type of switch used in shifters is
a. line switch
b. crossbar switch
c. transistor type switch
d.gate switch

23. Multipliers are built using
a) binary adders
b) binary subtractors
c) dividers
d) multiplexers

24. Which method uses reduced number of partial products?
a) Baugh-wooley algorithm
b) Wallace trees
c) Dadda multipliers
d) Modified booth encoding

25. Which method is easier to manipulate accumulator content?
a) left shifting
b) right shifting
c) serial shifting
d) parallel shifting

26. What is the delay required to perform a single operation in a pipelined structure?
a) 2n
b) 3n
c) 4n
d) n

27. Which multiplier is very well suited for twos-complement numbers?
a) Baugh-wooley algorithm
b) Wallace trees
c) Dadda multipliers
d) Modified booth encoding

28. Which method reduces number of cycles of operation?
a) Baugh-wooley algorithm
b) Wallace trees
c) Dadda multipliers
d) Modified booth encoding

29. All the comparisons made by comparator is done using _____
a) 1 circuit
b) 2 circuits
c) 3 circuits
d) 4 circuits

30. One that is not the outcome of magnitude comparator is _____
a) a > b

b) a – b
c) a < b
d) a = b

31. If two numbers are not equal then binary variable will be _____
a) 0
b) 1
c) A
d) B

32. How many inputs are required for a digital comparator?
a) 1
b) 2
c) 3
d) 4

33. Which one is a basic comparator?
a) XOR
b) XNOR
c) AND
d) NAND

34. Comparators are used in _____
a) Memory
b) CPU
c) Motherboard
d) Hard drive

35.A circuit that compares two numbers and determines their magnitude is called _____
a) Height comparator
b) Size comparator
c) Comparator
d) Magnitude comparator

36.A procedure that specifies finite set of steps is called _____
a) Algorithm
b) Flow chart
c) Chart
d) Venn diagram

37.A magnitude comparator is defined as a digital comparator which has _____
a) Only one output terminal
b) Two output terminals
c) Three output terminals
d) No output terminal

38. How many types of the counter are there?
a) 2
b) 3
c) 4
d) 5

39. A decimal counter has _____ states.
a) 5
b) 10
c) 15
d) 20

40.Ripple counters are also called _____
a) SSI counters
b) Asynchronous counters
c) Synchronous counters
d) VLSI counters

41. Why is SRAM more preferably in non-volatile memory?
a) low-cost
b) high-cost
c) low power consumption
d) transistor as a storage element

42. Which type of storage element of SRAM is very fast in accessing data but consumes lots of power?
a) TTL
b) CMOS
c) NAND
d) NOR

43. Which of the following is an SRAM?
a) 1T-RAM
b) PROM
c) EEPROM
d) EPROM

44. Which of the following memory technology is highly denser?
a) DRAM
b) SRAM
c) EPROM
d) Flash memory

45. In which of the memories, does the data disappear?
a) SRAM
b) DRAM

c) Flash memory
d) EPROM

46. Which of the following has the capability to store the information permanently?
a) RAM
b) ROM
c) Storage cells
d) Both RAM and ROM

47. The ROM is a _____
a) Sequential circuit
b) Combinational circuit
c) Magnetic circuit
d) Static circuit

48. In ROM, each bit is a combination of the address variables is called _____
a) Memory unit
b) Storage class
c) Data word
d) Address

49.In ROM, each bit combination that comes out of the output lines is called _____
a) Memory unit
b) Storage class
c) Data word
d) Address

50. Which is a comparatively slower device?
a) ROM
b) RAM
c) flash memory
d) SRAM

UNIT-5

1. The inputs in the PLD is given through _____
   a) NAND gates
   b) OR gates
   c) NOR gates
   d) AND gates
2. PAL refers to _____
   a) Programmable Array Loaded
   b) Programmable Logic Array
   c) Programmable Array Logic
   d) Programmable AND Logic
3. Outputs of the AND gate in PLD is known as _____
   a) Input lines
   b) Output lines
   c) Strobe lines
   d) Control lines
4. PLA is used to implement _____
   a) A complex sequential circuit
   b) A simple sequential circuit
   c) A complex combinational circuit
   d) A simple combinational circuit
5. Which type of device FPGA are?
   a) SLD
   b) SROM
   c) EPROM
   d) PLD
6. The difference between a PAL & a PLA is _____
   a) PALs and PLAs are the same thing
   b) The PLA has a programmable OR plane and a programmable AND plane, while the PAL only has a programmable AND plane
   c) The PAL has a programmable OR plane and a programmable AND plane, while the PLA only has a programmable AND plane
   d) The PAL has more possible product terms than the PLA
7. The full form of VLSI is _____
   a) Very Long Single Integration
   b) Very Least Scale Integration
   c) Very Large Scale Integration
   d) Very Long Scale Integration
8. Applications of PLAs are _____
   a) Registered PALs
   b) Configurable PALs

c) PAL programming
d) All of the Mentioned

9. PALs tend to execute _____ logic.
   a) SAP
   b) SOP
   c) PLA
   d) SPD

10. _____ are used at the inputs of PAL/GAL devices in order to prevent input loading from a large number of AND gates.
    a) Simplified AND gates
    b) Fuses
    c) Buffers
    d) Latches

11. SPLDs, CPLDs, and FPGAs are all which type of device?
    a) PAL
    b) PLD
    c) EPROM
    d) SRAM

12. FPGA stands for…
    a) Field Program Gate Array
    b) First Program Gate Array
    c) Field Programmable Gate Array
    d) First programmable Gate Array

13. Vertical and horizontal directions in FPGA are separated by_____
    a) A channel
    b) A line
    c) A flip-flop
    d) A strobe

14. The circuit should be tested at
    a) design level
    b) chip level
    c) transistor level
    d) switch level

15. _____ of the area is dedicated for testability.
    a) 20%
    b) 10%
    c) 30%
    d) 25%

16. Partitioning into subsystems are done at
    a) design stage
    b) prototype stage
    c) testing stage
    d) fabrication stage
17. In prototype testing, the circuits are
    a) open circuited
    b) short circuited
    c) tested as a whole circuit
    d) programmed
18. Test pattern generation is assisted using
    a) automatic test pattern generator
    b) exhaustive pattern generator
    c) repeated pattern generator
    d) loop pattern generator
19. _____ of faults are easier to detect.
    a) 50%
    b) 60%
    c) 70%
    d) 80%
20. Which model is used for pc board testing?
    a) stuck at
    b) stuck in
    c) stuck on
    d) stuck through
21. The input signal combination in exhaustive testing is given as
    a) 2^N
    b) $2^{1/N}$
    c) $2^{(M+N)}$
    d) $1/2^N$
22. Observability is the process of
    a) checking all inputs
    b) checking all outputs
    c) checking all possible inputs
    d) checking errors and performance
23. To propagate the fault along the selected path to primary output, setting _____ is done.
    a) AND to 1
    b) OR to 1
    c) NOR to 1
    d) NAND to 0
24. Sequential circuits are represented as
    a) finite state machine
    b) infinite state machine

c) finite synchronous circuit
d) infinite asynchronous circuit

25. Sequential circuit includes
    a) delays
    b) feedback
    c) delays and feedback from input to output
    d) delays and feedback from output to input
26. For a NAND gate, struck-at 1 fault in second input line cannot be detected if
    a) Q is 1
    b) Q is 0
    c) Q changes from 1 to 0
    d) Q changes from 0 to 1
27. Practical guidelines for testability aims at
    a) facilitating test generation
    b) facilitating test application
    c) avoiding timing problems
    d) all of the mentioned
28. The additional pads are accessed using
    a) probers
    b) selectors
    c) multiplexers
    d) buffers
29. The addition of _____ improves the observability.
    a) adders
    b) multiplexers
    c) multipliers
    d) demultiplexers
30. How to reduce test time?
    a) by reducing multiplexers
    b) by reducing adders
    c) by dividing circuit into subcircuits
    d) by using the whole circuit as a single system
31. Test generation effort for n gate circuit is proportional to
    a) n
    b) n^2
    c) n^3
    d) n^2 and n^3
32. Isolation and control is achieved using
    a) adders
    b) buffers
    c) multiplexers
    d) multipliers

33. Asynchronous logic is driven by
    a) clock
    b) gating circuit
    c) self-clock
    d) self timing
34. Which is better in terms of memory storage?
    a) synchronous circuits
    b) asynchronous circuits
    c) sequential circuits
    d) clocked circuits
35. Which circuits are faster?
    a) synchronous circuits
    b) asynchronous circuits
    c) sequential circuits
    d) clocked circuits
36. Which logic are difficult to design?
    a) synchronous circuits
    b) asynchronous circuits
    c) sequential circuits
    d) clocked circuits
37. Automatic test pattern generators depend on
    a) map design
    b) layout design
    c) logic domain
    d) testing domain
38. Counters are
    a) sequential circuits
    b) synchronous circuits
    c) asynchronous circuits
    d) buffer circuits
39. The boundary scan path is provided with
    a) serial input pads
    b) parallel input pads
    c) parallel output pads
    d) buffer pads
40. The fast rise and fall times give cross-talk problems if
    a) they are in close proximity
    b) if they are far away
    c) it always gives rise to cross-talk problems
    d) does not allow cross-talk problems
41. The boundary scan path tests the
    a) input nodes
    b) output nodes

c) buffer nodes
d) interconnection points

42. The major difficulty in sequential circuit testing is in
    a) determining output
    b) determining internal state
    c) determining external state
    d) determining input combinations
43. The design technique helps in improving
    a) controllability
    b) observability
    c) controllability and observability
    d) overall performance
44. A sequential circuit contains combinational logic and storage elements in
    a) feedback path
    b) output node
    c) input node
    d) non feedback path
45. Storage elements used are
    a) D flipflops
    b) JK flipflops
    c) RS flipflops
    d) All of the mentioned
46. Storage elements in scan design technique is reconfigured to form
    a) RAM
    b) shift registers
    c) buffers
    d) amplifiers
47. The efficiency of the test pattern generation is improved by
    a) adding buffers
    b) adding multipliers
    c) partitioning
    d) adding power dividers
48. Which has more number of I/O pins?
    a) lssd
    b) partial scan
    c) scan/set
    d) random access scan
49. Which is not the function of LSSD method?
    a) eliminates hazards
    b) eliminates races
    c) simplifies fault generation
    d) stores the data

50. Boundary scan test is used to test
    a) pins
    b) multipliers
    c) boards
    d) wires

EMBEDDED SYSTEM DESIGN

EMBEDDED SYSTEMS
(PROFESSIONAL ELECTIVE – II)
Syllabus

UNIT – I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems

UNIT - II

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces

UNIT - III

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT - IV

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT - V

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, **Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

TEXT BOOK:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill

REFERENCES:

2. Embedded Systems - Raj Kamal, TMH.
3. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
4. Embedded Systems – Lyla, Pearson, 2013
5. An Embedded Software Primer - David E. Simon, Pearson Education.

B.Tech III Year II Sem – Embedded Systems - Session Plan - with ITL Methods

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
UNIT – I (Introduction to Embedded Systems)							
1	22.03.2021 24.03.2021	Introduction to Embedded Systems	Briefing about an Embedded System.	Lecture	L1, L2		T1 - Ch1 R1 – Ch1 R2 – Ch1
2	25.03.2021 26.03.2021		Definition of Embedded System, Embedded Systems Vs General Computing Systems	Lecture	L3, L4		T1 - Ch1 R1 – Ch1 R2 – Ch1
3	26.03.2021 31.03.2021		History of Embedded Systems, Classification *(Classification based on Generation and on Complexity & performance)*	Lecture	L5,L6		T1 - Ch1 R1 – Ch1 R2 – Ch1
4	01.04.2021 05.04.2021	Major Application Areas	Domestic, Research, Defense, Industrial, Automation, Play Zone & etc.,	Lecture	L7,L8		T1 - Ch1 R1 – Ch1 R2 – Ch1
5	07.04.2021	Purpose of Embedded Systems	Data Collection/Storage/Representation, Data Communication,	Lecture	L9		T1 - Ch1 R1 – Ch1 R2 – Ch1
6	08.04.2021		Data Processing, Monitoring, Control & Application specific user Interface.	Lecture	L10		T1 - Ch1 R1 – Ch1 R2 – Ch1
7	09.04.2021		Characteristics of Embedded Systems	Lecture	L11,L12		T1 - Ch1 R1 – Ch1 R2 – Ch1
8	15.04.2021		Quality Attributes of Embedded Systems.	Lecture	L13		T1 - Ch1 R1 – Ch1 R2 – Ch1

UNIT – II (Typical Embedded System)							
9	16.04.2021	Core of the Embedded System	General Purpose and Domain Specific Processors,	Lecture	L14, L15		T1 – Ch2 R1 – Ch1
10	19.04.2021		ASICs, PLDs,	Lecture	L16		T1 – Ch2 R1 – Ch1
11	22.04.2021		Commercial Off The-Shelf Components (COTS)	Lecture	L17		T1 – Ch2 R1 – Ch1
12	23.04.2021	Memory	ROM, RAM	Lecture	L18, L19		T1 – Ch2 R1 – Ch2
13	26.04.2021		Memory according to the type of Interface	Lecture	L20		T1 – Ch2 R1 – Ch1
14	28.04.2021		Memory Shadowing, Memory selection	Lecture	L21		T1 – Ch2 R1 – Ch1
15	29.04.2021	Sensors and Actuators	LED, 7- Segment LED, Opto-Coupler	Lecture	L22		T1 – Ch2 R1 – Ch1
16	30.04.2021		Stepper motor, Relay, Peizo Buzzer,	Lecture	L23		T1 – Ch2 R1 – Ch1
17	30.04.2021		Keyboard, PPI	Lecture	L24		T1 – Ch2 R1 – Ch1
18	03.05.2021	Communication Interface	Onboard and External Communication Interfaces	Lecture	L25		T1 – Ch2
UNIT – III (Embedded Firmware)							
19	05.05.2021	Embedded Firmware	Developing Embedded firmware	Lecture	L26		T1 – Ch2
20	06.05.2021		Reset Circuit, Brown-out Protection Circuit,	Lecture	L27		T1 – Ch2 R1 – Ch3
21	07.05.2021		Oscillator Unit, Real Time Clock, Watchdog Timer	Lecture	L28,L29		T1 – Ch2 R1 – Ch3

