COVER IMAGE

Aalim Muhammed Salegh College of Engineering

Question Bank

ELECTRONICS & COMMUNICATION ENGINEERING

3rd YEAR

Index

Aalim Muhammed Salegh
College of Engineering

ELECTRONICS & COMMUNICATION ENGINEERING

CS6303

COMPUTER ARCHITECTURE

SEMESTER - VI

CS6303 COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I OVERVIEW & INSTRUCTIONS **9**

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions
– Logical operations – control operations – Addressing and addressing modes.

UNIT II ARITHMETIC OPERATIONS **7**

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

UNIT III PROCESSOR AND CONTROL UNIT **11**

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV PARALLELISM **9**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

UNIT V MEMORY AND I/O SYSTEMS **9**

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design arithmetic and logic unit.
- Design and anlayse pipelined control units
- Evaluate performance of memory systems.
- Understand parallel processing architectures.

TEXT BOOK:

1. David A. Patterson and John L. Hennessey, “Computer Organization and Design‟, Fifth edition, Morgan Kauffman / Elsevier, 2014.

REFERENCES:

1. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organisation“, VI edition, Mc Graw-Hill Inc, 2012.
2. William Stallings “Computer Organization and Architecture”, Seventh Edition , Pearson Education, 2006.
3. Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, Second Edition, Pearson Education, 2005.
4. Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications", first edition, Tata Mc Graw Hill, New Delhi, 2005.
5. John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata Mc Graw Hill, 1998.
6. http://nptel.ac.in/.

QUESTION BANK

UNIT-I OVERVIEW & INSTRUCTIONS

PART-A

1.Define Computer Architecture.

- It is concerned with the structure and behavior of the computer.
- It includes the information formats, the instruction set and techniques for addressing memory.

2.Define Computer Organization.

- It describes the function and design of the various units of digital computer that store and process information.
- It refers to the operational units and their interconnections that realize the architectural specifications.

3.What are the components of a computer.

- Input unit
- Memory unit
- Arithmetic and Logic Unit
- Output unit
- Control unit

4.Draw the block diagram of computer.

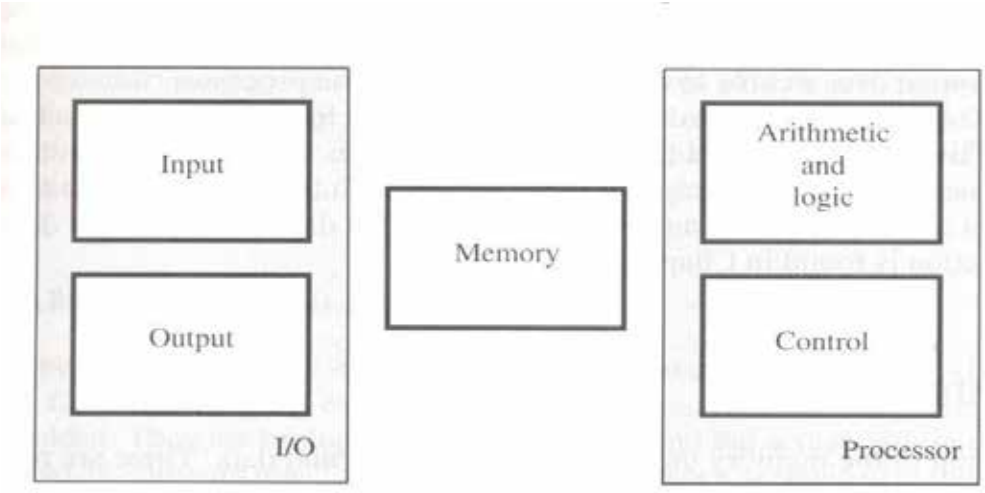


Figure 1.1 Basic functional units of a computer.

5. What is Execution time/Response time?

Response time also called execution time. The total time required for the computer to complete a task, including disk accesses, memory accesses, I/O activities, operating system overhead, CPU execution time, and so on.

6. What is CPU execution time, user CPU time and system CPU time?

1. CPU time : The actual time the CPU spends computing for a specific task.
2. User CPU time: The CPU time spent in a program itself.
3. System CPU time: The CPU time spent in the operating system performing tasks on behalf the program.

7.What is clock cycle and clock period?

1. clock cycle :The time for one clock period, usually of the processor clock, which runs at a constant rate.
2. clock period :The length of each clock cycle.

6. Define CPI

The term Clock Cycles Per Instruction Which is the average number of clock cycles each instruction takes to execute, is often abbreviated as CPI.

7.State and explain the performance equation?

N denotes number of machine Instructions, Suppose that the average number of basic steps needed to execute one machine instruction is S, where each basic step is completed in one clock cycle. If the clock cycle rate is R cycles per second, the processor time is given by
T = (N x S) / R This is often referred to as the basic performance equation.

8. Define MIPS .

MIPS: One alternative to time as the metric is MIPS(Million Instruction Per Second)

MIPS=Instruction count/(Execution time x1000000).

This MIPS measurement is also called Native MIPS to distinguish it from some alternative definitions of MIPS.

9.Define MIPS Rate:

The rate at which the instructions are executed at a given time.

10.Define Throughput and Throughput rate.

1. Throughput -The total amount of work done in a given time.
2. Throughput rate-The rate at which the total amount of work done at a given time.

11.What are the various types of operations required for instructions?

- Data transfers between the main memory and the CPU registers
- Arithmetic and logic operation on data
- Program sequencing and control
- I/O transfers

12. What is a Program?

A program is a set of instructions that specify the operations, operands and the sequence by which processing has to occur.

13. What is a Computer Instruction?

A Computer instruction is a binary code that specifies a sequence of micro operations for the computer.

14. What is a Instruction Code?

An instruction code is a group of bits that instruct the computer to perform a specific operation.

15. What is a Operation Code (Opcode)?

The operation code of an instruction is a group of bits that define operations as add, subtract, multiply, shift and complement etc.

16. Define Instruction Format.

- Instructions are represented as numbers .
- Therefore, entire programs can be stored in memory to be read or written just like numbers(data).
- Thus simplifies software/Hardware of computer systems
- Each instruction is encoded in binary called machine code.

17. What are the Most Common Fields Of An Instruction Format?

- An operation code field that specifies the operation to be performed.
- An address field that designates, a memory address or register.
- A mode field that specifies the way the operand or the effective address is determined

18. Explain the following the address instruction?

1. Three-address instruction-it can be represented as

ADD A, B, C

Operands a,b are called source operand and c is called destination operand.

2. Two-address instruction-it can be represented as
ADD A, B

3. One address instruction-it can be represented as LOAD A
ADD B STORE C

19. What is the straight-line sequencing?

The CPU control circuitry automatically proceed to fetch and execute instruction, one at a time in the order of the increasing addresses. This is called straight line sequencing.

20. Wrie down the MIPS Assembly language notation for arithmetic operations.

Category	Instruction	Example	Meaning	Comments
Arithmetic	add	add $s1,$s2,$s3	$s1 = $s2 + $s3	Three operands register
	subtract	sub $s1,$s2,$s3	$s1 = $s2 – $s3	Three operands register
	add immediate	addi $s1,$s2,20	$s1 = $s2 + 20	Used to add constants

21. What is Addressing Modes?

The different ways in which the location of an operand is specified in an instruction is called as Addressing mode.

22.What are the different types of addressing Modes?

- Immediate mode
- Register mode
- Absolute mode
- Indirect mode
- Index mode
- Base with index
- Base with index and offset
- Relative mode
- Auto-increment mode
- Auto-decrement mode

23.Wrie down the MIPS Assembly language notation for data transfer operations.