22	10.05.2021		Embedded Firmware Design Approaches	Lecture	L30		T1 – Ch2 R1 – Ch3
23	12.05.2021 13.05.2021		Development Languages	Lecture	L31,L32		T1 – Ch2 R1 – Ch3
UNIT – IV (RTOS Based Embedded System Design)							
24	07.06.2021 09.06.2021	RTOS Based Embedded System Design	Operating System Basics	Lecture	L33,L34		T1 – Ch10 R1 – Ch7 R4 – Ch6
25	10.06.2021 11.06.2021		Types of Operating Systems	Lecture	L35,L36		T1 – Ch10 R1 – Ch7 R4 – Ch6
26	11.06.2021 14.06.2021	Tasks and task states Tasks and data	Tasks, Task states	Lecture	L37,38		T1 – Ch10 R1 – Ch7 R4 – Ch6
27	16.06.2021		Tasks Data	Lecture	L39		T1 – Ch10 R1 – Ch7 R4 – Ch6
28	17.06.2021 18.06.2021		Tasks, Process and Threads	Lecture	L40,L41		T1 – Ch10 R1 – Ch7 R4 – Ch6
29	18.06.2021		Multiprocessing and Multitasking	Lecture	L42		T1 – Ch10 R1 – Ch7 R4 – Ch6
30	21.06.2021 23.06.2021		Task Scheduling	Lecture	L43,L44		T1 – Ch10 R1 – Ch7 R4 – Ch6
UNIT – V (Task Communication)							
31	24.06.2021 25.06.2021	Task Communication	Shared Memory	Lecture	L45,L46		T1 – Ch10 R1 – Ch7 R4 – Ch6
32	25.06.2021		Message Passing	Lecture	L47		T1 – Ch10 R1 – Ch7

							R4 – Ch6
33	28.06.2021 30.06.2021		Remote Procedure Call and Sockets	Lecture	L48,L49		T1 – Ch10 R4 – Ch6
34	01.07.2021 02.07.2021	Task Synchronization	Task Communication/ Synchronization Issues	Lecture	L50,L51		T1 – Ch10 R4 – Ch6
35	02.07.2021 05.07.2021		Task Synchronization Techniques	Lecture	L52,L53		T1 – Ch10 R4 – Ch6
36	07.07.2021 08.07.2021		Device Drivers	Lecture	L54,L55		T1 – Ch10 R4 – Ch6
37	09.07.2021		How to Choose an RTOS.	Lecture	L56,L57		T1 – Ch10 R4 – Ch6
38	12.07.2021 14.07.2021 15.07.2021	Revision	Syllabus, Question bank, assignment question and doubts.	Lecture	L58,L59,L60		

S. No	Case Studies	Seminars	Role Plays	Debates	Group Discussions	Quizzes
1		History of embedded systems	AGC			
2			Minuteman 1 missile			
3						
4						

S. No	Case Studies	Seminars	Role Plays	Debates	Group Discussions	Quizzes

S No.	Descriptive Questions
	Unit I
1	Define Embedded System with the help of an example ?
2	Differentiate between general purpose computers & embedded systems
3	Give a classification of embedded systems with examples?
4	List applications of embedded systems with examples?
5	Explain the various possible purposes of using and embedded system.
6	Write a brief note on history of embedded systems
7	Explain characteristics of embedded systems?
8	wth an example explain control purpose embedded system and monitor purpose embedded system applications?
9	With an example explain classification of embedded systems based on complexity and performance?
10	Explain quality attributes of an embedded systems?
	Unit II
1	What do you mean by core of the embedded system? What is its significance? What are the possible options that can be used as a core?
2	(a)Distinguish between Microprocessor & Microcontroller (b)Explain the concept of Load Store architecture and instruction pipelining.
3	Explain the different types of processors according to their system bus architecture and
4	Explain about following communication interfaces: 1. SPI bus 2.1-Wire Interface 3.Parallel Interface
5	Write short note on : i. DSP ii. PLD iii. ASIC iv. COTS
6	Explain Communication Interfaces with respect to embedded system
7	Explain the following with example: 1. Onboard communication interface 2. external communication interface
8	Explain about following communication interfaces: 1. I2C Bus 2.UART
9	Explain about following communication interfaces: 1. RS-232 C 2.Bluetooth 3.wi-fi,4. Zigbee
10	Write about memory classification of RAM and ROM and explain memory shadowing
	Unit III
1	Explain the operation of Real time clock.
2	Explain the working of Brown out circuit
3	write about reset circuit
4	write about oscillatory unit
5	what is watchdog timer explain its role in embedded systems with an example?
6	Discuss about the developmental languages used in embedded firmware and the design styles of firmware?
7	Discuss the advantages of high level languages and its limitations?
8	How to design and implement firmware for embedded systems?
9	Explain embedded firmware design approaches in detail?
10	Explain Hex file creation in assembly language?

11	What are the advantages of assembly language based application development?
12	What are the drawbacks of assembly language based approach?
13	Explain Hex file creation in high level language?
14	Discuss Inline assembly technique
	Unit IV
1	(a)what are the primary functions of an operating system? What is kernel? (b)write about kernel space and user space?
2	what is kernel and what are the services provided by kernel for general purpose OS?
3	Explain about monolithic kernel and micro kernel?
4	Explain about micro kernel design and its benefits?
5	Depending on the type of kernel and kernel services, classify the types of operating
6	What are the basic functions of a Real-Time kernel?
7	What are Hard Real-time and Soft Real-time systems?
8	Write a note an i)task ii)process iii)threads
9	Write about Process States and State Transition representation?
10	Explain about concept of multithreading?
11	Explain about multiprocessing and multitasking?
12	What are the types of multitasking?
13	Write brief note on task scheduling ?discuss FCFS scheduling with an example?
14	Discuss LCFS scheduling and SJF scheduling with an example and comment on time of execution?
15	Write about priority based scheduling with an example
16	What is preemptive scheduling? Explain round robin scheduling with an example?
	Unit V
1	Write about i)Competing Processes ii)Co-operating processes iii)Co-operation through Sharing iv)Co-operation through communication
2	Explain the concept of shared memory in task communication?
3	Write about message passing technique? Explain message queue based indirect messaging for IPC?
4	Explain about Remote Procedure Call for inter process communication?
5	Classify the different sockets used for IPC?
6	What is Task Synchronisation? Explain about racing or race condition?
7	what is Deadlock? What are the different conditions favouring a deadlock situation?
8	Write about memory mapped objects concept in detail?
9	Explain about Semaphore for shared resource access?
10	Explain about mutex for shared resource access?
11	What are device drivers?
12	What are the functional requirements that needs to be analyzed in the selection of an RTOS for an embedded design?

S.No	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION
	UNIT-1					
1	Which memory storage is widely used in PCs and Embedded Systems?	EEPROM	Flash memory	SRAM	DRAM	4
2	Which level simulates the algorithms that are used within the embedded systems?	algorithmic level	switch level	gate level	circuit level	1
3	How an embedded system communicate with the outside world?	Memory	Output	Peripherals	Input	3
4	An embedded system is a combination of	Software	Hardware	Both a and b	Devices	3
5	Which of the following are current embedded system being used in modern technology?	Microprocessors	Micro controllers	DSP processors	All the above	4
6	Which of the following are the sources of embedded system?	Cell phones	Washing machines	Smart watches	All the above	4
7	Which of the following are medical applications of embedded systems?	CT	MRI	PET	All the above	4
8	In which of the following programming language can an embedded software be programmed in?	C	C++	Java	Both a and b	4
9	Which of the following is an example of small scale embedded system?	Printer	DSP	Multipliers	IP cameras	1
10	Which of the following is an example of medium scale embedded system?	Printer	DSP	Multipliers	IP cameras	2
11	what is the first developed embedded system	AGC	autonetics-D17	PLV	None	1
12	embedded system is	an electronic system	an electro-mechanical system	pure mechanical system	Both a and b	4
13	the first mass produced embedded system is	minuteman-I	autonetics-D17	minuteman-II	AGC	2

14	which of the following is intended purpose of embedded system	data processing	data collection	data communication	All the above	4
15	the AGC was developed by	US military	MIT laboratory	defense	none	2
16	Which of the following are the characteristics of an ES?	Unique functionality	Real time based application	time critical	All the above	4
17	Which of the following are advantages of embedded system?	High technology	Long marketing	High cost	Minimum power consumption	4
18	Which of the following are the basic components of an ES	Sensor	ADC, DAC converters	Actuators	All the above	4
19	Which of the following is considered as the heart component of ES?	Software	Processor	Memory	Hardware	2
20	On which of the following frequency do AGC operate?	~1MHz	10 MHz	1 KHz	10 KHz	1
21	Which of the following are the applications of ES in automotive field?	Engine control	Ignition System	Brake system	All the above	4
22	Which of the following are the applications of ES in networking field?	Hub	Router	Gateways	All the above	4
23	Which of the following are the applications of ES in home automation?	Digital clock	ABS	Gateways	None	1
24	Which of the following are the applications of ES in Automobiles?	Air Bags	Digital clock	Hub	None	1
25	in mobile phone the user interface is provided through?	keypad	LCD module	system speaker	All the above	4
26	actuators present in AC is?	Sensor	compressor	feedback unit	control variable	2
27	example of controlling purpose embedded dystems	AC	Digital clock	Scanner	printer	1
28	example of monitoring purpose embedded dystems	ECG machine	printer	Digital clock	All the above	1
29	applications of data processing embedded systems	digital hearing aid	AC	ABS	None	1
30	wired-line medium for data communication	RS-232C	wi-fi	bluetooth	ethernet	1
31	ES that does data collection with memory storage is supported by	CROs	Medical scanners	DMM	None	2

32	ES in the stream of measurement and instrumentation is?	CROs	DMM	logic analyzers PLC systems	All the above	4
33	ES are classified depending on how many criteria's?	2	3	4	5	3
34	embedded operating systems are used in which generation	1	2	3	4	2
35	DSP's are used in which generation of embedded systems	2	3	4	5	3
36	Fourth generation of ES used	SOCA	reconfigurable processors	operating system	All the above	4
37	the number of instructions used by AGC embedded system are	11	12	13	22	1
38	the number of ICs used by AGC embedded system are	2000	3000	5000	4200	3
39	the number of modules in AGC are?	2	3	4	5	1
40	the number of engines in LE Module are?	17	16	18	20	3
41	the final configuration of fixed memory in AGC	4K	36K	38K	10K	2
42	the final configuration of Erasable memory in AGC	256	1K	2K	None	3
43	Embedded system as a _____ to perform a specific task	microcontroller-based	software-driven	real-time control system	All the above	4
44	Assembly language is often termed as?	low-level language	middle-level language	high-level language	None	1
45	how many bit processors are used in small scale embedded systems	2	4	8	16	3
46	how many bit processors are used in medium scale embedded systems	8	16/32	32/64	64	2
47	how many bit processors are used in large scale embedded systems	8	16/32	32/64	64	3
48	the first IC was produced in	1958	1959	1960	1961	1
49	the user interface unit for AGC is	DSKY	LCD module	USB	None	1

UNIT-2						
1	Which of the following processor architecture supports easier instruction pipelining?	Harvard	Von Neumann	Both of them	None of these	2
2	Which memory storage is widely used in PCs and Embedded Systems?	EEPROM	Flash memory	SRAM	DRAM	4
3	Which type of memory is suitable for low volume production of embedded systems?	Non-volatile	RAM	Volatile	ROM	1
4	How an embedded system communicate with the outside world?	Memory	Output	Peripherals	Input	3
5	What is approximate data access time of SRAM?	2ns	10ns	60ns	4ns	4
6	What is approximate data access time of DRAM?	2ns	10ns	60ns	4ns	3
7	How is memory accessed in RISC architecture?	load and store instruction	opcode instruction	memory instruction	bus instruction	1
8	Which of the following statements are true for von Neumann architecture?	shared bus between the program memory and data memory	separate bus between the program memory and data memory	external bus for program memory and data memory	external bus for data memory only	1
9	Why is SRAM more preferably in non-volatile memory?	low-cost	high-cost	low power consumption	transistor as a storage element	3
10	How many MOSFETs are required for SRAM?	2	4	6	8	3
11	Which of the following can access data even when the power supply is lost?	Non-volatile SRAM	DRAM	SRAM	RAM	1
12	Which of the following memory technology is highly denser?	DRAM	SRAM	RAM	Flash memory	1
13	Which is the storage element in DRAM?	inductor	capacitor	resistor	mosfet	2
14	Which one of the following is a storage element in SRAM?	capacitor	inductor	mosfet	resistor	3

15	Which of the following is more volatile?	SRAM	DRAM	RAM	Flash memory	2
16	FPGA stands for…	Field Program Gate Array	First Program Gate Array	Field Programmable Gate Array	First programmable Gate Array	3
17	CPLDs, and FPGAs are all which type of device?	SLD	PLD	EPROM	SRAM	2
18	COTS stands for	Commercial Off-The-Shelf states	Commercial Off-The-System state	Commercial Off-The-Shelf components	None of the mentioned	3
19	RAM is _ _ _ _ _ _ and _ _ _ _ _.	volatile, temporary	non-volatile, temporary	volatile, permanent	non-volatile, permanent	1
20	Which of the following memory is non-volatile?	RAM	ROM	Cache	ROM and Cache	2
21	Which computer memory chip allows simultaneous both read and write operations?	ROM	RAM	PROM	EEPROM	2
22	In which type of memory, once the program or data is written, it cannot be changed?	EPROM	EEPROM	PROM	None of these	3
23	In which type of ROM, data can be erased by ultraviolet light and then reprogrammed by the user or manufacturer?	PROM	EPROM	EEPROM	Both a and b	2
24	How many types of RAM are available?	2	3	4	5	3
25	What does I2C stand for?	inter integrated circuit	intra-IC	individual integrated chip		1
26	Which company developed I2C?	Intel	Motorola	Phillips	IBM	3
27	Which of the following is the most known simple interface?	I2C	Serial port	Parallel port	SPI	1
28	Which are the two lines used in the I2C?	SDA and SPDR	SPDR and SCL	SDA and SCL	SCL and status line	3
29	Which pin provides the reference clock for the transfer of data?	SDA	SCL	SPDR	Interrupt pin	2
30	Which of the following are the three hardware signals?	START, STOP, ACKNOWLEDGE	STOP, TERMINATE, END	START, SCL, SDA	STOP, SCL, SDA	1

31	Which of the following performs the START signal?	master	slave	CPU	memory	1
32	Which of the following byte performs the slave selection?	first byte	second byte	terminal byte	eighth byte	1
33	SPI device communicates in _____	Simplex	Half duplex	Full duplex	Both half and full duplex	3
34	Do SPI have/has a single master?	TRUE	FALSE			1
35	SPI is described as Asynchronous serial interface	TRUE	FALSE			2
36	How many logic signals are there in SPI?	5 signals	6 signals	4 signals	7 signals	3
37	MOSI means _____	Line for master to send data to the slave	Line for the slave to send data to the master	Line for the clock signal	Line for the master to select which slave to send data to	1
38	MISO means _____	Line for master to send data to the slave	Line for the slave to send data to the master	Line for the clock signal	Line for the master to select which slave to send data to	2
39	Which of the following is an advantage of SPI?	No start and stop bits	Use 4 wires	Allows for single master	Error checking is not present	1
40	Which has a half duplex communication?	Queued SPI	I2C	Quad SPI	none of these	2
41	What does UART stand for?	universal asynchronous receiver transmitter	unique asynchronous receiver transmitter	universal address receiver transmitter	unique address receiver transmitter	1
42	What rate can define the timing in the UART?	bit rate	baud rate	speed rate	voltage rate	2
43	How is the baud rate supplied?	baud rate voltage	external timer	peripheral	internal timer	2
44	Which of the following can be used for long distance communication?	I2C	Parallel port	SPI	RS232	4

45	Which of the following have an asynchronous data transmission?	SPI	RS232	Parallel port	I2C	2
46	The RS232 is also known as	UART	SPI	Physical interface	Electrical interface	4
47	Which of the following is not a serial protocol?	SPI	I2C	Serial port	RS232	4
48	What is the standard form of WI-FI?	Wired Fidelity	Wired Function	Wireless Fidelity	None of the above	3
49	The frequency range of WI-FI is around _____	2.4 GHz and 5GHz	2.9 GHz and 5GHz	3.4 GHz and 5GHz	4.4 GHz and 5GHz	1
50	The range of the WI-FI is around _____	50 meters	60 meters	70 meters	80 meters	1
	UNIT-3					
1	Which operational feature of PIC allows it to reset especially when the power supply drops the voltage below 4V?	Built-in Power-on-reset	Brown-out reset	Both a & b	None of the above	2
2	Which timer/s possess an ability to prevent an endless loop hanging condition of PIC along with its own on-chip RC oscillator by contributing to its reliable operation?	Power-Up Timer (PWRT)	Oscillator Start-Up Timer (OST)	Watchdog Timer (WDT)	All of the above	3
3	What is the very first practical oscillator based on?	Electric arcs	Feedback	Frequency	Linearity	1
4	The _____ feedback is used in oscillators.	Positive	Negative	Neither negative nor positive	None of the above	1
5	What is the Real-time systems?	Used for monitoring events as they occur	Primarily used on mainframe computers	Used for real-time interactive users	Used for program development	1
6	The _____ Operating System pays more attention to the meeting of the time limits	Network	Distributed	Online	Real-time	4
7	A watchdog timer circuit is basically a _____.	Register	ALU	Memory	counter✓	4
8	The watchdog counts up and resets the Controller when it reaches the limit?	true	false	cant be said	depends on the conditions	1
9	Watchdog timer is used to generate system reset if system gets	hanged up	shut down	power off	None of the above	1

10	If counter reaches to certain value then watchdog hardware will generates a	reset pulse	sine signal	clock	cos signal	1
11	the reset pulse width can be adjusted by changing the values of?	R and C	R and I	R only	C only	1
12	reset pulses are available in active high and active low logic	TRUE	FALSE			1
13	Embedded firmware refers to	control algorithm	memory	hardware	watch dog timer	1
14	IDEs are different for different family of processors/controllers	TRUE	FALSE			1
15	Integrated Development Environment (The IDE) will contain	compiler	linker	debugger	all the above	4
16	program in Assembly language is written using	opcodes	instructio ns	loops	None of the above	2
17	Which of the following are the components of embedded programming instruction?	Opcode	Mnemoni cs	Operands	All the above	4
18	Which of the following is an example of opcode?	2	ADD A,B	@#	None of the above	2
19	Which of the following are operands in add A,B ?	A,B	add	Both a & b	None of the above	1
20	The process of converting the program written in either a high level language or processor/controller specific Assembly code to machine readable binary code is called	firmware	black file creation	HEX File Creation	None of the above	3
21	If the pro¬ gram is written in Embedded C/C++ using an IDE,hex file is generated using?	cross compiler	linker	debugger	all the above	1
22	if assembly language based programming technique is followed,then hex file is created using?	utilities supplied by the vendors	utilities supplied by the programm ers	compiler	None of the above	1
23	high level languages for embedded programming?	C	C++	Both a & b	None of the above	3
24	For a beginner in the embedded software field, it is strongly recommended to use	high level languages	assembly language	machine language	None of the above	1
25	code written in high level language is highly	not easy and portable	easy and not portable	easy and portable	None of the above	3

26	programs written in high level languages are not developer dependent.	FALSE	TRUE			2
27	system development time will be reduced to a greater extent in high level languages	TRUE	FALSE			1
28	The embedded software development process in assembly language is	tedious	time consuming	Both a & b	None of the above	3
29	programs written in assembly language are developer dependent.	TRUE	FALSE			1
30	Two types of control algorithm design exist in embedded firmware are?	super loop and operating system based	start loop and operating system based	Both a & b	None of the above	1
31	In 'super loop ' based approach,the control flow runs from top to bottom and then jumps back to start of the program	TRUE	FALSE			1
32	super loop approach is similar to	while loop execution	do-while loop execution	for-while loop execution	None of the above	1
33	operating system base approach deals with splitting the functions to be executed into	parts	tasks	files	sections	2
34	It is very difficult for a second person to understand the code written in	Assembly	high level languages	Both a & b	None of the above	1
35	running tasks in os based systems use scheduler	TRUE	FALSE			1
36	The reset circuit is essential to ensure that the device is not operating at a	reference level	voltage level	frequency level	pulse	2
37	The reset signal brings the internal registers and the different hardware systems of the processor/controller to a known state	FALSE	TRUE			2
38	reset starts the firmware execution from the	reset vector	base address vector	Both a & b	None of the above	1
39	the reset pulse should be wide enough to give time for the clock oscillator to stabilise	TRUE	FALSE			1

40	The reset signal to the processor can be applied at	power on	power off	Both a & b	None of the above	1
41	Brown-out protection circuit prevents the processor/controller from unexpected program execution behaviour when the supply voltage to the processor/controller falls below a specified voltage.	TRUE	FALSE			1
42	brown-out protection circuit holds the processor/controller in which state	reset state	wait state	hold state	None of the above	1
43	The instruction execution of a microprocessor/controller occurs in sync with a	clock signal	reset signal	hold signal	ack signal	1
44	reset unit of the embedded system is responsible for generating the precise clock for the processor	TRUE	FALSE			2
45	Quartz crystals and ceramic resonators are equivalent in operation to	Oscillator Unit	reset unit	Brown-out protection unit	None of the above	1
46	system power consumption is directly proportional to the	clock frequency	baud rate	speed	None of the above	1
47	The accuracy of the crystal oscillator or ceramic resonator is normally expressed in terms of	+/-ppm	#VALUE!	m/sec	None of the above	1
48	Real-Time Clock (RTC) is a system component responsible for keeping track of	data	interrupts	time	files	3
49	The RTC can interrupt the OS kernel by asserting the interrupt line	TRUE	FALSE			1
50	The RTC can interrupt the OS kernel by asserting the interrupt line of the processor/controller to which the RTC interrupt line is connected	TRUE	FALSE			1

UNIT-4

1	The operating system acts as a bridge between the user _____ and the underlying system resources	requirements	applications/tasks	input	none of the above	2
2	The OS manages the system resources and makes them available to the user applications/tasks on a need basis	TRUE	FALSE			1

3	The primary functions of an operating system is	Makes the system convenient to use	Organise and manage the system resources	Both a & b	none of the above	3
4	The kernel is the_____ of the operating system	heart	core	software	hardware	2
5	kernel is responsible for managing the system resources and the communication among the hardware and other system services?	TRUE	FALSE			1
6	Kernel acts as the _____ layer between system resources and user applications	abstraction	extraction	identical	none of the above	1
7	Kernel contains a set of system	libraries and services	defination s and services	utilities and services	none of the above	1
8	primary memory refers to the	ROM	RAM	EPROM	EEPROM	2
9	Memory Management Unit (MMU) of the kernel is responsible for	Keeping track of memory	Dynamic memory allocation	Both a & b	none of the above	3
10	The various file system management operations are OS independent	TRUE	FALSE			2
11	The service 'Device Manager' of the kernel is responsible for handling all _____ related operations	I/O	memory	data	none of the above	1
12	Secondary memory is used as backup medium for programs and data since the main memory is volatile	FALSE	TRUE			1
13	The secondary storage management service of kernel deals with	Disk storage allocation	Disk scheduling	Free Disk space manageme nt	all of the above	4
14	The memory space at which the kernel code is located is known as _____	kernal space	os space	memory space	all of the above	1
15	all user applications are loaded to a specific area of primary memory and this memory area is referred as	User Space	kernal space	kernal space	os space	1
16	The partitioning of memory into kernel and user space is purely Operating System independent	FALSE	TRUE			1

17	The act of loading the code into .... .and out of the main memory is termed as	Swapping	interchanging	jumping	none of the above	1
18	Swapping happens between the main (primary) memory and_____	secondary storage memory	RAM	ROM	SRAM	1
19	In monolithic kernel architecture, all kernel services run in the.	os space	User Space	kernel space	memory space	3
20	in monolithic kernal any error or failure in any one of the kernel modules leads to	crashing of the entire application	generation of the entire application	Both a & b	none of the above	1
21	examples of monolithic kernel	LINUX	SOLARIS	MS-DOS kernels	all of the above	4
22	Microkernel based design approach offers the following benefit	Robustness	Configurability	Both a & b	none of the above	3
23	Process management Deals with setting up the_____ for the tasks	User Space	kernel space	memory space	none of the above	3
24	A _____ is used for holding the information corresponding to a task	Task Control Block	task generation block	task synchronisation block	none of the above	1
25	Real-Time Operating Systems that strictly adhere to the timing constraints for a task is referred as	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	3
26	Missing any deadline may produce catastrophic results for Hard Real-Time Systems	TRUE	FALSE			1
27	examples for Hard Real-Time Systems	Air bag control systems	Anti-lock Brake Systems(ABS)	Both a & b	washing machine	3
28	Real-Time Operating System that does not guarantee meeting deadlines, but offer the best effort to meet the deadline	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	2
29	Missing deadlines for tasks are acceptable for	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	2
30	Process is also known as an _____in execution	instance of a program	task of a program	order of a program	none of the above	1
31	The concept of ‘ Process' leads to_____ execution (pseudo parallelism) of tasks	serial	parallel	concurrent	step-by-step	3

32	A _____ is a single sequential flow of control within a process	process	thread	TCB	task	2
33	POSIX stands for					
34	In the operating system context _____describes the ability to execute multiple processes simultaneously	multiprocessing	multitasking	Both a & b	none of the above	1
35	Multiprocessor systems possess multiple ____ and can execute multiple processes	CPUs	Cus	ALUs	none of the above	1
36	_____ multitasking ensures that every task/process gets a chance to execute.	non-preemptive	emptive	Preemptive	none of the above	3
37	non-preemptive scheduling adopted in task/process scheduling are	First-Come-First-Served (FCFS)/FIFO	Last-Come-First Served (LCFS)	Shortest Job First (SJF)	all of the above	4
38	Average Execution Time = _____	(Execution time for all processes)/ No. of processes				
39	Average Turn Around Time = _____	Average waiting time + Average execution time				
40	time is not improved with the SJF scheduling for the same processes when compared to the FCFS algorithm.	TRUE	FALSE			2
41	in monolithic kernal any error or failure in any one of the kernel modules leads to	crashing of the entire application	generation of the entire application	Both a & b	none of the above	1

42	examples of monolithic kernel	LINUX	SOLARIS	MS-DOS kernels	all of the above	4
43	Microkernel based design approach offers the following benefit	Robustness	Configurability	Both a & b	none of the above	3
44	Process management Deals with setting up the_____ for the tasks	User Space	kernel space	memory space	none of the above	3
45	A _____ is used for holding the information corresponding to a task	Task Control Block	task generation block	task synchronisation block	none of the above	1
46	Real-Time Operating Systems that strictly adhere to the timing constraints for a task is referred as	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	3
47	Missing any deadline may produce catastrophic results for Hard Real-Time Systems	TRUE	FALSE			1
48	examples for Hard Real-Time Systems	Air bag control systems	Anti-lock Brake Systems(ABS)	Both a & b	washing machine	3
49	Real-Time Operating System that does not guarantee meeting deadlines, but offer the best effort to meet the deadline	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	2
50	Missing deadlines for tasks are acceptable for	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	2
51	Process is also known as an _____in execution	instance of a program	task of a program	order of a program	none of the above	1
UNIT-5						
1	Processes use IPC mechanisms for	Communicating between process	Synchronising the access of shared resource	Both a & b	None of these	1
2	Which of the following techniques is used by operating systems for inter process communication?	Shared memory	Messaging	Signalling	All of these	4

3	Under Windows Operating system, the input and output buffer memory for a named pipe is allocated in	Non-paged system memory	Paged system memory	Virtual memory	None of the above	4
4	Which among the following techniques is used for sharing data between processes?	Semaphores	Shared memory	Messages	both b & c	3
5	Which among the following is a shared memory technique for IPC?	Pipes	Memory mapped Object	Both a & b	Events	3
6	Why is message passing relatively fast compared to shared memory based IPC?	Message passing is relatively free from synchronisation overheads	Message passing does not involve any OS intervention	All of these	None of these	1
7	In asynchronous messaging, the message posting thread just posts the message to the queue and will not wait for an acceptance (return) from the thread to which the message is posted	TRUE	FALSE			1
8	Under Windows operating system, the message is passed through_____for Inter Process Communication (IPC) between processes?	Message structure	Memory mapped object	Semaphore	All of these	1
9	Which of the following is true about ‘ Signals’ for Inter Process Communication?	Signals are used for'asynchronous notifications	Signals are not queued	Signals do not carry any data	All of these	1

10	Which of the following is true about Racing or Race condition	It is the condition in which multiple processes compete (race) each other to access and manipulate shared data concurrentl y	In a race condition the final value of the shared data depends on the process which acted on the data finally	Racing will not occur if the shared data access is atomic	All of these	1
11	Which of the following is true about deadlock ?	Deadlock is the condition in which a process is waiting for a resource held by another process which is waiting for a resource held by the first process	Is the situation in which none of the competing process will be able to access the resources held by other processes since they are locked by the respective processes	Is a result of chain of circular wait	All of these	1
12	What are the conditions favouring deadlock in multitasking?	Mutual Exclusion	Hold and Wait	No resource preemption at kernel level	Chain of circular waits	5

13	Livelock describes the situation where	A process waits on a resource is not blocked on it and it makes frequent attempts to acquire the resource. But unable to acquire it since it is held by other process	A process waiting in the 'Ready' queue is unable to get the CPU time for execution	Both a & b	None of these	2
14	Priority inversion is	The Condition in which a high priority task needs to wait for a low priority task to release a resource which is shared between the high priority task and the low priority task	The act of increasing the priority of a process dynamically	The act of decreasing the priority of a process dynamically	All of these	1

15	Which of the following is true about Priority' inheritance?	A low priority task which currently holds a shared resource requested by a high priority task temporarily inherits the priority of the high priority task	The priority of the low priority task which is temporarily boosted to high is brought to the original value when it releases the shared resource	All of these	None of these	1