Category	Instruction	Example	Meaning	Comments
Data transfer	load word	lw $s1,20($s2)	$s1 = Memory[$s2 + 20]	Word from memory to register
	store word	sw $s1,20($s2)	Memory[$s2 + 20] = $s1	Word from register to memory
	load half	lh $s1,20($s2)	$s1 = Memory[$s2 + 20]	Halfword memory to register
	load half unsigned	lhu $s1,20($s2)	$s1 = Memory[$s2 + 20]	Halfword memory to register
	store half	sh $s1,20($s2)	Memory[$s2 + 20] = $s1	Halfword register to memory
	load byte	lb $s1,20($s2)	$s1 = Memory[$s2 + 20]	Byte from memory to register
	load byte unsigned	lbu $s1,20($s2)	$s1 = Memory[$s2 + 20]	Byte from memory to register
	store byte	sb $s1,20($s2)	Memory[$s2 + 20] = $s1	Byte from register to memory
	load linked word	ll $s1,20($s2)	$s1 = Memory[$s2 + 20]	Load word as 1st half of atomic swap
	store condition.	sc $s1,20($s2)	Memory[$s2+20]=$s1;$s1=0 or	Store word as 2nd half of atomic swap
	load upper immed.	lui $s1,20	$s1 = 20 * 2^{16}	Loads constant in upper 16 bits

24.Wrie down the MIPS Assembly language notation for Logical operations.

Category	Instruction	Example	Meaning	Comments
Logical	and	and $s2,$s3	$s1 = $s2 & $s3	Three reg. operands; bit-by-bit AND
	or	or $s1,$s2,$s3	$s1 = $s2 | $s3	Three reg. operands; bit-by-bit OR
	nor	nor $s1,$s2,$s3	$s1 = ~ ($s2 | $s3)	Three reg. operands; bit-by-bit NOR
	and immediate	andi $s1,$s2,20	$s1 = $s2 & 20	Bit-by-bit AND reg with constant
	or immediate	ori $s1,$s2,20	$s1 = $s2 | 20	Bit-by-bit OR reg with constant
	shift left logical	sll $s1,$s2,10	$s1 = $s2 << 10	Shift left by constant
	shift right logical	srl $s1,$s2,10	$s1 = $s2 >> 10	Shift right by constant

25.Wrie down the MIPS Assembly language notation for Unconditional branch operations.

Category	Instruction	Example	Meaning	Comments
Unconditional jump	jump	j 2500	go to 10000	Jump to target address
	jump register	jr $ra	go to $ra	For switch, procedure return
	jump and link	jal 2500	$ra = PC + 4; go to 10000	For procedure call

26. Wrie down the MIPS Assembly language notation for conditional branch operations.

Category	Instruction	Example	Meaning	Comments
Conditional branch	branch on equal	beq $s1,$s2,25	if ($s1 == $s2) go to PC + 4 + 100	Equal test; PC-relative branch
	branch on not equal	bne $s1,$s2,25	if ($s1!= $s2) go to PC + 4 + 100	Not equal test; PC-relative
	set on less than	slt $s1,$s2,$s3	if ($s2 < $s3) $s1 = 1; else $s1 = 0	Compare less than; for beq, bne
	set on less than unsigned	sltu $s1,$s2,$s3	if ($s2 < $s3) $s1 = 1; else $s1 = 0	Compare less than unsigned
	set less than immediate	slti $s1,$s2,20	if ($s2 < 20) $s1 = 1; else $s1 = 0	Compare less than constant
	set less than immediate unsigned	sltiu $s1,$s2,20	if ($s2 < 20) $s1 = 1; else $s1 = 0	Compare less than constant unsigned

27.Define Register mode and Absolute Mode with examples.

Register mode
The operand is the contents of the processor register.

The name (address) of the register is given in the instruction.

Absolute Mode(Direct Mode):

- The operand is in new location.

- The address of this location is given explicitly in the instruction.

Eg: MOVE LOC,R2

The above instruction uses the register and absolute mode.

The processor register is the temporary storage where the data in the register are accessed using register mode.

The absolute mode can represent global variables in the program.

Mode	Assembler Syntax	Addressing Function
Register mode	Ri	EA=Ri
Absolute mode	LOC	EA=LOC

Where **EA**-Effective Address

28.What is a Immediate addressing Mode?

The operand is given explicitly in the instruction.

Eg: Move 200 immediate ,R0

- It places the value 200 in the register R0.The immediate mode used to specify the value of source operand.
- In assembly language, the immediate subscript is not appropriate so # symbol is used. It can be re-written as

Move #200,R0

Assembly Syntax:	Addressing Function
Immediate #value	Operand =value

29.Define Indirect addressing Mode.

The effective address of the operand is the contents of a register .We denote the indirection by the name of the register or new address given in the instruction.

Fig: Indirect Mode

Address of an operand (B) is stored into R1 register. If we want this operand, we can get it through register R1(indirection).

The register or new location that contains the address of an operand is called the **pointer.**

Mode	Assembler Syntax	Addressing Function
Indirect	Ri , LOC	EA=[Ri] or EA=[LOC]

30.Define Index addressing Mode.

- The effective address of an operand is generated by adding a constant value to the contents of a register.

- The constant value uses either special purpose or general purpose register. We indicate the index mode symbolically as,

$X(R_i)$

Where **X** – denotes the constant value contained in the instruction
R_i – It is the name of the register involved.

The Effective Address of the operand is,

EA=X + [Ri]

- The index register R1 contains the address of a new location and the value of X defines an offset(also called a displacement).

To find operand,

First go to Reg R1 (using address)-read the content from R1-1000

Add the content 1000 with offset 20 get the result.

1000+20=1020

Here the constant X refers to the new address and the contents of index register define the offset to the operand.

The sum of two values is given explicitly in the instruction and the other is stored in register.

Eg: Add 20(R1) , R2 (or) EA=>1000+20=1020

Index Mode	Assembler Syntax	Addressing Function
Index	X(Ri)	EA=[Ri]+X
Base with Index	(Ri,Rj)	EA=[Ri]+[Rj]
Base with Index and offset	X(Ri,Rj)	EA=[Ri]+[Rj] +X

31.What is a Relative Addressing mode?

It is same as index mode. The difference is, instead of general purpose register, here we can use program counter(PC).

Relative Mode:

- The Effective Address is determined by the Index mode using the PC in place of the general purpose register (gpr).
- This mode can be used to access the data operand. But its most common use is to specify the target address in branch instruction. Eg. Branch>0 Loop
- It causes the program execution to go to the branch target location. It is identified by the name loop if the branch condition is satisfied.

Mode	Assembler Syntax	Addressing Function
Relative	X(PC)	EA=[PC]+X

32.Define Auto-increment addressing mode.

- The Effective Address of the operand is the contents of a register in the instruction.
- After accessing the operand, the contents of this register is automatically incremented to point to the next item in the list.

Mode	Assembler syntax	Addressing Function
Auto-increment	(Ri)+	EA=[Ri]; Increment Ri

33.Define Auto-decrement addressing mode.

- The Effective Address of the operand is the contents of a register in the instruction.
- After accessing the operand, the contents of this register is automatically decremented to point to the next item in the list.