16	Which of the following is true about Priority Ceiling based Priority inversion handling?	A priority is associated with each shared resource	The priority associated to each resource is the priority of the highest priority task which uses this shared resource	Whenever a task accesses a shared resource, the scheduler elevates the priority of the task to that of the ceiling priority of the resource	The priority of the task is brought back to the original level once the task completes the accessing of the shared resource The priority of the task is brought back to the original level once the task completes the	2
17	Process/Task synchronisation is essential for?	Avoiding conflicts in resource access in multitaskin g environme	Ensuring proper sequence of operation across processes.	Communic ating between processes	All of these	4

18	Which of the following is true about Critical Section!	It is the code memory area which holds the program instructions (piece of code) for accessing a shared resource	The access to the critical section should be exclusive	All of these	None of these	1
19	Which of the following is true about mutual exclusion?	Mutual exclusion enforces mutually exclusive access of resources by processes	Mutual exclusion may lead to deadlock	Both a & b	None of these	
20	Which of the following is an example of mutual exclusion enforcing policy	Busy Waiting (Spin lock)	Sleep & Wake up	Both a & b	None of these	3
21	Which of the following synchronisation techniques follow the ‘Sleep & Wake-up' mechanism for mutual exclusion?	Mutex	Semaphore	Critical Section	Spin lock	2

22	Which of the following is true about Critical Section object ?	It can only be used by the threads of a single process (Intra process)	The 'Critical Section' must be initialised before the threads of a process can use it	Accessing Critical Section blocks the execution of the caller thread if the critical section is already in use by other threads	Threads which are blocked by the Critical Section access call, waiting on a critical section, are added to a wait queue and are woken when the Critical Section is available to the requested thread	5
23	A system resource for implementing mutual exclusion in shared resource access_____					Semapho re
24	The binary semaphore implementation for exclusive resource access_____					Mutex
25	A piece of software that acts as a bridge between the operating system and the hardware _____					Device driver
26	A situation where none of the processes are able to make any progress in their execution is_____					Deadlock
27	A kernel which incorporates only the essential services within the kernel space and the rest is installed as loadable modules called					servers

28	device driver implements the following:	Device (Hardware) Initialisation and Interrupt configuration	Interrupt handling and processing	Client interfacing (Interfacing with user applications)	all of these	4
29	In device drivers, OS provides interfaces in the form of Application Programming Interfaces (APIs) for accessing the hardware	TRUE	FALSE			1
30	Counting Semaphores can be used for both exclusive access	TRUE	FALSE			1
31	Counting Semaphores are similar to Binary Semaphores in ____	structure	operation	execution	timing	2
32	The 'Busy waiting' technique uses a lock variable for implementing	synchronisation	communication	mutual exclusion	None of the above	3
33	_____is a section of the shared memory used by processes for communicating	task	Pipe	RAM	ROM	2
34	_____are unnamed, unidirectional pipes used for data transfer between two processes.	Anonymous Pipes	Pipes	Named Pipes	None of these	1
35	_____is a named, unidirectional or bi-directional pipe for data exchange between processes	Anonymous Pipes	Pipes	Named Pipes	None of these	3
36	With _____any process can act as both client and server allowing point-to-point communication	Anonymous Pipes	Pipes	Named Pipes	None of these	3
37	Message Queue Usually the process which wants to talk to another process posts the message to a First-In-First-Out (FIFO) queue called _____					Message queue
38	Mailbox technique for IPC in RTOS is usually used for_____ messaging	one way	two way	Both a & b	None of these	1
39	The thread which creates the mailbox is known as	mailbox server	mailbox clients	Both a & b	None of these	1
40	the threads which subscribe to the mailbox are known as	mailbox server	mailbox clients	Both a & b		2

41	The mailbox creation, subscription, message reading and writing are achieved through OS kernel provided API calls.	TRUE	FALSE			1
42	The implementation of mailbox is OS kernel _____	dependent	independent	supported	None of these	1
43	_____ is a primitive way of communication between process¬ es/threads	Signalling	thread	task	message queue	1
44	Which of the following is an example of mutual exclusion enforcing policy	Busy Waiting (Spin lock)	Sleep & Wake up	Both a & b	None of these	3
45	Which of the following synchronisation techniques follow the 'Sleep & Wake-up' mechanism for mutual exclusion?	Mutex	Semaphore	Critical Section	Spin lock	2
46	Microkernel based design approach offers the following benefit	Robustness	Configurability	Both a & b	none of the above	3
47	Process management Deals with setting up the_____ for the tasks	User Space	kernel space	memory space	none of the above	3
48	A _____ is used for holding the information corresponding to a task	Task Control Block	task generation block	task synchronisation block	none of the above	1
49	Real-Time Operating Systems that strictly adhere to the timing constraints for a task is referred as	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	3
50	Missing any deadline may produce catastrophic results for Hard Real-Time Systems	TRUE	FALSE			1
51	examples for Hard Real-Time Systems	Air bag control systems	Anti-lock Brake Systems(ABS)	Both a & b	washing machine	3
52	Real-Time Operating System that does not guarantee meeting deadlines, but offer the best effort to meet the deadline	Deterministic systems	soft Real-Time systems	Hard Real-Time systems	reactive systems	2

FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS

CS601OE: FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS (Open Elective – I)

B.Tech. CSE/IT III Year II Sem

L	T	P	C
3	0	0	3

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT - I

Introduction to Management: Evolution of Management, Nature & Scope-Functions of Management-Role of Manager-levels of Management-Managerial Skills - Challenges-Planning-Planning Process-Types of Plans-MBO

UNIT - II

Organization Structure & HRM: Organization Design-Organizational Structure-Departmentation–Delegation-Centralization - Decentralization-Recentralization-Organizational Culture- Organizational climate- Organizational change

Human Resource Management-HR Planning - Recruitment & Selection - Training & Development-Performance appraisal - Job Satisfaction-Stress Management Practices

UNIT - III

Operation Management: Introduction to Operations Management-Principles and Types of Plant Layout-Methods of production (Job Batch and Mass production) - Method study and Work Measurement-Quality Management - TQM-Six sigma - Deming's Contribution to Quality - Inventory Management – EOQ - ABC Analysis - JIT System-Business Process Re-engineering (BPR)

UNIT - IV

Marketing Management: Introduction to Marketing-Functions of Marketing-Marketing vs. Selling-Marketing Mix - Marketing Strategies - Product Life Cycle - Market Segmentation -Types of Marketing - Direct Marketing-Network Marketing - Digital Marketing-Channels of Distribution - Supply Chain Management (SCM)

UNIT - V

Project Management: Introduction to Project Management-steps in Project Management - Project Planning - Project Life Cycle-Network Analysis-Program Evaluation & Review Technique (PERT)-Critical Path Method (CPM) - Project Cost Analysis - Project Crashing - Project Information Systems

TEXT BOOKS:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P.Robbins, Pearson Education, 2009.
3. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
4. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
5. Industrial Engineering and Management: Including Production Management, T.R.Banga, S.C Sharma , Khanna Publishers.

S NO	Date	Topics of the each unit as per jntu	Modules/sub-modules for each unit	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text books / reference books
UNIT: I INTRODUCTION TO MANAGEMENT							
1.	22.03.2021	Nature, importance , Functions of Management	Introduction to Business, organization and Management	**Lecture**	L1		T1:1.4-1.7 R1:32-34, 184-192
2.	23.03.2021		Definitions and explanation of management, Organization Nature and Importance management,	**Lecture**	L2		R2:12-13
3.	25.03.2021		functions of management-planning, organizing, staffing, directing and controlling	**Lecture**	L3		T1:2.2-2.6,R1:36-38, R2:79-85
4.	30.03.2021	Scientific management and Principles of Management	Scientific management-Tools and Principles , 14 principles of Henry fayol	**Lecture**	L4		T1: 3.2-3.6, R1:60-63, R2:41-50
5.	01.04.2021 05.04.2021	Motivational theories	Maslow's theory - physiological needs, safety needs, affiliation needs, esteem needs, self actualization needs. Assumptions of Theory X &Theory Y of Douglas McGregor's	**LCD**	L5,L6		T1:3.8-3.9 R1:471,473 R2:588

6.		SEMINAR		ITL		LG1,LG2,LG3	
UNIT-II ORGAISATION STRUCTURE AND HRM							
7.	06.04.2021	Designing Organisational Structures	**Lecture**	**Lecture**	L7		T1:5.3-5.7,R1:340, 341,360, R2:305-306
8.	08.04.2021 15.04.2021	Evaluation of mechanistic and organic structures of organization and suitability	Mechanistic ,Organic organizational structure definition,	**Lecture**	L8, L9		T1:5.10-5.17 R1:343,356, 359 R2:318,335, 338,339,348
9.	19.04.2021	Types of organisational Structures	Types of organizational Structures	**LCD**	L10		T1:5.23-5.25, R2: 363,353
10.	20.04.2021	Departmentation,Delegation, Centralisation, Decentralization and Recentrali	Departmentation,Delegation, Centralisation, Decentralization and Recentralisation	**Lecture**	L11		T1:5.3-5.7,R1:340, 341,360, R2:305-306

		satio n					
11.			SEMINAR	ITL		LG4,LG5,LG6	
HUMAN RESOURCES MANAGEMENT (HRM)							
12.	22.04.2021	Evolution of HRM Concepts of HRM	Definition, Evolution of HRM	**Lecture**	L12		T1:12.3-12.14
13.	26.04.2021	Functions of HR Manager	Functions of HR Manager Managerial functions, Operational functions	**LCD**	L13		T1:13.1-13.3, R8: 8-9
14.	27.04.2021	Man power planning, Recruitment	Man power planning,.Definition ,Importance&Recruitment	**Lecture**	L14		T1:13.5-13.11,14.1-14.2
15.			Methods ,Draw backs of recruitments	**Lecture**			R1:405- 412
16.	29.04.2021	Selection , Training and development Placement , Promotion , Transfer, Separation	Selection –Definition, Process	**LCD**	L15		T1:14.2-14.9

17.	03.05.2021	Training and development	Training methods Performance appraisal-.Definition,. Importance,Factors affecting compensation.	**Lecture**	L16		R1:413-420R8 :182,206-219 T1:14.9-14.10, R1:423-425 R8:238-248
18.	04.05.2021	Performance appraisal	Wage and Salary Administration	**Lecture**	L17		T1:14.10-14.18
19.	06.05.2021	Job evaluation and merit rating	Job Evaluation – definition, advantages,.methods	**Lecture**	L18		T1:14.20-14.26
20.			Role Play as HR Manager	**ITL**		LG7,LG8,LG9	
UNIT:III OPERATIONS MANAGEMENT							
21.	10.05.2021	Principles and Types of Plant layout ,Methods of Production(job ,batch and mass production)	Plant location, factors effecting plant location, plant layout,. types of lay out	**Lecture**	L19		T1: 6.3 - 6.10, R3:165,183
22.	11.05.2021	Work Study-Basic procedur	Work Study-Definition, Importance ,Method study-.Definition &.Basic procedure	**LCD**	L20		T1 :8.2-8.11, R3:497-498

		e involved in Method study					
23.	13.05.2021	Work measurement	Procedure &Time study equipments	**Lecture**	L21		R1:248, R3:536
24.	07.06.2021	– Statistical Quality control	Statistical quality control, inspection, Methods of inspection	**LCD**	L22		T1:,9.1-9.3,R3:510, 298
25.	08.06.2021	Deming's contribution to quality	Deming's contribution to Quality-14 points of contribution	**Lecture**	L23		T1:9.24-9.25, R1:246-47
26.	10.06.2021 14.06.2021	Total Quality Management (TQM), Six sigma	TQM Definition, steps in Six sigms	**Lecture**	L24,25		T1:9.17 - 9.23,20.7 – 20.10, R1:246-47
27.	15.06.2021 17.06.2021	(BPR) ,Business Process Re-engineering,	BPR, Work measurement ,Definition	**LCD**	L26,L27		T1:20.19, 8.11-8.15

28.	21.06.2021	Inventory control	Definition of material, material management, Inventory, Objectives of inventory control, Factors affecting inventory control	**Lecture**	L28		T1:10.3-10.4,R4:196,R5:332
29.	24.06.2021 28.06.2021	EOQ, ABC Analysis,	Determine EOQ-Problems, ABC analysis,	**Lecture**	L29,L30		T1:10.14-10.19, R4:199,221, R5:338,187
30.	29.06.2021	JIT) System, supply chain management	supply chain management, JIT system	**Lecture**	L31		T1:20.5,10.29
31.			GD on Quality management practices and cost	**ITl**	LG10,LG11 ,LG12		
UNIT-IV MARKETING MANAGEMENT							
32.	05.07.2021	Marketing introduction Marketing Mix	Definition of marketing, functions and marketing mix	**Lecture**	L33		T1: 11.2-11.10,R6: 4-8,23, R7:12-13
33.	06.07.2021	Marketing Strategies, Product Life Cycle, Channels of distribution	Marketing Strategies, Segmentation, Strategies based on Product Life Cycle, Types of Marketing,Channels of distribution Supply chain Management	**Lecture**	L34		T1:11.10-11.17, R6:278-287,14-15, R7:457-459,504-505
34.			SEMINAR ON			LG13,LG1	

			MARKETING STRATEGIES			4,LG15	
UNIT : V PROJECT MANAGEMENT (PERT/CPM)							
35.	08.07.2021	Project Mangement and Network Analysis	Project Management definition, stepsNetwork Analysis-Definiton	**Lecture**	L35		T1:15.4-15.7 R4:137-139 R9:413- 414
36.	12.07.2021	Network analysis	PERT and CPM 1.differences 2.network terminology 3.rules to draw network	**Lecture**	L36		T1:15.7-15.10 R4:139-142 R6:431 - 436
37.	13.07.2021	Identify critical path	CPM - , Identifying critical simple path(problems)	**Lecture**	L37		T1:15.13-15.16, R4:145,R6 - 437
38.	15.07.2021 19.07.2021	Probability of completing the project within given time	PERT-Probability of completing the project within given time (simple problems)	**Lecture**	L38,39		T1:15.16-15.2 R4:142 R6 :443
39.	20.07.2021	Project cost analysis	Project Cost Analysis (Simple Problems)	**Lecture**	L40		T1:16.1-16.16 R4:149 R6:450
40.	22.07.2021 26.07.2021	Project Crashing.	Project crashing (Simple Problems)	**Lecture**	L41,L42		T1:16.1-16.16 R6;439

QUESTION BANK UNIT-I

UNIT-I

Short Answer Questions

S. No.	Question	Blooms Taxonomy Level	Course Outcome
1	Define Management	Remember	1
2	What are the functions of management	Remember	2
3	What are the levels of management	Remember	2
4	What are the different skills of manager	Remember	2
5	Distinguish between Administration and Management	Remember	2
6	What are the different theories of management	Remember	2
7	Explain a short note on Management	Understand	2
8	Write a short note on Classical Approach	Remember	1

Long Answer Questions

S. No.	Question	Blooms Taxonomy Level	Course Outcome
1	Explain in detail, Henry Fayol's contribution to management thought .To what Extent these principles are relevant in today's context? Answer with proper justification to your guidance to your argument	Remember	2
2	What do you mean by contingency theory of management what are its implications and relevance? Also state how does this approach differs from systems approach	Remember	2
3	Compare and contrast between behavioral theory and contingency theory.	Remember	2
4	Explain a short note on the following a) System theory b) Administrative theory c) Classical theory	Remember	2
5	What are the approaches to management?	Remember	2
6	Discuss about vroom's participative decision model.	Remember	3
7	Explain the scientific management and its principles	Understand	2
8	Explain the role and importance of management in the present society	Remember	2
9	Define the management .describe the functions of a manager	Remember	2
10	What are the contributions of Henry Fayal towards explain its principles	Remember	2

UNIT-2

Short Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Explain Time management?	Remember	6
2	Discuss the Relationship between the Authority, Power and Influence?	Remember	7
3	Define Organization What Are The Principles Of Organization	Remember	2
4	Compare and Contrast Centralization with Decentralization?	Remember	7
5	What Is Span Of Control?	Remember	5
6	What Is Line And Staff Relationships	Remember	4
7	What Are The Sources Of Recruitment And Selection? What Should Be The Features Of A Sound Promotion Policy	Understand	4
8	Explain Staffing?	Remember	8
9	What Do You Mean By Performance Appraisal? Discuss Its Needs And Importance In An Organization?	Remember	8
10	What Is Meant By Job Analysis,Job Evaluation?	Remember	4

Long Answer Questions

S. No.	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the Principles And steps That Constitute The Organization Process	Remember	4
2	Explain The Various Differences Between The Concept Of Centralization And Decentralization	Remember	7
3	What Are The Basis For Departmentation In A Business Organizations State Also The Difficulties Of Delegation?	Remember	5
4	What Is Span Of Management? What Are The Factors That Decide The Span Of Management?	Remember	6
5	Compare Line And Staff And Functional Organizational Structure?	Remember	4
6	What are the Steps In Recruitment And Selection. What Should Be The Features Of A Sound Promotion Policy?	Remember	4
7	Explain the Requisites Of An Effective Performance Appraisals'	Understand	8
8	What Are The Different Methods Of Training?	Remember	5
9	Explain About Different Techniques Of Interviews?	Remember	5
10	Define Organization And Explain About Its Various Structures Of Organization?	Remember	4

UNIT-3

Short Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Write a brief note on Economic Order Quantity	Remember	6
2	Define Just in Time (JIT). Explain basic elements of JIT	Remember	7
3	Define Operations Management.	Remember	2
4	Define quality, quality management and discuss dimensions of quality	Remember	7
5	Define business process re-engineering	Remember	5
6	Explain Deming's contribution to quality?	Remember	4
7	Explain the concept of TQM?	Understand	4
8	Explain the principles of operations management?	Remember	8
9	Define six sigma	Remember	8
10	Define method study and work measurement	Remember	4

Long Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Explain product and process layout in detail with its advantages and disadvantages	Remember	6
2	Explain types of layout with examples	Remember	7
3	Explain the ABC analysis technique of Inventory Control	Remember	2
4	Discuss concept of Inventory Management. Explain concept of dependent demand and Independent demand.	Remember	7
5	Explain batch production and mass production along with its advantages and disadvantages.	Remember	5
6	Discuss various activities involved in Production and operations management.	Remember	4
7	Explain concept of material handling and Discuss Various material handling Equipments of inventory management	Understand	4
8	Explain in detail Elements of Production planning and control	Remember	8
9	Explain the difference between job,mass,batch production	Remember	8
10	What is production management? What is operations management? Bring out the differences between the two?	Remember	4

UNIT-4

Short Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Define marketing mix	Remember	6
2	Difference between selling and marketing mix	Remember	7

3	Explain factions of marketing	Remember	**2**
4	Brief out the types of marketing	Remember	**7**
5	Explain channels of distribution	Remember	**5**
6	Define marketing? With real example	Remember	**4**
7	Explain network marketing	Understand	**4**
8	Difference between direct marketing and digital marketing	Remember	**8**
9	Explain marketing vs. selling	Remember	**8**
10	Define marketing strategies	Remember	**4**

Long Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Explain the product life cycle(PLC)with real example	Remember	**6**
2	Explain different types of marketing	Remember	**7**
3	Explain the concept of supply chain management in the marketing management	Remember	**2**
4	Differentiate between channels of distribution and supply chain management	Remember	**7**
5	Write the advantages of digital marketing	Remember	**5**
6	Explain all different kinds of marketing strategies	Remember	**4**
7	Define marketing?explain types of market segmentation to cater the customer needs?	Understand	**4**
8	Explain the functions of marketing in and its importance	Remember	**8**
9	Diffrencaite between direct,network,digital marketing	Remember	**8**
10	Explain supply chain managemet and its importance	Remember	**4**

UNIT-5

Short Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Define project management	Remember	**6**
2	Difference critical path method	Remember	**7**
3	Define PERT model	Remember	**2**
4	Explain project information system	Remember	**7**
5	Difference between project life cycle and product life cycle	Remember	**5**
6	Differentiate between PERT&CPM	Remember	**4**
7	explain advantages of project planning	Understand	**4**
8	What project cost analysis	Remember	**8**
9	Define project crashing	Remember	**8**
10	Explain steps in project management ?	Remember	**4**

Long Answer Questions

S. No.	Questions	Blooms Taxonomy Level	Course Outcome
1	Define project management?expalin steps in project management	Remember	**6**
2	Write any four phases of Project Management	Remember	**7**
3	Explain Project Management Life Cycle and the various phases in a Project Life Cycle.	Remember	**2**
4	Explain the concept of PERT	Remember	**7**
5	Write a detailed note on the various steps involved in Project Formulation	Remember	**5**
6	project Management Framework, Project Manager Role and Agile Practice	Remember	**4**
7	Project Schedule Management and Project Cost Management	Understand	**4**
8	Write a detailed note Project Management.	Remember	**8**
9	State the importance of Project Management.	Remember	**8**
10	Discuss the role of Project Manager	Remember	**4**

OBJECTIVE QUESTIONS: JNTUH

UNIT I

1. Management exists at the____level of the organization.

A. Lower B, Middle C. Top D. All of the above

Answer : **D**

2. Management is

A. an art B. a science C. both an art and a science D. none of the above

Answer : **C**

3. In what order do managers typically perform the managerial functions?

A. organising, planning, controlling, leading

B. planning, organising, leading, controlling

C. planning, organising, controlling, leading

D. organising, leading, planning, controlling

Answer : **C**

4. Coordinating people and human resources to accomplish organizational goals is the process of

A. directing

B. planning

C. leadership

D. management

Answer : **C**

5. Which of the following is not a principle by Henry Fayol?

A. Harmony not discord

B. Division of work

C. Unity of command

D. Discipline

Answer : **A**

6. Which one of the following is not one of Drucker's five guiding principles of management?

A. Making people's strengths effective and their weaknesses irrelevant.

B. Integrating people in a common venture by thinking through, setting and exemplifying the organisational objectives, values and goals.

C. To operate the organisation's status system.

D. Enhancing the ability of people to contribute.

Answer : **C**

7. Planning, organizing, directing and controlling are the:

A. goals of management.

B. functions of management.

C. results of management.

D. all of the above.

Answer : **B**

8.Which one is not a recognised key skill of management?

A. Conceptual skills

B. Human skills

C. Technical skills

D. Writing skills

Answer : **D**

9. Which of the following would be included in the "controlling function" ?

A. explaining routines

B. measuring results against corporate objectives.

C. giving assignments.

D. setting standards.

Answer : **B**

10. Supervisory management spends most of his/her time on

A. planning and organizing

B. planning and controlling

C. organizing and controlling

D. directing and controlling

Answer : **D**

11. Main functions of administrative management are

A. planning , organizing, directing and controlling

B. planning, organizing, controlling and representation

C. planning, organizing , staffing, directing and controlling

D. planning ,organizing, staffing and directing

Answer : **A**

12. Management is said to be the combination of

A. arts, commerce and science

B. arts, science and engineering

C. arts, commerce and engineering

D. arts, science and profession

Answer : **D**

13. Which of the following management functions are closely related?

A. planning and organizing

B. staffing and control

C. planning and staffing

D. planning and control

Answer : **D**

14. Positive motivation makes people willing to do their work in the best way they can and improve their _____.

A. Personality

B. Productivity

C. Performance

D. All of the above

Answer : **C**

15. Directing function of management embraces activities of

A. supervising subordinates

B. providing leadership and motivation to subordinates

C. issuing orders to subordinates

D. all of above

Answer : **A**

16. All of the following are elements of planning Expect

A. Developing Plans

B. Monitoring Performance

C. Establishing Strategies

D. Coordinate Activities

Answer : **B**

17. Planning function of management is performed by .....

A. Top Management

B. Middle Management

C. Lower Management

D. All of the above

Answer : **D**

18. Which of the following is not an element of administration?

A. coordinating

B. planning

C. organizing

D. initiative

Answer : **D**

19. Guiding and supervising the efforts of subordinates towards the attainment of the organization's goals describes the function of

A. organizing

B. planning

C. directing

D. controlling

Answer : **C**

20. The control function of management embraces

A. Financial Control

B. Budgetary Control

C. Cost Control

D. All of the above

Answer : **D**

UNIT II

Q1. Human Resource departments are_____

(a) line departments (b) authority department
(c) service department (d) functional department **Ans. (c)**

Q2. What is human factor?
(a) Micro and macro issues of socio•economic factor.
(b) Interrelated Physiological, Psychological and Socio-ethical aspects of human being.
(c) The entire concept of human behaviour
(d) None of the above. Ans. (b)

Q3. Job Analysis is a systematic procedure for securing and reporting information defining a_____.(a) specific job (b) specific product (c) specific service (d) all of these

Ans. (a)

Q4. What are the factors responsible for the growth of HRM?

(a) Development of scientific management and awakened sense of social responsibility.
(b) The problem of how the available human resource could effectively minimise the cost and maximise the production.
(c) Technical factors, awakening amongst workers, attitude of the government, cultural and social system.
(d) All the above.
Ans. (c)
Q5. Which among the followings describe the skills that are available within the company?

(a) Human Resource inventory (b) HRIS (c) Skills inventory (d) Management inventories

Ans. (a)

Q6. Who has defined personnel management as a field of management which has to do with planning and controlling various operative functions of procuring, developing, maintaining and utilising labour force?

(a) Harold Koontz (b) Glueck (c) Michael Jucius (d) Flippo

Ans. (c)

Q7. Resources and capabilities that serve as a source of competitive advantage for a firm over its rivals are called _____.

(a) core competency (b) core competence (c) competitive advantage (d) competency

Ans. (a)

Q8. Human Resource planning is compulsory for_____.

(a) effective employee development programme

(b) base for recruitment (c) base for selection policy (d) all of these

Ans. (d)

Q9. Job analysis, HR planning, recruitment, selection, placement, inductions and internal mobility are few important functions which come under the heading of_____of HRM.
(a) integration function (b) development (c) maintenance (d) procurement function
Ans. (d)
Q10. Directing is one of the important functions of HRM which comes under_____.
(a) managerial function (b) operative function
(c) technical function (d) behavioral function
Ans. (a)

UNIT III

Production and Operations Management

1. Which of the following is (are) important consideration(s) concerning activity times?

A. Activity time should be obtained from the person responsible for the completion of an activity

B. Activity time must be independent of any influence which the preceding or succeeding activity may have on it.

C. Activity time may assume that just the normal quantity of resources required to carry out the activity are available.

D. All of the above

2. Objective of Work Study is to improve ---------

A. Cycle time

B. Productivity

C. Production

D. All of the above

3. The following is not a major contributor in the development of Control Charts and Sampling plan

A. F H Dodge

B. H G Roming

C. Walter Schewhart

D. J M Juran

4. Organizational models are

A. multinational model

B. international model

C. global organizational model

D. All of the above

5. The ———— is the defect level for which lots are regarded as bad lots.

A. Acceptable quality level

B. Consumer's risk

C. Producer's risk

D. Lot Tolerance Percentage Defective

6. What are the advantages of templates over diagrams?

A. Can be conveniently moved on the graph paper

B. Less laborious

C. Saves time

D. All of the above

7. Attack strategies are

A. Frontal attack

B. Flank attack

C. Encirclement attack

D. All of the above

8. Which of the following are assignable cause?

A. Large variations in hardness of material

B. Tool wear

C. Errors in setting

D. All of the above

9. Which of the following are activities of corrective maintenance?

A. Overhauling

B. Emergency repairs

C. Modifications and improvements

D. All of the above

10. Limitations of Traditional cost accounting are

A. Assumes factory as an isolated entity

B. It measures only the cost of producing

C. both (A) and (B)

D. none of the above

UNIT IV

Marketing Management

1. Which of the following statements is correct?

A. Marketing is the term used to refer only to the sales function within a firm

B. Marketing managers usually don't get involved in production or distribution decisions

C. Marketing is an activity that considers only the needs of the organization, not the needs of society as a whole

D. Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large

2. Which of the following is NOT an element of the marketing mix?

A. Distribution

B. Product

C. Target market

D. Pricing

3. Marketing decision makers in a firm must constantly monitor competitors' activities-their products, prices, distribution, and promotional efforts-because

A. The competitors may be violating the law and can be reported to the authorities

B. The actions of competitors may threaten the monopoly position of the firm in its industry

C. The actions of competitors may create an oligopoly within an industry

D. New product offerings by a competitor with the resulting competitive variations may require adjustments to one or more components of the firm's marketing mix

4. Political campaigns are generally examples of---

A. Cause marketing

B. Organization marketing

C. Event marketing

D. Person marketing

5._____is the collection and interpretation of information about forces, events, and relationships that may affect the organization.

A. Environmental scanning

B. Stakeholder analysis

C. Market sampling

D. Opportunity analysis

6. Which of the following is typically NOT a result of recognizing the importance of ethnic groups by marketers?

A. Use of an undifferentiated one-size-fits-all marketing strategy

B. Different pricing strategies for different groups

C. Variations in product offerings to suit the wants of a particular group

D. Study of ethnic buying habits to isolate market segments

7. Strategic marketing planning establishes the---

A. Resource base provided by the firm's strategy

B. Economic impact of additional sales

C. Tactical plans that must be implemented by the entire organization

D. Basis for any marketing strategy

8. These objectives are often the most suitable when firms operate in a market dominated by a major competitor and where their financial resources are limited

A. Niche

B. Hold

C. Harvest

D. Divest

9. When companies make marketing decisions by considering consumers' wants and the long-run interests of the company, consumer, and the general population, they are practicing which of the following principles?

A. Innovative marketing

B. Consumer-oriented marketing

C. Value marketing

D. Societal marketing

10. The use of price points for reference to different levels of quality for a company's related products is typical of which product-mix pricing strategy?