Mode	Assembler Syntax	Addressing Function
Auto-decrement	-(Ri)	EA=[Ri]; Decrement Ri

PART-B

1. Discuss about the various techniques to represent instructions in a computer system **(APR/MAY 2015)**
2. What is the need for addressing in a computer system? Explain the different addressing modes with suitable examples. **(APR/MAY 2015)**
3. Assume a two address format specified as source, destination. Examine the following sequence of instructions and explain the addressing modes used and the operation done in every instruction. **(NOV/DEC 2015)**

Move (R5)+, R0

Add(R5)+, R0

Move R0, (R5)

Move 16(R5), R3

Add #40, R5

4. Consider the computer with three instruction classes and CPI measurements as given below and instruction counts for each instruction class for each instruction class for the same program from two different compilers are given. Assume that the computer's

clock rate is 4GHZ. Which code sequence will execute faster according to execution time? (NOV/DEC 2015)

Code from	CPI for this Instruction Class		
	A	B	C
CPI	1	2	3

Code from	Instruction Count for each Class		
	A	B	C
Compiler1	2	1	2
Compiler2	4	1	1

5. Explain the components of a computer system. **(NOV/DEC 2015)**
6. State the CPU performance equation and discuss the factors that affect performance. (NOV/DEC 2015)

7. Explain the Eight ideas of the Computer architects in detail.
8. Explain the chip manufacturing process with a neat diagram in detail.
9. Explain the techniques used to measure the performance of a computer.

(i)Prove that how performance and execution are inverse to each other.

(ii) If computer A runs a program in 10 seconds and computer B runs the same program in 15 seconds, how much faster is A than B?

(iii)Write the formula to calculate the CPU execution time for a program.

(iv)Write the formula to calculate the CPU clock cycles.

(v)Write the formula to calculate the classic CPU Performance equation.

10. Explain the need to switch from uniprocessors to multiprocessors and draw the performance chart for processors over years.

11. What do you mean by addressing modes? Explain various addressing modes with the help of examples.

UNIT-2 ARITHMETIC OPERATIONS

PART-A

1. State the principle of operation of a carry look-ahead adder.

The input carry needed by a stage is directly computed from carry signals obtained from all the preceding stages i-1,i-2,.....0, rather than waiting for normal carries to supply slowly from stage to stage. An adder that uses this principle is called carry look-ahead adder.

2. What are the main features of Booth's algorithm?

- It handles both positive and negative multipliers uniformly.
- It achieves some efficiency in the number of addition required when the multiplier has a few large blocks of 1s.

3. How can we speed up the multiplication process?(CSE Nov/Dec 2003)

There are two techniques to speed up the multiplication process:

- The first technique guarantees that the maximum number of summands that must be added is n/2 for n-bit operands.
- The second technique reduces the time needed to add the summands.

4. What is bit pair recoding? Give an example.

- Bit pair recoding halves the maximum number of summands. Group the Booth-recoded multiplier bits in pairs and observe the following:
- The pair (+1 -1) is equivalent to the pair (0 +1). That is instead of adding -1 times the

multiplicand m at shift position i to +1 (M at position i+1, the same result is obtained by adding +1 (M at position i.

Eg: 11010 – Bit Pair recoding value is 0 -1 -2

5. What is the advantage of using Booth algorithm?

- It handles both positive and negative multiplier uniformly.
- It achieves efficiency in the number of additions required when the multiplier has a few large blocks of 1's.
- The speed gained by skipping 1's depends on the data.

6. Write the algorithm for restoring division.

Do the following for n times:

- Shift A and Q left one binary position.
- Subtract M and A and place the answer back in A.
- If the sign of A is 1, set q0 to 0 and add M back to A. Where A- Accumulator, M-Divisor, Q- Dividend.

7. Write the algorithm for non restoring division.

Do the following for n times:
Step 1: Do the following for n times:

- If the sign of A is 0 , shift A and Q left one bit position and subtract M from A; otherwise , shift A and Q left and add M to A.
- Now, if the sign of A is 0,set q0 to 1;otherwise , set q0 to0.

Step 2: if the sign of A is 1, add M to A.

8. When can you say that a number is normalized?

When the decimal point is placed to the right of the first (nonzero) significant digit, the number is said to be normalized.

9. Explain about the special values in floating point numbers.

The end values 0 to 255 of the excess-127 exponent E are used to represent special values such as:
When E= 0 and the mantissa fraction M is zero the value exact 0 is represented. When E= 255 and M=0, the value is represented.

When E= 0 and M = 0 , denormal values are represented.

When E= 2555 and M =0, the value represented is called Not a number.

10. Write the Add/subtract rule for floating point numbers.

- Choose the number with the smaller exponent and shift its mantissa right a number of steps equal to the difference in exponents.
- Set the exponent of the result equal to the larger exponent.
- Perform addition/subtraction on the mantissa and determine the sign of the result
- Normalize the resulting value, if necessary.

11. Write the multiply rule for floating point numbers.

- Add the exponent and subtract 127.
- Multiply the mantissa and determine the sign of the result .
- Normalize the resulting value , if necessary.

12. What is the purpose of guard bits used in floating point arithmetic

Although the mantissa of initial operands are limited to 24 bits, it is important to retain extra bits, called as guard bits.

13. What are the ways to truncate the guard bits?

There are several ways to truncate the guard bits:

1) **Chooping**
2) **Von Neumann rounding**
3) **Rounding**

14. Define carry save addition(CSA) process.

Instead of letting the carries ripple along the rows, they can be saved and introduced into the next roe at the correct weighted position. Delay in CSA is less than delay through the ripple carry adder.

15. What are generate and propagate function?

The generate function is given by Gi=xiyi and

The propagate function is given as

Pi=xi+yi.

16. What is floating point numbers?

In some cases, the binary point is variable and is automatically adjusted as computation proceeds. In such case, the binary point is said to float and the numbers are called floating point numbers.

17. In floating point numbers when so you say that an underflow or overflow has occurred?

In single precision numbers when an exponent is less than -126 then we say that an underflow has occurred. In single precision numbers when an exponent is less than +127 then we say that an overflow has occurred.

18. What are the difficulties faced when we use floating point arithmetic?

Mantissa overflow: The addition of two mantissas of the same sign may result in a carryout of the most significant bit

Mantissa underflow: In the process of aligning mantissas ,digits may flow off the right end of the mantissa.

Exponent overflow: Exponent overflow occurs when a positive exponent exceeds the maximum possible value.

Exponent underflow: It occurs when a negative exponent exceeds the maximum possible exponent value.

19. In conforming to the IEEE standard mention any four situations under which a processor sets exception flag.

Underflow: If the number requires an exponent less than -126 or in a double precision, if the number requires an exponent less than -1022 to represent its normalized form the underflow occurs.

Overflow: In a single precision, if the number requires an exponent greater than -127 or in a double precision, if the number requires an exponent greater than +1023 to represent its normalized form the underflow occurs.

Divide by zero: It occurs when any number is divided by zero.

Invalid: It occurs if operations such as 0/0 are attempted.

20. Why floating point number is more difficult to represent and process than integer?(CSE May/June 2007)

- An integer value requires only half the memory space as an equivalent. IEEE double-precision floating point value. Applications that use only integer based arithmetic will

therefore also have significantly smaller memory requirement

- A floating-point operation usually runs hundreds of times slower than an equivalent integer based arithmetic operation.

21. Give the booth's recoding and bit-pair recoding of the computer.

1000111101000101(CSE May/June 2006)

Booth's recoding																
1	0	0	0	1	1	1	1	0	1	0	0	0	1	0	1	0
-1	0	0	+1	0	0	0	-1	+1	-1	0	0	+1	-1	+1	-1	
Bit-Pair recoding:																
1	0	0	0	1	1	1	1	0	1	0	0	0	1	0	1	0
-2		+1		0		-1		+1		0		+1		1		

22.Draw the full adder circuit and give the truth table (CSE May/June 2007).

PART-B

1. Explain the design of ALU in detail.
2. Explain with an example how to multiply two unsigned binary numbers.
3. Multiply the following pair of signed nos. using Booth's bit-pair recoding of the multiplier.

   A=+13 (Multiplicand) and B=- 6 (Multiplier). **(NOV/DEC 2015)**

4. Explain the sequential version of multiplication algorithm and its hardware. **(APR/MAY 2015)**
5. Describe in detail booth's multiplication algorithm and its hardware implementation?
6. Explain the Working of a Carry-Look Ahead adder. **(NOV/DEC 2015)**
7. Explain how floating point addition is carried out in a computer system. Give an example for a binary floating point addition. **(APR/MAY 2015)**
8. Design a 4-bit adder/subtractor circuit using full adders and explain it's function?
9. Describe the algorithm for integer division with suitable examples.

10. Divide 12_{10} by 3_{10} using restoring and Non restoring division algorithm with step by step intermediate results and explain. **(NOV/DEC 2015)**

UNIT-3 PROCESSOR AND CONTROL UNIT

PART-A

1.Define pipelining.

Pipelining is a technique of decomposing a sequential process into sub operations with each sub process being executed in a special dedicated segment that operates concurrently with all other segments.

2.Define parallel processing.

Parallel processing is a term used to denote a large class of techniques that are used to provide simultaneous data-processing tasks for the purpose of increasing the computational speed of a computer system.

Instead of processing each instruction sequentially as in a conventional computer, a parallel processing system is able to perform concurrent data processing to achieve faster execution time.

3.Define instruction pipeline.

The transfer of instructions through various stages of the CPU instruction cycle.,including fetch opcode, decode opcode, compute operand addresses. Fetch operands, execute Instructions and store results. This amounts to realizing most (or) all of the CPU in the form of multifunction pipeline called an instruction pipelining.

4. What are the steps required for a pipelinened processor to process the instruction?

1. F Fetch: read the instruction from the memory
2. D Decode: decode the instruction and fetch the source operand(s).
3. E Execute: perform the operation specified by the instruction.
4. W Write: store the result in the destination location

5. What are Hazards?

- A hazard is also called as hurdle .
- The situation that prevents the next instruction in the instruction stream from executing during its designated Clock cycle.
- Stall is introduced by hazard. (Ideal stage)

6. State different types of hazards that can occur in pipeline.

The types of hazards that can occur in the pipelining were,

1. Data hazards.
2. Instruction hazards.
3. Structural hazards.

7. Define Data hazards

A data hazard is any condition in which either the source or the destination operands of an instruction are not available at the time expected in pipeline. As a result some operation has to be delayed, and the pipeline stalls.

8. Define Instruction hazards

The pipeline may be stalled because of a delay in the availability of an instruction. For example, this may be a result of miss in cache, requiring the instruction to be fetched from the main memory. Such hazards are called as Instruction hazards or Control hazards.

9.Define Structural hazards?

The structural hazards is the situation when two instructions require the use of a given hardware resource at the same time. The most common case in which this hazard may arise is access to memory.

10. What are the classification of data hazards?

Classification of data hazard: A pair of instructions can produce data hazard by referring reading or writing the same memory location. Assume that i is executed before J. So, the hazards can be classified as,

1. RAW hazard
2. WAW hazard

3. WAR hazard

11.Define RAW hazard : (read after write)

Instruction 'j' tries to read a source operand before instruction 'i' writes it.

12. Define WAW hazard :(write after write)

Instruction 'j' tries to write a source operand before instruction 'i' writes it.

13.Define WAR hazard :(write after read)

Instruction 'j' tries to write a source operand before instruction 'i' reads it.

14. How data hazard can be prevented in pipelining?

Data hazards in the instruction pipelining can prevented by the following techniques.

a)Operand Forwarding

b)Software Approach

15.How Compiler is used in Pipelining?

- A compiler translates a high level language program into a sequence of machine instructions.
- To reduce N, we need to have suitable machine instruction set and a compiler that makes good use of it.
- An optimizing compiler takes advantages of various features of the target processor to reduce the product N*S, which is the total number of clock cycles needed to execute a program.
- The number of cycles is dependent not only on the choice of instruction, but also on the order in which they appear in the program.
- The compiler may rearrange program instruction to achieve better performance of course, such changes must not affect of the result of the computation.

16. How addressing modes affect the instruction pipelining?

Degradation of performance is an instruction pipeline may be due to address dependency where operand address cannot be calculated without available information needed by addressing mode for e.g. An instructions with register indirect mode cannot proceed to fetch the operand if the previous instructions is loading the address into the register. Hence operand access is delayed degrading the performance of pipeline.

17. What is locality of reference?

Many instruction in localized area of the program are executed repeatedly during some time period and the remainder of the program is accessed relatively infrequently .this is referred as locality of reference.

18. What is the need for reduced instruction chip?

- Relatively few instruction types and addressing modes.
- Fixed and easily decoded instruction formats.
- Fast single-cycle instruction execution.
- Hardwired rather than micro programmed control

19. Define memory access time?

The time that elapses between the initiation of an operation and completion of that operation ,for example ,the time between the READ and the MFC signals .This is Referred to as memory access time.

20. Define memory cycle time.

The minimum time delay required between the initiations of two successive memory operations, for example, the time between two successive READ operations.

21.Define Static Memories.

Memories that consist of circuits capable of retaining the state as long as power is applied are known as static memories.

22. List out Various branching technique used in micro program control unit?

a) Bit-Oring

b) Using Conditional Variable

c) Wide Branch Addressing

23. How the interrupt is handled during exception?

* CPU identifies source of interrupt
* CPU obtains memory address of interrupt handles
* PC and other CPU status information are saved
* Pc is loaded with address of interrupt handler and handling program to handle it.

24. List out the methods used to improve system performance.

The methods used to improve system performance are

1. Processor clock
2. Basic Performance Equation
3. Pipelining
4. Clock rate
5. Instruction set
6. Compiler

PART-B

1. Discuss the basic concepts of pipelining.
2. Explain in detail how exceptions are handled in MIPS architecture. **(APR/MAY 2015)**
3. Draw and explain the modified three-bus structure of the processor suitable for four – stage pipelined execution. How this structure is suitable to provide four-stage pipelined execution? **(APR/MAY 2015)**
4. Explain Data Path and its control in detail. **(NOV/DEC 2015)**
5. What is Hazard? Explain its types with suitable examples. **(NOV/DEC 2015)**

UNIT-4 PARALLELISM

PART-A

1. What is Instruction Level Parallelism? (NOV/DEC 2011)

Pipelining is used to overlap the execution of instructions and improve performance. This potential overlap among instructions is called instruction level parallelism (ILP).

2 Explain various types of Dependences in ILP.

- Data Dependences
- Name Dependences
- Control Dependences

3. What is Multithreading?

- Multithreading allows multiple threads to share the functional units of a single processor in an overlapping fashion.
- To permit this sharing, the processor must duplicate the independent state of each thread.

4. What are multiprocessors? Mention the categories of multiprocessors?

Multiprocessor are used to increase performance and improve availability. The different categories are SISD, SIMD, MIMD.

5. What are two main approaches to multithreading?

- Fine-grained multithreading
- Coarse-grained multithreading

6. What is the need to use multiprocessors?

4. Microprocessors as the fastest CPUs Collecting several much easier than redesigning 1
5. Complexity of current microprocessors Do we have enough ideas to sustain 1.5X/yr? Can we deliver such complexity on schedule?
3. Slow (but steady) improvement in parallel software (scientific apps, databases, OS)
4. Emergence of embedded and server markets driving microprocessors in addition to desktops Embedded functional parallelism, producer/consumer model
5. Server figure of merit is tasks per hour vs. latency.