A. Optional-product pricing

B. Captive-product pricing

C. By-product pricing

D. Product line pricing

UNIT V

1-A_____is a set of activities which are networked in an order and aimed towards achieving the goals of a project.

(A) Project (B) Process (C) Project management (D) Project cycle

2-Resources refers to

(A) Manpower (B) Machinery (C) Materials (D) All of the above

3-Developing a technology is an example of

(A) Process (B) Project (C) Scope (D) All of the above

4-The project life cycle consists of

(A) Understanding the scope of the project (B) Objectives of the project

(C) Formulation and planning various activities (D) All of the above

5-Following is(are) the responsibility(ies) of the project manager.

(A) Budgeting and cost control (B) Allocating resources

(C) Tracking project expenditure (D) All of the above

6-Following are the phases of Project Management Life Cycle. Arrange them in correct order

1.Design, 2. Marketing, 3. Analysis and evaluation, 4. Inspection, testing and delivery

(A) 3-2-1-4 (B) 1-2-3-4 (C) 2-3-1-4 (D) 4-3-2-1

7-Design phase consist of

(A) Input received (B) Output received (C) Both (A) and (B) (D) None of the above

8-Project performance consists of

(A) Time (B) Cost (C) Quality (D) All of the above

9-Five dimensions that must be managed on a project

(A) Constraint, Quality, Cost, Schedule, Staff (B) Features, Quality, Cost, Schedule, Staff

(C) Features, priority, Cost, Schedule, Staff (D) Features, Quality, Cost, Schedule, customer

10-Resorce requirement in project becomes constant while the project is in its_____progress stage.

(A) 40 to 55% (B) 55 to 70% (C) 70 to 80% (D) 80 to 95

ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE

B.Tech. III Year I/II Semester

Course Objectives:

- To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning.
- Study of Markov Models enable the student readyto step into applied AI.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents **Basic Search Strategies**: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation,Minimax Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule,Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, KnowledgeAcquisition.

TEXT BOOK:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hillpublications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving,Pearson Education, 6th ed., 2009.

B.Tech III Year II Sem R18- AI - Session Plan

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
1	22.03.2021	Introduction	Introduction to AI	**Lecture**	L1		T1:29-55
2	24.03.2021	AI problems, Agents and Environments		**Lecture**	L2		T1:60-71 R1:3-5
3	26.03.2021	Structure of Agents, Problem Solving Agents		**Lecture**	L3		T1: 72-91
4	31.03.2021	Basic Search Strategies		**Lecture**	L4		T1:101
5	05.04.2021	Problem spaces, Uniformed search (BFS, DFS, Depth first with Iterative Deepening)	Defining the problem as state space search, problem characteristics	**Debate**	L5		T1:101-106 R1:29-60
6	07.04.2021	Heuristic Search(Hill Climbing, Generic Best-first, A*)		**Seminars**	L6	LG1,LG2	T1:122-127 R1:63-96
7	09.04.2021	Constraint satisfaction: Backtracking		**Role Play**	L7	LG3,LG4	T1:165-177
8	16.04.2021	Local Search		**Lecture**	L8		T1: 147-156
UNIT 1 QUIZ							
9	19.04.2021	Advanced Search	Constructing search trees	**Lecture**	L9		T1:189
10	23.04.2021	Stochastic search, Alpha-Beta pruning		**Lecture**	L10		R1-314-318

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
11	26.04.2021	A* search implementation, Minimax search		**Lecture**	L11		R1:310-313
12	28.04.2021	Basic Knowledge representation and Reasoning		**Lecture**	L12		T1:222-227
13	30.04.2021	Propositional Logic, First-order Logic, Forward and backward Chaining	Syntax and semantics of first-order logic	**Lecture**	L13		T1:228-247, 268-295, 300-322
14	03.05.2021	Introduction to probabilistic Reasoning, Bayes Theorem	Bayes rule, networks	**Lecture**	L14		T1:520-546
	UNIT 2 QUIZ						
15	05.05.2021	Advanced Knowledge Representation and Reasoning		**Lecture**	L15		R1:171-191
16	07.05.2021	Knowledge representation issues, non-monotonic reasoning		**Lecture**	L16		R1:195-208
17	10.05.2021	Other knowledge representation schemes		**Lecture**	L17		R1-209-225
18	12.05.2021	Reasoning under uncertainty		**Lecture**	L18		
19	07.06.2021	Basic probability, acting under uncertainty, Bayes' Rule		**Lecture**	L19		T1:507-510
20	09.06.2021	Learning		**Lecture**	L20		T1: 677-678
UNIT 3 QUIZ							

S.No	Date	Topic	Sub Topic	Mode of Teaching (Lecture/ITL)	Lecture/ITL No	Learning Groups	Text Books and References
21	11.06.2021	Rote Learning, Learning by taking advice		**Lecture**	L21		R1:448-451
22	14.06.2021	Learning in problem solving		**Lecture**	L22		R1:452-470
23	16.06.2021	Learning from examples, Winston's Learning program		**Lecture**	L23		R1:457-474
24	18.06.2021	Decision Trees		**Lecture**	L24		T1:681-691
UNIT 4 QUIZ							
25	21.06.2021	Expert Systems		**Seminars**	L25	LG5,LG6	R1:547
26	23.06.2021	Representing and using Domain Knowledge		**Lecture**	L26		R1:547-548
27	25.06.2021	Shell, Explanation		**Lecture**	L27		R1:549-552
28	28.06.2021	Knowledge Acquisition		**Lecture**	L28		R1:553-555
UNIT 5 QUIZ							

S. No	Case Studies	Seminars	Role Plays	Debates	Group Discussions	Quizzes
1		Heuristic Search	Backtracking	BFS,DFS		
2		Expert Systems				
3						

QUESTION BANK

UNIT- I

1. Explain the following uninformed search strategies with examples.
(a) Breadth First Search. (b) Uniform Cost Search (c) Depth First Search (d) Depth Limited Search
2.What is PEAS? Explain different agent types with their PEAS descriptions.
3.Explain in detail the properties of Task Environments.
4. How an algorithm's performance is evaluated?
5.Compare different uninformed search strategies in terms of the four evaluation criteria.
6.What is Greedy Best First Search? Explain with an example the different stages of Greedy Best First search.
7.What is A* search? Explain various stages of A* search with an example.
8.Define Artificial Intelligence. Explain the techniques of A.I. Also describe the characteristics of Artificial Intelligence.
9.Explain in detail about Uninformed Search and Informed Search Strategies.
10. List and explain the applications of Artificial Intelligence.

UNIT-II

1. Define constraint satisfaction problem (CSP). How CSP is formulated as a search problem? Explain with an example.
2.Explain with examples (i) Adversarial search problem (ii) Game
3.Differentiate between forward and backward reasoning
4.Explain with algorithm and example : (i). Minimax algorithm (ii). Alpha-Beta Pruning
5.Define the syntactic elements of first-Order logic and Illustrate the use of first-order logic to represent knowledge.
6.Give a brief note on Alpha-Beta Pruning.
7.Explain with an example (a) forward chaining (b) Backward chaining
8.Differentiate propositional logic with FOL.
9.List the inference rules along with suitable examples for first order logic

10.Explain how values are propagated in the game tree using MINIMAX and ALPHA-BETA pruning. Show the nodes that will be pruned.

UNIT- III

1.Describe Bayes theorem.
2.What are the elements of propositional logic?
3.Explain the steps involved in the knowledge Engineering process. Give an example.
4.What is propositional logic?
5.Define the syntactic elements of first-order logic.
6.Explain with an example (a) forward chaining (b) Backward chaining
7.What are Bayesian networks? Give an example
8.Illustrate the use of first-order logic to represent knowledge.
9.What are the components of agents.
10.What is learning? What are its types?

UNIT- IV

1.Write the decision tree learning algorithm
2.How hypotheses formed by pure inductive inference or induction?Explain with ex - amples.

3.Define and explain (i) Supervised learning (ii) Unsupervised learning (iii) Reinforcement learning

4.Explain the process of inducing decision trees from examples.
5.Write the decision tree learning algorithm
6.What is explanation based learning? Explain in detail with an example.
7.Explain the process of inducing decision trees from examples.
8.Write the decision tree learning algorithm
9.How the performance of a learning algorithm is assessed? Draw a learning curve for the decision tree algorithm.
10.What is reinforcement learning?

UNIT- V

1.What are Expert Systems?
2.Briefly explain the knowledge acquistion process.
3.List the characteristic features of a expert system.
4.Mention some of the key applications of ES.
5.What is Explanation Based Learning? How is it useful?
6.Discuss ambiguity and disambiguation.
7.What is Grammar indication? Explain with an example.
8.Explain in detail (a) Information Retrieval (b) Information Extraction.
9.What is machine translation? What are different types of machine translation?
10.Draw the schematic of a machine translation and explain for an example problem.

SL. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION	TOPIC NAME
1	Artificial Intelligence is about_____.	Playing a game on Computer	Making a machine Intelligent	Programming on Machine with your Own Intelligence	Putting your intelligence in Machine	2	UNIT-I
2	What is the full form of "AI"?	Artificially Intelligent	Advanced Intelligence	Artificial Intelligence	Artificially Intelligence	2	UNIT-I
3	Which of the following is the branch of Artificial Intelligence?	Machine Learning	Cyber forensics	Full-Stack Developer	Network Design	1	UNIT-I
4	Which of the following is a component of Artificial Intelligence?	Learning	Training	Designing	Puzzling	1	UNIT-I
5	Which of the following is not a type of Artificial Intelligence agent?	Learning AI agent	Goal-based AI agent	Simple reflex AI agent	Unity-based AI agent	4	UNIT-I
6	Which of the following is not an application of artificial intelligence?	Face recognition system	Chatbots	LIDAR	DBMS	4	UNIT-I
7	Which of the following machine requires input from the humans but can interpret the outputs themselves?	Actuators	Sensor	Agents	AI system	4	UNIT-I
8	_____ number of informed search method are there in Artificial Intelligence.	4	3	c2	1	1	UNIT-I
9	What is the work of Task Environment and Rational Agents?	Problem and Solution	Solution and Problem	Observation and Problem	Observation and Solution	1	UNIT-I
10	What is meant by a "Complete Algorithm"?	If a solution exists, the algorithm will find it before terminating.	It will find the solution in a finite amount of time.	Both A and B.	None of the above.	3	UNIT-I
11	AI agents are composed of _____?	Architecture	Program	Both A and B	None of the above	3	UNIT-I
12	Which of the following are appropriate levels for a knowledge-based AI agent?	Knowledge Level	Logical Level	Implementation Level	All of the above	4	UNIT-I
13	The total number of proposition symbols in AI are _____	3 proposition symbols	1 proposition symbols	2 proposition symbols	No proposition symbols	3	UNIT-I
14	The total number of logical symbols in AI are _____	There are 3 logical symbols	There are 5 logical symbols	Number of logical symbols are based on the input	Logical symbols are not used	2	UNIT-I
15	Which of the following environment is strategic?	Rational	Deterministic	Partial	Stochastic	2	UNIT-I
16	Who is known as the -Father of AI"?	Fisher Ada	Alan Turing	John McCarthy	Allen Newell	3	UNIT-I
17	Select the most appropriate situation for that a blind search can be used.	Real-life situation	Small Search Space	Complex game	All of the above	2	UNIT-I
18	The application/applications of Artificial Intelligence is/are	Expert Systems	Gaming	Vision Systems	All of the above	4	UNIT-I
19	Among the given options, which search algorithm requires less memory?	Optimal Search	Depth First Search	Breadth-First Search	Linear Search	2	UNIT-I
20	If a robot is able to change its own trajectory as per the external conditions, then the robot is considered as the__	Mobile	Non-Servo	Open Loop	Intelligent	4	UNIT-I
21	Which of the given language is not commonly used for AI?	LISP	PROLOG	Python	Perl	4	UNIT-I

22	A technique that was developed to determine whether a machine could or could not demonstrate the artificial intelligence known as the___	Boolean Algebra	Turing Test	Logarithm	Algorithm	2	UNIT-I
23	The component of an Expert system is_____.	Knowledge Base	Inference Engine	User Interface	All of the above	4	UNIT-I
24	Which algorithm is used in the Game tree to make decisions of Win/Lose?	Heuristic Search Algorithm	DFS/BFS algorithm	Greedy Search Algorithm	Min/Max algorithm	4	UNIT-I
25	The available ways to solve a problem of state-space-search.	1	2	3	4	2	UNIT-I
26	Among the given options, which is not the required property of Knowledge representation?	Inferential Efficiency	Inferential Adequacy	Representational Verification	Representational Adequacy	3	UNIT-I
27	An AI agent perceives and acts upon the environment using___.	Sensors	Perceiver	Actuators	Both a and c	4	UNIT-I
28	Which agent deals with the happy and unhappy state?	Utility-based agent	Model-based agent	Goal-based Agent	Learning Agent	1	UNIT-I
29	Which term describes the common-sense of the judgmental part of problem-solving?	Values-based	Critical	Analytical	Heuristic	4	UNIT-I
30	The search algorithm which is similar to the minimax search, but removes the branches that don't affect the final output is known as__.	Depth-first search	Breadth-first search	Alpha-beta pruning	None of the above	3	UNIT-I
31	The maximum depth to which the alpha-beta pruning can be applied.	Eight states	Six states	Ten states	Any depth	4	UNIT-I
32	Among the given options, which is also known as inference rule?	Reference	Reform	Resolution	None of the above	3	UNIT-I
33	If according to the hypothesis, the result should be positive, but in fact it is negative, then it is known as_____.	False Negative Hypothesis	False Positive Hypothesis	Specialized Hypothesis	Consistent Hypothesis	2	UNIT-I
34	The PEAS in the task environment is about_____.	Peer, Environment, Actuators, Sense	Performance, Environment, Actuators, Sensors	Perceiving, Environment, Actuators, Sensors	None of the above	2	UNIT-I
35	In which search problem, to find the shortest path, each city must be visited once only?	Map coloring Problem	Depth-first search traversal on a given map represented as a graph	Finding the shortest path between a source and a destination	Travelling Salesman problem	4	UNIT-I
36	The main function of problem-solving agent is to_____.	Solve the given problem and reach the goal	Find out which sequence of action will get it to the goal state.	Both a & b	None of the above	3	UNIT-I
37	For propositional Logic, which statement is false?	The sentences of Propositional logic can have answers other than True or False.	Each sentence is a declarative sentence.	Propositional logic is a knowledge representation technique in AI.	None of the above	1	UNIT-I
38	First order logic Statements contains_____.	Predicate and Preposition	Subject and an Object	Predicate and Subject	None of the above	3	UNIT-I
39	A knowledge-based agent can be defined with _____ levels.	2 Levels	3 Levels	4 Levels	None of the above	2	UNIT-I
40	Ways to achieve AI in real-life are_____.	Machine Learning	Deep Learning	Both a & b	None of the above	3	UNIT-I
41	The main tasks of an AI agent are_____.	Input and Output	Moment and Humanly Actions	Perceiving, thinking, and acting on the environment	None of the above	3	UNIT-I
42	The probabilistic reasoning depends upon_____.	Estimation	Observations	Likelihood	All of the above	4	UNIT-I
43	The inference engine works on _____.	Forward Chaining	Backward Chaining	Both a and b	None of the above	3	UNIT-I