7. Write the advantages of Multithreading.

If a thread gets a lot of cache misses, the other thread(s) can continue, taking advantage of the unused computing resources, which thus can lead to faster overall execution, as these resources would have been idle if only a single thread was executed. If a thread cannot use all the computing resources of the CPU (because instructions depend on each other's result), running another thread permits to not leave these idle.
If several threads work on the same set of data, they can actually share their cache, leading to better cache usage or synchronization on its values.

8. Write the disadvantages of Multithreading.

Multiple threads can interfere with each other when sharing hardware resources such as caches or translation look aside buffers (TLBs). Execution times of a single-thread are not improved but can be degraded, even when only one thread is executing. This is due to slower frequencies and/or additional pipeline stages that arc necessary to accommodate thread-switching hardware. Hardware support for Multithreading is more visible to software,

thus requiring more changes to both application programs and operating systems than Multi processing.

9. What is CMT?

Chip multiprocessors - also called multi-core microprocessors or CMPs for short - are now the only way to build high-performance microprocessors, for a variety of reasons. Large uniprocessors are no longer scaling in performance, because it is only possible to extract a limited amount of parallelism from a typical instruction stream using conventional superscalar instruction issue techniques. In addition, one cannot simply ratchet up the clock speed on today's processors, or the power dissipation will become prohibitive in all but water-cooled systems.

10. What is SMT?

Simultaneous multithreading, often abbreviated as SMT, is a technique for improving the overall efficiency of superscalar CPUs with hardware multithreading. SMT permits multiple independent threads of execution to better utilize the resources provided by modern processor architectures.

11. Write the advantages of CMP?

CMPs have several advantages over single processor solutions energy and silicon area efficiency

i. By Incorporating smaller less complex cores onto a single chip
ii. Dynamically switching between cores and powering down unused cores
iii. Increased throughput performance by exploiting parallelism
iv. Multiple computing resources can take better advantage of instruction, thread, and process level

12. What are the Disadvantages of SMT?

Simultaneous multithreading cannot improve performance if any of the shared resources are limiting bottlenecks for the performance. In fact, some applications run slower when simultaneous multithreading is enabled. Critics argue that it is a considerable burden to put on software developers that

they have to test whether simultaneous multithreading is good or bad for their application in various situations and insert extra logic to turn it off if it decreases performance.

13. What are the types of Multithreading?

- Block multi-threading
- Interleaved multi-threading

14. What Thread-level parallelism (TLP)?

- Explicit parallel programs already have TLP (inherent)
- Sequential programs that are hard to parallelize or ILP-limited can be speculatively parallelized in hardware.

15. List the major MIMD Styles

Centralized shared memory ("Uniform Memory Access" time or "Shared Memory Processor")
Decentralized memory (memory module CPU) get more memory bandwidth, lower memory
Drawback: Longer communication latency
Drawback: Software model more complex

16. Distinguish between shared memory multiprocessor and message-passing multiprocessor.

- A multiprocessor with a shared address space, that address space can be used to communicate data implicitly via load and store operations is shared memory multiprocessor.

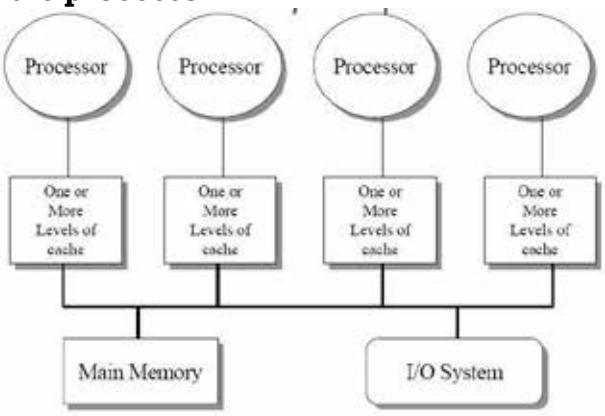
- A multiprocessor with a multiple address space, communication of data is done by explicitly passing message among processor is message-passing multiprocessor.

17. What is multicore'?

At its simplest, multi-core is a design in which a single physical processor contains the core logic of more than one processor. It's as if an Intel Xeon processor were opened up and inside were packaged all the circuitry and logic for two (or more) Intel Xcon processors.

The multi-core design takes several such processor "cores" and packages them as a single physical processor. The goal of this design is to enable a system to run more tasks simultaneously and thereby achieve greater overall system performance.

18.Draw the basic structure of Basic Structure of a Symmetric Shared Memory Multiprocessor



19. Write the software implications of a multicore processor?

Multi-core systems will deliver benefits to all software, but especially multi-threaded programs. All code that supports HT Technology or multiple processors, for example, will benefit automatically from multi-core processors, without need for modification. Most server-side enterprise packages and many desktop productivity tools fall into this category.

20. What is coarse grained multithreading?

It switches threads only on costly stalls. Thus it is much less likely to slow down the execution an individual thread.

PART-B

1. Discuss about SISD, MIMD, SIMD, SPMD and VECTOR systems. **(APR/MAY 2015)**
2. What is hardware multithreading? Compare and contrast Fine grained Multi-Threading and Coarse grained Multi-Threading. **(APR/MAY 2015)**
3. Explain Instruction level Parallel processing. State the challenges of parallel processing. **(NOV/DEC 2015)**
4. Explain the terms
   - Multicore Processor
   - Hardware Multithreading **(NOV/DEC 2015)**
5. Explain briefly the Flynn's classification?
6. Explain the following:
   i. Implicit and Explicit multithreading.
   ii. Interleaved, Blocked and Simultaneous multithreading.
7. What are multicore processors? Explain the common configurations that support multiprocessing?

UNIT-5 MEMORY AND I/O SYSTEMS

PART-A

1. What are the multimedia applications which use caches?

Some Multimedia application areas where cache is extensively used are
*Multimedia Entertainment
*Education
*Office Systems
*Audio and video Mail
*Computer Architecture - Set 6

2. Explain virtual memory technique.

Techniques that automatically move program and data blocks into the physical memory when they are required for execution are called virtual memory technique.

3. What are virtual and logical addresses?

The binary addresses that the processor issues for either instruction or data are called virtual or logical addresses.

4. Define translation buffer.

Most commercial virtual memory systems incorporate a mechanism that can avoid the bulk of the main memory access called for by the virtual to physical addresses translation buffer. This may be done with a cache memory called a translation buffer.

5. What is branch delay slot?

The location containing an instruction that may be fetched and then discarded because of the branch is called branch delay slot.

6. What is optical memory?

Optical or light based techniques for data storage, such memories usually employ optical disk which resemble magnetic disk in that they store binary information in concentric tracks on an electromechanically rotated disks. The information is read as or written optically, however with a laser replacing the read write arm of a magnetic disk drive. Optical memory offer high storage capacities but their access rate is are generally less than those of magnetic disk.

7. What are static and dynamic memories?

Static memory are memories which require periodic no refreshing. Dynamic memories are memories, which require periodic refreshing.

8. What are the components of memory management unit?

A facility for dynamic storage relocation that maps logical memory references into physical memory addresses. A provision for sharing common programs stored in memory by different users .

9. What is the role of MAR and MDR?

The MAR (memory address register) is used to hold the address of the location to or from which data are to be transferred and the MDR(memory data register) contains the data to be written into or read out of the addressed location.

10. Distinguish Between Static RAM and Dynamic RAM?

Static RAM are fast, but they come at high cost because their cells require several transistors. Less expensive RAM can be implemented if simpler cells are used. However such

cells do not retain their state indefinitely; Hence they are called Dynamic RAM.

11. Distiguish between asynchronies DRAM and synchronous RAM.

The specialized memory controller circuit provides the necessary control signals, RAS And CAS ,that govern the timing. The processor must take into account the delay in the response of the memory. Such memories are referred to as asynchronous DRAMS.The DRAM whose

operations is directly synchronized with a clock signal. Such Memories are known as synchronous DRAM.