44	The best AI agent is one which_____	Needs user inputs for solving any problem	Can solve a problem on its own without any human intervention	Need a similar exemplary problem in its knowledge base	All of the above	2	UNIT-I
45	An Algorithm is said as Complete algorithm if_____	It ends with a solution (if any exists).	It begins with a solution.	It does not end with a solution.	It contains a loop	1	UNIT-I
46	Which statement is valid for the Heuristic function?	The heuristic function is used to solve mathematical problems.	The heuristic function takes parameters of type string and returns an	The heuristic function does not have any return type.	The heuristic function calculates the cost of an optimal path between the pair of states.	4	UNIT-I
47	Which of the given element improve the performance of AI agent so that it can make better decisions?	Changing Element	Performance Element	Learning Element	None of the above	3	UNIT-I
48	The decision tree algorithm reaches its destination using_____.	Single Test	Two Test	Sequence of test	No test	3	UNIT-I
49	What is the total number of quantification available in artificial intelligence?	4	3	1	2	4	UNIT-I
50	The computer program simulating the thought process of humans is known as:	Expert reason	Personal information	Expert system	Human logic	3	UNIT-I
51	The other name for a robot's "arm" is its:	Manipulator	End Effector	Servomechanism	Actuator	1	UNIT-II
52	What is Artificial Intelligence	Programming with your own intelligence	Putting your intelligence into Computer	Making a Machine intelligent	Playing a Game	3	UNIT-II
53	What kind of behaviour does the stochastic enviroment posses?	Deterministic	Local	Primary	Rational	2	UNIT-II
54	Computational Intelligence is a full form of_____	Knowledge management	Singularity	Artificial intelligence	case-based reasoning	3	UNIT-II
55	Which of the following is not a stage of knowledge engineering?	Assemble the relevant knowledge	Encode general knowledge about the domain	Identify the task	Fixing a Problem	4	UNIT-II
56	Which of the following is not a stage in AI?	Predictive analytics	Diagnotic analytics	Cognitive analytics	All of the above	3	UNIT-II
57	Strong AI is_____	The embodiment of human intellectual capabilities within a computer	The study of mental faculties through the use of mental models implemented	Both A & B	None	1	UNIT-II
58	What is state space in AI	The whole problem	Problem you design	Whole design	Representing your problem with variable and parameter	4	UNIT-II
59	What is the frame in AI?	Data Type	Data Structure	A way of representing knowledge	All of the above	3	UNIT-II
60	The primary method that people use to sense their environment is:	Reading	Writing	Speaking	Seeing	4	UNIT-II
61	The first AI programming language was called:	BASIC	FORTRAN	IPL	LISP	3	UNIT-II
62	In which university the first demontration of AI program run?	Carnegie Mellon University.	Oxford University	Cambridge University	Stanford University	1	UNIT-II
63	A major thrust of AI is in the development of computer functions associated with human intelligence.	TRUE	FALSE	AI is not associated with human intelligence	None of the Above	1	UNIT-II
64	Which of the following areas can not contribute to build an intelligent system?	Neuron science	Maths	Computer Science	Geology	4	UNIT-II
65	In which year John McCarthy coined the term Artificial Intelligence?	1950	1953	1956	1959	3	UNIT-II

66	A process that is repeated, evaluated, and refined is called _____	diagnostic	descriptive	interpretive	iterative	4	UNIT-II
67	Which is created by using single propositional symbol?	Complex sentences	Atomic sentences	Composition sentences	None of the mentioned	2	UNIT-II
68	What is the condition of variables in first-order literals?	Existentially quantified	Universally quantified	Both Existentially & Universally quantified	None of the mentioned	2	UNIT-II
69	Which knowledge base is called as fixed point?	First-order definite clause are similar to propositional forward chaining	First-order definite clause are mismatch to propositional forward chaining	c) All of the mentioned	None of the mentioned	1	UNIT-II
70	A) Knowledge base (KB) is consists of set of statements. B) Inference is deriving a new sentence from the KB.	A is true, B is true	A is false, B is false	A is true, B is false	A is false, B is true	1	UNIT-II
71	AI agents are composed of?	Architecture	Program	Both A and B	None of the above	3	UNIT-II
72	For external action selection, which element is used in the agent?	Perceive	Performance	Actuator	None of the above	2	UNIT-II
73	PEAS is an abbreviation for?	Peace, Environment, Action, Sense	Peer, Environment, Actuators, Sensors	Performance, Environment, Actuators, Sensors	Performance, Environment, Actuators, Sense	3	UNIT-II
74	Which of the following are heuristic search algorithms?	Best First Search Algorithm	A* Search Algorithm	Both A and B	None of the above	3	UNIT-II
75	Artificial Intelligence is associated with computers of which generation?	Second	First	Fifth	Third	3	UNIT-II
76	Which of the following is not a type of AI?	Weak AI	Theory of Mind	Reactive Machines	All of the above	3	UNIT-II
77	Which of the following is an advantage of artificial intelligence?	Reduces the time taken to solve the problem	Helps in providing security	Have the ability to think hence makes the work easier	All of the above	4	UNIT-II
78	Which of the following is/are the composition for AI agents?	Program only	Architecture only	Both Program and Architecture	None of the mentioned	3	UNIT-II
79	On which of the following approach A basic line following robot is based?	Applied approach	Weak approach	Strong approach	Cognitive approach	2	UNIT-II
80	Artificial Intelligence has evolved extremely in all the fields except for _____	Web mining	Construction of plans in real time dynamic systems	Understanding natural language robustly	All of the mentioned	4	UNIT-II
81	Which of the following is an expansion of Artificial Intelligence application?	Game Playing	Planning and Scheduling	Diagnosis	All of the mentioned	4	UNIT-II
82	What is an AI 'agent'?	Takes input from the surroundings and uses its intelligence and performs the desired operations	An embedded program controlling line following robot	Perceives its environment through sensors and acting upon that	All of the mentioned	4	UNIT-II
83	The search algorithm which is similar to the minimax search, but removes the branches that don't affect the final output is known as__.	Depth-first search	Breadth-first search	Alpha-beta pruning	None of the above	3	UNIT-II
84	The maximum depth to which the alpha-beta pruning can be applied.	Eight states	Six states	Ten states	Any depth	4	UNIT-II
85	Among the given options, which is also known as inference rule?	Reference	Reform	Resolution	None of the above	3	UNIT-II
86	If according to the hypothesis, the result should be positive, but in fact it is negative, then it is known as_____.	False Negative Hypothesis	False Positive Hypothesis	Specialized Hypothesis	Consistent Hypothesis	2	UNIT-II
87	Translate the following statement into FOL."For every a, if a is a philosopher, then a is a scholar"	∀ a philosopher(a) scholar(a)	∃ a philosopher(a) scholar(a)	All of the mentioned	None of the mentioned	1	UNIT-II

88	The statement comprising the limitations of FOL is/are _____	Expressiveness	Formalizing Natural Languages	Many-sorted Logic	All of the mentioned	4	UNIT-II
89	First Order Logic is also known as _____	First Order Predicate Calculus	Quantification Theory	Lower Order Calculus	All of the mentioned	4	UNIT-II
90	Which is used to compute the truth of any sentence?	Semantics of propositional logic	Alpha-beta pruning	First-order logic	Both Semantics of propositional logic & Alpha-beta pruning	1	UNIT-II
91	What is the basic element of a language?	Literal	Variable	Random variable	All of the mentioned	3	UNIT-II
92	For propositional Logic, which statement is false?	The sentences of Propositional logic can have answers other than True or False.	Each sentence is a declarative sentence.	Propositional logic is a knowledge representation technique in AI.	None of the above	1	UNIT-II
93	First order logic Statements contains_____.	Predicate and Preposition	Subject and an Object	Predicate and Subject	None of the above	3	UNIT-II
94	Among the given options, which search algorithm requires less memory?	Optimal Search	Depth First Search	Breadth-First Search	Linear Search	2	UNIT-II
95	In a conditional statement, the first part is the antecedent and the second part is the...	Predicate	Consequent	Subject	Disjunct	2	UNIT-II
96	Which of the following is/are the composition for AI agents?	Program only	Architecture only	Both Program and Architecture	None of the mentioned	3	UNIT-II
97	On which of the following approach A basic line following robot is based?	Applied approach	Weak approach	Strong approach	Cognitive approach	2	UNIT-II
99	Artificial Intelligence has evolved extremely in all the fields except for _____	Web mining	Construction of plans in real time dynamic systems	Understanding natural language robustly	All of the mentioned	4	UNIT-II
100	Which of the following is an expansion of Artificial Intelligence application?	Game Playing	Planning and Scheduling	Diagnosis	All of the mentioned	4	UNIT-II

SR. NO	QUESTION TEXT	OPTION 1	OPTION 2	OPTION 3	OPTION 4	CORRECT OPTION	TOPIC NAME
1	Select the most appropriate situation for that a blind search can be used.	Real-life situation	Small Search Space	Complex game	All of the above	2	UNIT-III
2	Which algorithm is used in the Game tree to make decisions of Win/Lose?	Heuristic Search Algorithm	DFS/BFS algorithm	Greedy Search Algorithm	Min/Max algorithm	4	UNIT-III
3	The available ways to solve a problem of state-space-search.	2	1	4	3	1	UNIT-III
4	Among the given options, which is not the required property of Knowledge representation?	Inferential Efficiency	Inferential Adequacy	Representational Verification	Representational Adequacy	3	UNIT-III
5	An AI agent perceives and acts upon the environment using___.	Sensors	Perceiver	Actuators	Both a and c	4	UNIT-III
6	Rational agent always does the right things.	TRUE	FALSE	Both	None	1	UNIT-III
7	Which term describes the common-sense of the judgmental part of problem-solving?	Values-based	Critical	Analytical	Heuristic	4	UNIT-III
8	Among the given options, which is also known as inference rule?	Reference	Reform	Resolution	None of the above	3	UNIT-III
9	Which of the following option is used to build complex sentences in knowledge representation?	Symbols	Connectives	Quantifier	None of the above	2	UNIT-III
10	If according to the hypothesis, the result should be positive, but in fact it is negative, then it is known as_____.	False Positive Hypothesis	Specialized Hypothesis	False Negative Hypothesis	Consistent Hypothesis	1	UNIT-III
11	A hybrid Bayesian Network consist_____.	Discrete variables only	Discontinuous Variable	Both Discrete and Continuous variables	Continuous Variable only	3	UNIT-III
12	The process of capturing the inference process as Single Inference Rule is known as:	Clauses	Generalized Modus Ponens	Variables	Ponens	2	UNIT-III
13	For propositional Logic, which statement is false?	The sentences of Propositional logic can have	Each sentence is a declarative sentence.	Propositional logic is a knowledge	None of the above	1	UNIT-III
14	First order logic Statements contains_____.	Predicate and Preposition	Subject and an Object	Predicate and Subject	None of the above	3	UNIT-III
15	A knowledge-based agent can be defined with _____ levels.	2 Levels	3 Levels	4 Levels	None of the above	2	UNIT-III
16	The probabilistic reasoning depends upon_____.	Estimation	Observations	Likelihood	All of the above	4	UNIT-III
17	The inference engine works on _____.	Forward Chaining	Backward Chaining	Both a and b	None of the above	3	UNIT-III
18	Which of the given statement is true for Conditional Probability?	Conditional Probability gives 100% accurate	Conditional Probability has no effect or	Conditional Probability can be applied to a single	None of the above.	2	UNIT-III
19	After applying conditional Probability to a given problem, we get_____	Estimated Values	100% accurate result	Wrong Values	None of the above	1	UNIT-III
20	The Bayesian Network gives_____	A complete description of the problem	Partial Description of the domain	A complete description of the domain	None of the above	3	UNIT-III
21	An Algorithm is said as Complete algorithm if_____	It begins with a solution.	It does not end with a solution.	It contains a loop	It ends with a solution (if any exists).	4	UNIT-III
22	What will take place as the agent observes its interactions with the world?	Learning	Hearing	Perceiving	Speech	1	UNIT-III
23	How many things are concerned in the design of a learning element?	1	2	3	4	3	UNIT-III

24	What is used in determining the nature of the learning problem?	Environment	Feedback	Problem	All of the mentioned	2	UNIT-III
25	Which is used for utility functions in game playing algorithm?	Linear polynomial	Weighted polynomial	Polynomial	Linear weighted polynomial	4	UNIT-III
26	How the decision tree reaches its decision?	Single test	Two test	Sequence of test	No test	3	UNIT-III
27	Which of the following does not include different learning methods?	Memorization	Analogy	Deduction	Introduction	4	UNIT-III
28	Automated vehicle is an example of _____	Supervised learning	Unsupervised learning	Active learning	Reinforcement learning	1	UNIT-III
29	Which of the following is not an application of learning?	Data mining	WWW	Speech recognition	None of the mentioned	4	UNIT-III
30	Decision trees are appropriate for the problems where _____	Attributes are both numeric and nominal	Target function takes on a discrete number	Data may have errors	All of the mentioned	4	UNIT-III
31	Which of the following is also called as exploratory learning?	Supervised learning	Active learning	Unsupervised learning	Reinforcement learning	3	UNIT-III
32	Which of the following is an advantage of using an expert system development tool?	imposed structure	knowledge engineering assistance	rapid prototyping	all of the mentioned	4	UNIT-III
33	An AI system developed by Daniel Bobrow to read and solve algebra word problems.	STUDENT	BACON	SIMD	SHRDLU	1	UNIT-III
34	In his landmark book Cybernetics, Norbert Wiener suggested a way of modeling scientific phenomena using not energy, but _____	mathematics	information	history	intelligence	2	UNIT-III
35	What is the field that investigates the mechanics of human intelligence?	history	cognitive science	sociology	psychology	2	UNIT-III
36	Input segments of AI programming contain(s)?	sound	smell	touch	none of the mentioned	4	UNIT-III
37	What is the name of the computer program that simulates the thought processes of human beings?	Human logic	Expert reason	Expert system	Personal information	3	UNIT-III
38	What is the name of the computer program that contains the distilled knowledge of an expert?	Database management system	Management information System	Artificial intelligence	Expert system	4	UNIT-III
39	Decision support programs are designed to help managers make _____	budget projections	visual presentations	business decisions	vacation schedules	3	UNIT-III
40	Programming a robot by physically moving it through the trajectory you want it to follow is called _____	contact sensing control	continuous-path control	robot vision control	pick-and-place control	2	UNIT-III
41	Ambiguity may be caused by _____	syntactic ambiguity	multiple word meanings	unclear antecedents	all of the mentioned	4	UNIT-III
42	Which of the following does not include different learning methods?	Introduction	Analogy	Deduction	Memorization	1	UNIT-III
43	In his landmark book Cybernetics, Norbert Wiener suggested a way of modeling scientific phenomena using not energy, but _____	mathematics	information	history	intelligence	2	UNIT-III
44	An expert system differs from a database program in that only an expert system:	Contains declarative knowledge	Contains procedural knowledge	Features the retrieval of stored information	Expects users to draw their own conclusions	2	UNIT-III
45	Programming a robot by physically moving it through the trajectory you want it to follow is called:	Contact sensing control	Robot vision control	Pick-and-place control	Continuous-path control	4	UNIT-III
46	The primary method that people use to sense their environment is:	Reading	Writing	Seeing	Speaking	3	UNIT-III
47	The area of AI that investigates methods of facilitating communication between people and computers is:	Natural language processing	Symbolic processing	Robotics	Decision support	1	UNIT-III