12. What do you mean associative mapping technique?

The tag of an address received from the CPU is compared to the tag bits of each block of the cache to see if the desired block is present. This is called associative mapping technique.

13. What is SCSI?

Small computer system interface can be used for all kinds of devices including RAID storage subsystems and optical disks for large- volume storage applications.

14. What are the two types of latencies associated with storage?

The latency associated with storage is divided into 2 categories

1. Seek Latencies which can be classified into Overlapped seek,Mid transfer seek and Elevator seek.
2. Rotational Latencies which can be reduced either by Zero latency read or Write and Interleave factor.

15. What do you mean by Disk Spanning?

Disk spanning is a method of attaching drives to a single host uadapter. All drives appear as a single contiguous logical unit. Data is written to the first drive first and when the drive is full, the controller switches to the second drive, then the second drive writes until its full.

16. What is SCSI?

Small computer system interface can be used for all kinds of devices including RAID storage subsystems and optical disks for large- volume storage applications.

17. Define the term RELIABILITY

“Means feature that help to avoid and detect such faults. A realible system does not silently continue and delivery result that include interrected and corrupted data, instead it corrects the corruption when possible or else stops.

18. Define the term AVAILABLITY:

“Means features that follow the systerm to stay operational even offen faults do occur. A highly available systerm could dis able do the main functioning portion and continue operating at the reduced capacity”.

19. How the interrupt is handled during exception?

- cpu identifies source of interrupt
- cpu obtains memory address of interrupt handles
- pc and other cpu status information are saved

- Pc is loaded with address of interrupt handler and handling program to handle it.

20.What is IO mapped input output?

A memory reference instruction activated the READ M (or)WRITE M control line and does not affect the IO device. Separate IO instruction are required to activate the READ IO and WRITE IO lines ,which cause a word to be transferred between the address aio port and the CPU. The memory and IO address space are kept separate.

21. Specify the three types of the DMA transfer techniques?

--Single transfer mode(cyclestealing mode)
--Block Transfer Mode(Brust Mode) --Demand Transfer Mode
--Cascade Mode

22. What is an interrupt?

An interrupt is an event that causes the execution of one program to be suspended and another program to be executed.

23. What are the uses of interrupts?

*Recovery from errors
*Debugging
*Communication between programs
*Use of interrupts in operating system

24. Define vectored interrupts.

In order to reduce the overhead involved in the polling process, a device requesting an interrupt may identify itself directly to the CPU. Then, the CPU can immediately start executing the corresponding interrupt-service routine. The term vectored interrupts refers to all interrupt handling schemes base on this approach.

25. Name any three of the standard I/O interface.

*SCSI (small computer system interface),bus standards
*Back plane bus standards
*IEEE 796 bus (multibus signals)
*NUBUS & IEEE 488 bus standard

26. What is an I/O channel?

An I/O channel is actually a special purpose processor; also called peripheral processor. The main processor initiates a transfer by passing the required information in the input output channel. The channel then takes over and controls the actual transfer of data.

27. What is a bus?

A collection of wires that connects several devices is called a bus.

28. Define word length?
Each group of n bits is referred to as a word of information and n is called the word length.

29. Why program controlled I/O is unsuitable for high-speed data transfer?
In program controlled i/o considerable overhead is incurred. Because several program instruction have to be executed for each data word transferred between the external devices and MM. Many high speed peripheral; devices have a synchronous modes of operation. That is data transfers are controlled by a clock of fixed frequency, independent of the CPU.

30. What is the function of I/O interface?
The function is to coordinate the transfer of data between the CPU and external devices.

31. What is NUBUS?
A NUBUS is a processor independent, synchronous bus standard intended for use in 32 bitmicro processor system. It defines a backplane into which upto 16 devices may be plugged each in the form of circuit board of standard dimensions.

32. Name some of the IO devices.
*Video terminals
*Video displays
*Alphanumeric displays
*Graphics displays
*Flat panel displays
*Printers
*Plotters

33. What are the steps taken when an interrupt occurs?
- Source of the interrupt
- The memory address of the required ISP
- The program counter &CPU information saved in subroutine *Transfer control back to the interrupted program

34. Define interface.
The word interface refers to the boundary between two circuits or devices

35. What is programmed I/O?
Data transfer to and from peripherals may be handled using this mode. Programmed I/O operations are the result of I/O instructions written in the computer program.

36. Types of buses.
* Synchronous bus

* Asynchronous bus

37.Define Synchronous bus.

- Synchronous bus on other hand contains synchronous clock that is used to validate each and every signal.
- Synchronous buses are affected noise only when clock signal occurs.
- Synchronous bus designers must control with meta stability when attempting different clock signal Frequencies
- Synchronous bus of meta stability arises in any flip flop. when time will be violated.

38. Define Asynchronous bus.

- Asynchronous buses can mistake noise pulses at any time for valid handshake signal.
- Asynchronous bus designer must deal with events that like synchronously.
- It must contend with meta stability when events that drive bus transaction.

- When flip flop experiences effects can occur in downstream circuitry unless proper design technique which are used

PART-B

1. Explain mapping functions in cache memory to determine how memory blocks are placed in cache. **(NOV/DEC 2015)**
2. Explain in detail about the Bus Arbitration techniques in DMA. **(NOV/DEC 2015)**
3. Explain with the block diagram the DMA transfer in a computer system. **(NOV/DEC 2015)**
4. Draw different memory address layouts and brief about the technique used to increase the average rate of fetching words from the main memory. **(NOV/DEC 2015)**
5. Explain in detail about any two standard input and output interfaces required to connect the I/O device to the Bus. **(NOV/DEC 2015)**
6. Elaborate on the various memory technologies and its relevance. **(APR/MAY 2015)**
7. What is virtual memory? Explain the steps involved in virtual memory address translation. **(APR/MAY 2015)**
8. Describe in detail about IOP organization.
9. Discuss the design of a typical input or output interface.
10. What are interrupts? How are they handled?

Aalim Muhammed Salegh College of Engineering

ELECTRONICS & COMMUNICATION ENGINEERING

CS6551
COMPUTER NETWORKS

SEMESTER - VI

CS6551 - COMPUTER NETWORKS

Unit - I

Fundamentals and Link Layer

Two Mark Questions

1. **What is network? What are the three criteria necessary for an effective and efficient network?**
   Network is a connected group of autonomous computers that are abided by some rules and also where functionality is shared.
   The most important criteria are performance, reliability and security.
   Performance of the network depends on number of users, type of transmission medium, and the capabilities of the connected h/w and the efficiency of the s/w.
   Reliability is measured by frequency of failure, the time it takes a link to recover from the failure and the network's robustness in a catastrophe.
   Security issues include protecting data from unauthorized access and viruses.

2. **What is meant by data communication?**
   Data communication is the exchange of data (in the form of 1s and 0s) between two devices via some form of transmission medium (such as a wire cable).

3. **What are the three fundamental characteristics determine the effectiveness of the data communication system?**
   The effectiveness of the data communication system depends on three fundamental characteristics:
   Delivery: The system must deliver data to the correct destination.
   Accuracy: The system must deliver data accurately.
   Timeliness: The system must deliver data in a timely manner.

4. **What are the advantages of distributed processing?**
   Advantages of distributed processing include security/encapsulation, distributed databases, faster problem solving, security through redundancy and collaborative processing.