48	If a robot can alter its own trajectory in response to external conditions, it is considered to be:	Intelligent	Mobile	Open loop	Non-servo	1	UNIT-III
49	A robot's "arm" is also known as its:	End effector	Actuator	Manipulator	Servomechanism	3	UNIT-III
50	What is the term used for describing the judgmental or commonsense part of problem solving?	Critical	Heuristic	Value based	Analytical	2	UNIT-IV
51	Expert Ease was developed under the direction of:	John McCarthy	Lofti Zadeh	Alan Turing	Donald Michie	4	UNIT-IV
52	Decision support programs are designed to help managers make:	Budget projections	Visual presentations	Business decisions	Vacation schedules	3	UNIT-IV
53	Knowledge and reasoning also play a crucial role in dealing with _____ environment.	Completely Observable	Partially Observable	Neither Completely nor Partially	Only Completely and Partially Observable	2	UNIT-IV
54	Treatment chosen by doctor for a patient for a disease is based on _____	Only current symptoms	Current symptoms plus some knowledge	Current symptoms plus some knowledge	All of the mentioned	3	UNIT-IV
55	A) Knowledge base (KB) is consists of set of statements.B) Inference is deriving a new sentence from the KB.Choose the correct option.	A is true, B is true	A is false, B is false	A is true, B is false	A is false, B is true	1	UNIT-IV
56	Wumpus World is a classic problem, best example of _____	Single player Game	Two player Game	Reasoning with Knowledge	Knowledge based Game	3	UNIT-IV
57	'α |= β '(to mean that the sentence α entails the sentence β) if and only if, in every model in which α is _____ β is also _____	True, true	True, false	False, true	False, false	1	UNIT-IV
58	Which is not a property of representation of knowledge?	Representational Adequacy	Inferential Adequacy	Inferential Efficiency	Representational Verification	4	UNIT-IV
59	Which is not Familiar Connectives in First Order Logic?	and	iff	or	not	4	UNIT-IV
60	Which of the following statements correctly define knowledge representation in AI?	It is the way in which facts and information are	It is the way in which we feed the knowledge in	We modify the knowledge and convert it into the	All of the above	1	UNIT-IV
61	Knowledge and reasoning also play a crucial role in dealing with _____ environment.	Completely Observable	Partially Observable	Neither Completely nor Partially	Only Completely and Partially Observable	2	UNIT-IV
62	Default reasoning is another type of -	Analogical reasoning	Bitonic reasoning	Non-monotonic reasoning	Monotonic reasoning	3	UNIT-IV
63	A Hybrid Bayesian network contains	Both discrete and continuous variables	Only Discontinuous variable	Both Discrete and Discontinuous	Continous variable only.	1	UNIT-IV
64	Computational learning theory analyzes the sample complexity and computational complexity of -	Forced based learning	Weak learning	Inductive learning	Knowledge based learning.	3	UNIT-IV
65	What is an component of an Expert system?	Inference Engine	User Interface	Knowledge Base	All are correct	4	UNIT-IV
66	A heuristic is a way of trying	To search and measure how far a node in a search	To discover something or an idea embedded in	To compare two nodes in a search tree to see if one	All are correct	4	UNIT-IV
67	What is state space in AI?	The whole problem	Representing your problem with variable and	The whole problem	Problem you design	2	UNIT-IV
68	Face recognition system is based on which AI?	Serial AI	Parallel AI	Applied AI	Strong AI	3	UNIT-IV
69	Factors which affect the performance of learner system does not include?	Good data structures	Representation scheme used	Training scenario	Type of feedback	1	UNIT-IV
70	Which of the following is the model used for learning?	Decision trees	Neural networks	Propositional and FOL rules	All of the mentioned	4	UNIT-IV
71	Automated vehicle is an example of _____	Supervised learning	Unsupervised learning	Active learning	Reinforcement learning	1	UNIT-IV

72	hich of the following is an example of active learning?	News Recommender system	Dust cleaning machine	Automated vehicle	None of the mentioned	1	UNIT-IV
73	In which of the following learning the teacher returns reward and punishment to learner?	Active learning	Reinforcement learning	Supervised learning	Unsupervised learning	2	UNIT-IV
74	Decision trees are appropriate for the problems where _____	Attributes are both numeric and nominal	Target function takes on a discrete number	Data may have errors	All of the mentioned	4	UNIT-IV
75	Which of the following is also called as exploratory learning?	Supervised learning	Active learning	Unsupervised learning	Reinforcement learning	3	UNIT-IV
76	Which of the following is the component of learning system?	Goal	Model	Learning rules	All of the mentioned	4	UNIT-IV
77	Which of the following is not an application of learning?	Data mining	WWW	Speech recognition	None of the mentioned	4	UNIT-IV
78	Which of the following is an advantage of using an expert system development tool?	imposed structure	knowledge engineering assistance	rapid prototyping	all of the mentioned	4	UNIT-IV
79	The “Turing Machine” showed that you could use a/an _____ system to program any algorithmic task.	binary	electro-chemical	recursive	semantic	1	UNIT-IV
80	MCC is investigating the improvement of the relationship between people and computers through a technology called _____	computer-aided design	human factors	parallel processing	all of the mentioned	2	UNIT-IV
81	The first widely-used commercial form of Artificial Intelligence (AI) is being used in many popular products like microwave ovens, automobiles and plug in circuit boards	Boolean logic	Human logic	Fuzzy logic	Functional logic	3	UNIT-IV
82	In his landmark book Cybernetics, Norbert Wiener suggested a way of modeling scientific phenomena using not energy, but _____	mathematics	intelligence	information	history	3	UNIT-IV
83	Which of the following applications include in the Strategic Computing Program?	battle management	autonomous systems	pilot’s associate	all of the mentioned	4	UNIT-IV
84	Which of the following are Components of Expert Systems?	Knowledge Base	Inference Engine	User Interface	All of the above	4	UNIT-IV
85	Which of the following is incorrect application of Expert System?	Systems domain	Design Domain	Monitoring Systems	Knowledge Domain	1	UNIT-IV
86	Which of the following is not a benefits of Expert Systems?	Availability	Speed	Time	Less Error Rate	3	UNIT-IV
87	What is the full form of JESS in Expert System Technology?	Java Expert System Shell	Javascript Expert System Shell	Java Expert Sub System	Javascript Expert Sub System	1	UNIT-IV
88	What is the form of Knowledge representation?	IF-THEN	IF-THEN-ELSE	IF-ELSE	All of the above	2	UNIT-IV
89	An expert system is a ___ which has the ability of decision-making like a human expert.	Computer system	Operating system	Transaction processing system	None of these	1	UNIT-IV
90	___ are designed to solve complex problems by reasoning through bodies of knowledge.	Computer systems	Operating systems	Expert systems	Transaction processing systems	3	UNIT-IV
91	The first expert system was created in the ___.	1965	1968	1970	1972	1	UNIT-IV
92	An expert system is divided into ___ Subsystems.	Three	One	Four	Two	4	UNIT-IV
93	The ___ represents facts and rules.	Inference engine	Knowledge base	Operating system	None of these	2	UNIT-IV
94	The ___ applies the rules to the known facts to deduce new facts..	Inference engine	Knowledge base	Operating system	None of these	1	UNIT-IV
95	The first expert system was used to design the ___ in SID (Synthesis of Integral Design) software program.	Small-scale product	Average-scale product	Large-scale product	None of these	3	UNIT-IV

96	The expert systems are the ___.	Mobile application	Computer applications	Both A and B	None of these	2	UNIT-IV
97	The expert systems are capable of ___.	Decision making	Deriving a solution	Interpreting input	All of these	4	UNIT-V
98	The expert systems are incapable of ___.	Producing accurate output for inadequate	Substituting human decision makers	Both A and B	None of these	3	UNIT-V
99	Expert system is a type of information system which facilitates the computer to make ___ like an expert.	System analysis	Suggestions and function	Analytical results	None of the mentioned above	2	UNIT-V
100	In Expert System, User Interface,	Contains a computerized system	Interacts between the user and the machine	Friendly communication	All of the mentioned above	3	UNIT-V
101	In Expert System, Knowledge Acquisition means,	System implementation	How to get required domain knowledge by the	System maintenance	None of the mentioned above	1	UNIT-V
102	An Expert System is an ___ computer-based decision-making system.	Integrated system	Interactive and reliable	Process and enhancement	None of the mentioned above	3	UNIT-V
103	Improved ___ are key benefits of an Expert System.	Decision quality	Consistency	Reliability	All of the mentioned above	3	UNIT-V
104	Expert System (ES) retains significant levels of the knowledge base.	TRUE	FALSE	Both	None	1	UNIT-V
105	Experts make decisions based on ___ information.	Numerical data	Qualitative & quantitative	Experimental information	None of the mentioned above	2	UNIT-V
106	In expert system Forward Chaining, is a strategy to answer the question, "___".	What can happen previously?	What can happen next?	Both A and B	All of the mentioned above	2	UNIT-V
107	What is state space in AI?	The whole problem	Representing your problem with variable and	The whole problem	Problem you design	2	UNIT-V
108	Which of the following is also called as exploratory learning?	Supervised learning	Active learning	Unsupervised learning	Reinforcement learning	3	UNIT-V
109	The “Turing Machine” showed that you could use a/an _____ system to program any algorithmic task.	binary	electro-chemical	recursive	semantic	1	UNIT-V
110	Which of the following applications include in the Strategic Computing Program?	battle management	autonomous systems	pilot’s associate	all of the mentioned	4	UNIT-V
111	If a robot can alter its own trajectory in response to external conditions, it is considered to be:	Intelligent	Mobile	Open loop	Non-servo	1	UNIT-V
112	Which university introduced Expert systems ?	Massachusetts Institute of Technology	University of Oxford	Stanford University	University of Cambridge	3	UNIT-V
113	Which is not Familiar Connectives in First Order Logic?	and	iff	or	not	4	UNIT-V
114	Knowledge and reasoning also play a crucial role in dealing with _____ environment.	Completely Observable	Partially Observable	Neither Completely nor Partially	Only Completely and Partially Observable	2	UNIT-V
115	Default reasoning is another type of -	Analogical reasoning	Bitonic reasoning	Non-monotonic reasoning	Monotonic reasoning	3	UNIT-V
116	A Hybrid Bayesian network contains	Both discrete and continuous variables	Only Discontinuous variable	Both Discrete and Discontinuous	Continous variable only.	1	UNIT-V
117	What is an component of an Expert system?	Inference Engine	User Interface	Knowledge Base	All are correct	4	UNIT-V
118	A heuristic is a way of trying	To search and measure how far a node in a search	To discover something or an idea embedded in	To compare two nodes in a search tree to see if one	All are correct	4	UNIT-V
119	Factors which affect the performance of learner system does not include?	Good data structures	Representation scheme used	Training scenario	Type of feedback	1	UNIT-V

120	Which of the following is the model used for learning?	Decision trees	Neural networks	Propositional and FOL rules	All of the mentioned	4	UNIT-V
121	Automated vehicle is an example of _____	Supervised learning	Unsupervised learning	Active learning	Reinforcement learning	1	UNIT-V
122	Decision trees are appropriate for the problems where _____	Attributes are both numeric and nominal	Target function takes on a discrete number	Data may have errors	All of the mentioned	4	UNIT-V
123	Which of the following is not an application of learning?	Data mining	WWW	Speech recognition	None of the mentioned	4	UNIT-V
124	Which of the following is an advantage of using an expert system development tool?	imposed structure	knowledge engineering assistance	rapid prototyping	all of the mentioned	4	UNIT-V
125	MCC is investigating the improvement of the relationship between people and computers through a technology called _____	computer-aided design	human factors	parallel processing	all of the mentioned	2	UNIT-V
126	Which of the following applications include in the Strategic Computing Program?	battle management	autonomous systems	pilot's associate	all of the mentioned	4	UNIT-V
127	Which of the following are Components of Expert Systems?	Knowledge Base	Inference Engine	User Interface	All of the above	4	UNIT-V
128	What is the full form of JESS in Expert System Technology?	Java Expert System Shell	Javascript Expert System Shell	Java Expert Sub System	Javascript Expert Sub System	1	UNIT-V
129	What is the form of Knowledge representation?	IF-THEN	IF-THEN-ELSE	IF-ELSE	All of the above	2	UNIT-V
130	The first expert system was created in the ___.	1965	1968	1970	1972	1	UNIT-V
131	The ___ applies the rules to the known facts to deduce new facts..	Inference engine	Knowledge base	Operating system	None of these	1	UNIT-V
132	What is the name of the computer program that simulates the thought processes of human beings?	Human logic	Expert reason	Expert system	Personal information	3	UNIT-V
133	Programming a robot by physically moving it through the trajectory you want it to follow is called _____	contact sensing control	continuous-path control	robot vision control	pick-and-place control	2	UNIT-V
134	In his landmark book Cybernetics, Norbert Wiener suggested a way of modeling scientific phenomena using not energy, but _____	mathematics	information	history	intelligence	2	UNIT-V
135	An expert system differs from a database program in that only an expert system:	Contains declarative knowledge	Contains procedural knowledge	Features the retrieval of stored information	Expects users to draw their own conclusions	2	UNIT-V
136	The primary method that people use to sense their environment is:	Reading	Writing	Seeing	Speaking	3	UNIT-V
137	A robot's "arm" is also known as its:	End effector	Actuator	Manipulator	Servomechanism	3	UNIT-V
138	Decision support programs are designed to help managers make:	Budget projections	Visual presentations	Business decisions	Vacation schedules	3	UNIT-V
139	A) Knowledge base (KB) is consists of set of statements.B) Inference is deriving a new sentence from the KB.Choose the correct option.	A is true, B is true	A is false, B is false	A is true, B is false	A is false, B is true	1	UNIT-V
140	Which is not a property of representation of knowledge?	Representational Adequacy	Inferential Adequacy	Inferential Efficiency	Representational Verification	4	UNIT-V
141	Which is not Familiar Connectives in First Order Logic?	and	iff	or	not	4	UNIT-V

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