5. **What are the types of network?** **NOV/11**
   LAN, MAN and WAN

6. **What are some of the factors that determine whether a communication system is a LAN, MAN, or WAN?**
   Size, Ownership, the distance it covers and its physical structure

7. **What is a protocol? Why are standards needed?** **NOV/13**

In networks, communication occurs between the entities in different systems. Two entities cannot just send bit streams to each other and expect to be understood. For communication, the entities must agree on a protocol. A protocol is a set of rules that govern data communication.

Co-ordination across the nodes of a network is necessary for an efficient communication. If there are no standards, difficulties arise. A standard provides a model or basis for development to which everyone has agreed.

CS6551 - COMPUTER NETWORKS

Unit - I

Fundamentals and Link Layer

Two Mark Questions

1. **What is network? What are the three criteria necessary for an effective and efficient network?**
   Network is a connected group of autonomous computers that are abided by some rules and also where functionality is shared.
   The most important criteria are performance, reliability and security.
   Performance of the network depends on number of users, type of transmission medium, and the capabilities of the connected h/w and the efficiency of the s/w.
   Reliability is measured by frequency of failure, the time it takes a link to recover from the failure and the network's robustness in a catastrophe.
   Security issues include protecting data from unauthorized access and viruses.

2. **What is meant by data communication?**
   Data communication is the exchange of data (in the form of 1s and 0s) between two devices via some form of transmission medium (such as a wire cable).

3. **What are the three fundamental characteristics determine the effectiveness of the data communication system?**
   The effectiveness of the data communication system depends on three fundamental characteristics:
   Delivery: The system must deliver data to the correct destination.
   Accuracy: The system must deliver data accurately.
   Timeliness: The system must deliver data in a timely manner.

4. **What are the advantages of distributed processing?**
   Advantages of distributed processing include security/encapsulation, distributed databases, faster problem solving, security through redundancy and collaborative processing.

5. **What are the types of network?** **NOV/11**
   LAN, MAN and WAN

6. **What are some of the factors that determine whether a communication system is a LAN, MAN, or WAN?**
   Size, Ownership, the distance it covers and its physical structure

7. **What is a protocol? Why are standards needed?** **NOV/13**

In networks, communication occurs between the entities in different systems. Two entities cannot just send bit streams to each other and expect to be understood. For communication, the entities must agree on a protocol. A protocol is a set of rules that govern data communication.

Co-ordination across the nodes of a network is necessary for an efficient communication. If there are no standards, difficulties arise. A standard provides a model or basis for development to which everyone has agreed.

8. For n devices in a network, what is the number of cable links required for a mesh and ring topology?

Mesh topology - n (n-1)/2

Ring topology - n

9. What is the difference between a passive and an active hub?

An active hub contains a repeater that regenerates the received bit patterns before sending them out. A passive hub provides a simple physical connection between the attached devices.

10. Distinguish between peer-to-peer relationship and a primary-secondary relationship.

Peer-to-peer relationship: All the devices share the link equally.

Primary-secondary relationship: One device controls traffic and the others must transmit through it.

11. Assume 6 devices are arranged in a mesh topology. How many cables are needed? How many ports are needed for each device?

Number of cables=n (n-1)/2=6(6-1)/2=15

Number of ports per device=n-1=6-1=5

12. Group the OSI layers by function.

The seven layers of the OSI model belonging to three subgroups. Physical, data link and network layers are the network support layers; they deal with the physical aspects of moving data from one device to another. Session, presentation and application layers are the user support layers; they allow interoperability among unrelated software systems. The transport layer ensures end-to-end reliable data transmission.

13. What are header and trailers and how do they get added and removed?

Each layer in the sending machine adds its own information to the message it receives from the layer just above it and passes the whole package to the layer just below it. This information is added in the form of headers or trailers. Headers are added to the message at the layers 6,5,4,3, and 2. A trailer is added at layer2. At the receiving machine, the headers or trailers attached to the data unit at the corresponding sending layers are removed, and actions appropriate to that layer are taken.

14. The transport layer creates a communication between the source and destination. What are the three events involved in a connection?

Creating a connection involves three steps: connection establishment, data transfer and connection release.

15. Give the relationship between propagation speed and propagation time?

Propagation time = distance / propagation speed (speed of light)

The time required for a signal or a bit to travel from one point to another is called **Propagation time**.

16 .What are the responsibilities of data link layer? **APR/15**

Specific responsibilities of data link layer include the following.
a) Framing
b) Physical addressing
c) Flow control
d) Error control
e) Access control

17. Mention the types of errors. **APR/13**

There are 2 types of errors
a) Single-bit error.
b) Burst-bit error.

Single bit error: The term single bit error means that only one bit of a given data unit (such as byte character/data unit or packet) is changed from 1 to 0 or from 0 to 1.
Burst error: Means that 2 or more bits in the data unit have changed from 1 to 0 from 0 to 1.

18. What is redundancy?

It is the error detecting mechanism, which means a shorter group of bits or extra bits may be appended at the destination of each unit.

19. List out the available detection methods.

There are 4 types of redundancy checks are used in data communication.
a) Vertical redundancy checks (VRC).
b) Longitudinal redundancy checks (LRC).
c) Cyclic redundancy checks (CRC).
d) Checksum.

20. Write short notes on VRC.

The most common and least expensive mechanism for error detection is the vertical redundancy check (VRC) often called a parity check. In this technique a redundant bit4called a parity bit, is appended to every data unit so, that the total number of 0's in the unit(including the parity bit) becomes even.

21. Write short notes on LRC.

In longitudinal redundancy check (LRC), a block of bits is divided into rows and a redundant row

of bits is added to the whole block.

22. Write short notes on CRC. **APR/11**

The third and most powerful of the redundancy checking techniques is the cyclic redundancy checks (CRC) CRC is based on binary division. Here a sequence of redundant bits, called the CRC remainder is appended to the end of data unit.

23. Write short notes on CRC generator.

A CRC generator uses a modulo-2 division.

- In the first step, the 4-bit divisor is subtracted from the first 4 bit of thedividend.
- Each bit of the divisor is subtracted from the corresponding bit of the dividend without disturbing the next higher bit.

24. Write short notes on CRC checker.

A CRC checker functions exactly like a generator. After receiving the data appended with the CRC it does the same modulo-2 division. If the remainder is all 0's the CRC isdropped and the data accepted. Otherwise, the received stream of bits is discarded and thedates are resent.

25. Give the essential properties for polynomial.

A polynomial should be selected to have at least the following properties.
a) It should not be
b) It should be divisible by(x+1).

26. Define checksum.

The error detection method used by the higher layer protocol is called checksum. Checksum is based on the concept of redundancy.

27. Write short notes on error correction.

It is the mechanism to correct the errors and it can be handled in 2 ways.
a) When an error is discovered, the receiver can have the sender retransmit the entire data unit.
b) A receiver can use an error correcting coder, which automatically corrects certain errors.

28. Mention the types of error correcting methods.

There are 2 error-correcting methods.
a) Single bit error correction
b) Burst error correction.

29. What is the purpose of hamming code?

A hamming code can be designed to correct burst errors of certain lengths. So the simple strategy used by the hamming code to correct single bit errors must be redesigned to be applicable for multiple bit correction.

30. Define flow control. **MAY/11, APR/15**

Flow control refers to a set of procedures used to restrict the amount of data. The sender can send before waiting for acknowledgment.

41. What is a buffer?

Each receiving device has a block of memory called a buffer, reserved for storing incoming data until they are processed.

42. Mention the categories of flow control.

There are 2 methods have been developed to control flow of data across communication links.
a) Stop and wait- send one from at a time.
b) Sliding window- send several frames at a time.

16 Mark Questions

1. Explain ISO/OSI reference model. **NOV/12, APR/15**

Physical layer
Data link layer
Network layer
Transport layer
Session layer
Presentation layer
Application layer

2. Explain the topologies of the network. **MAY/11**

Mesh topology
Star topology
Bus topology
Ring topology
Hybrid topology

3. Explain the categories of networks.

Local Area Network (LAN)

Metropolitan Area Network (MAN)

Wide Area Network (WAN)

4. Explain error detection and error correction techniques. **NOV/13, APR/15**

* Types of errors

* Single bit error

* Burst error

* Error detection

* Vertical redundancy check(VRC)

* Longitudinal redundancy check(LRC)

* Cyclic redundancy check(CRC)

* Checksum

* Error correction

* Single-bit error correction

* Hamming code

* Burst error correction

5. Explain the flow control mechanism

* Stop and wait

* Sliding window.

Unit – II
Media Access & Internetworking

Two Mark Questions

3. With down the relationship of IEEE Project to the OSI model?

The IEEE has subdivided the data link layer into two sub layers:
* Logical link control (LLC)
* Medium access control (MAC)

LLC is non-architecture specific. The MAC sub layer contains a number of distinct modules ,each carries proprietary information specific to the LAN product being used.

4. What are the functions of LLC? **APR/14**

The IEEE project 802 model takes the structure of an HDLC frame and divides it into 2 sets of functions. One set contains the end user portion of the HDLC frame - the logical address, control information, and data. These functions are handled by the IEEE 802.2 logical link control (LLC) protocol.

5. What are the functions of MAC? **APR/12**

MAC sub layer resolves the contention for the shared media. It contains synchronization, flag, flow and error control specifications necessary to move information from one place to another, as well as the physical address of the next station to receive and route a packet.

6. What are headers and trailers and how do they get added and removed?

The control data added to the beginning of a data is called headers. The control data added to the end of a data is called trailers. At the sending machine, when the message passes through the layers each layer adds the headers or trailers. At the receiving machine, each layer removes the data meant for it and passes the rest to the next layer.

7. What are the responsibilities of network layer?

The network layer is responsible for the source-to-destination delivery of packet across multiple network links. The specific responsibilities of network layer include the following:

- Logical addressing.
- Routing.

8. What is a virtual circuit?

A logical circuit made between the sending and receiving computers. The connection is made after both computers do handshaking. After the connection, all packets follow the same route and arrive in sequence.

9. What are data grams? **NOV/13**

In datagram approach, each packet is treated independently from all others. Even when one packet represents just a place of a multipacket transmission, the network treats it although it existed alone. Packets in this technology are referred to as datagram.

10. What are the two types of implementation formats in virtual circuits?

Virtual circuit transmission is implemented in 2 formats.

- Switched virtual circuit
- Permanent virtual circuit.

11. What is meant by switched virtual circuit?

Switched virtual circuit format is comparable conceptually to dial-up line in circuit switching. In this method, a virtual circuit is created whenever it is needed and exits only for the duration of specific exchange.

12. What is meant by Permanent virtual circuit?

Permanent virtual circuits are comparable to leased lines in circuit switching. In this method, the same virtual circuit is provided between two uses on a continuous basis. The circuit is dedicated to the specific uses.

16 Mark Questions

1. Define bridge and explain the type of bridges.

* Bridges

* Types of bridges

* Simple bridge

* Multiport bridge

* Transparent bridge

2. Explain about Ethernet. **APR/15**

* Access method :CSMA/CD

* Addressing

* Electrical specification

* Frame format

* Implementation:

* 10 base 5 :Thick Ethernet

* 10 base 2 :Thin Ethernet

* 10 base T :Twisted-pair Ethernet

* 1 base 5 :Star LAN

3. Explain IP addressing method.

* Internetwork protocol (IP)

* Datagram

* Addressing

* Classes

* Dotted decimal notation

* A sample internet

4. Explain the two approaches of packet switching techniques.

* Datagram approach

* Virtual circuit approach

* Switched virtual circuit(SVC)

* Permanent virtual circuit(PVC)

* Circuit – switched connection versus virtual – circuit connection

* Path versus route

* Dedicated versus shared

5. Compare Address Resolution Protocol and RARP. **MAY/11**

ARP

RARP

6. Explain in detail about Internet Control Message Protocol. **MAY/11,NOV/12**

ICMP defines a collection of error messages that are sent back to the source host whenever a router or host is unable to process an IP datagram successfully.

ICMP-Redirect

Example

Unit – III
Routing

1. What are network support layers?

Network support layers:

The network support layers are Physical layer, Data link layer and Network layer. These deals with electrical specifications, physical connection, transport timing and reliability.

2. **What are the user support layers?**

User support layers:

The user support layers are: Session layer, Presentation layer, Application layer. These allow interoperability among unrelated software system.

13. Define Routers. **APR/11**

Routers relay packets among multiple interconnected networks. They Route packets from one network to any of a number of potential destination networks on internet routers operate in the physical, data link and network layer of OSI model.

14. What is meant by hop count?

The pathway requiring the smallest number of relays, it is called hop-count routing, in which every link is considered to be of equal length and given the value one.

15. How can the routing be classified?

The routing can be classified as,

- Adaptive routing
- Non-adaptive routing.

16. What is time-to-live or packet lifetime?

As the time-to-live field is generated, each packet is marked with a lifetime, usually the number of hops that are allowed before a packet is considered lost and accordingly, destroyed. The time-to-live determines the lifetime of a packet.

17. What is meant by brouter?

A brouter is a single protocol or multiprotocol router that sometimes acts as a router and sometimes act as a bridge.

18. Write the keys for understanding the distance vector routing. **NOV/12**

The three keys for understanding the algorithm are

- Knowledge about the whole networks
- Routing only to neighbors
- Information sharing at regular intervals

19. Write the keys for understanding the link state routing. **NOV/14**

The three keys for understanding the algorithm are

- Knowledge about the neighborhood.
- Routing to all neighbors.
- Information sharing when there is a range.

20. How the packet cost referred in distance vector and link state routing?

In distance vector routing, cost refer to hop count while in case of link state routing, cost is a weighted value based on a variety of factors such as security levels, traffic or the state of the link.

21. How the routers get the information about neighbor?

A router gets its information about its neighbors by periodically sending them a short greeting packets. If the neighborhood responds to the greeting as expected, it is assumed to be alive and functioning. If it dose not, a change is assumed to have occurred and the sending router then alerts the rest of the network in its next LSP.

22. What are the four internetworking devices? **NOV/14**

The four internetworking devices are,

- Repeaters, Bridges, Router and Gateway .

23. Define IP address.

IP address is the 3-bit number for representing a host or system in the network. One portion of the IP address indicates a networking and the other represents the host in a network.

24. What is Token Bus?

Token Bus is a physical bus that operates as a logical ring using tokens. Here stations are logically organized into a ring. A token is passed among stations. If a station wants to send data, it must wait and capture the token. Like Ethernet, station communicates via a common bus.

25. What is token passing?

Stations may attempt to send data multiple times before a transmission makes it onto a link. This redundancy may create delays of indeterminable length if the traffic is heavy. Token ring resolves this uncertainty by requiring that stations take turns sending data. Each station may transmit only during its turn and may send only one frame during each turn. The mechanism that coordinates this rotation is called token passing.

26. Define Masking?

Masking is the process that extracts the address of the physical network from an IP address.

27. What are the rules of boundary-level masking?

The rules of boundary-level masking

- The bytes in the IP address that corresponds to 255 in the mask will be repeated in the subnetwork address
- The bytes in the IP address that corresponds to 0 in the mask will change to 0 in the subnetwork address

28. What are the rules of nonboundary-level masking?

- The bytes in the IP address that corresponds to 255 in the mask will be repeated in the subnetwork address
- The bytes in the IP address that corresponds to 0 in the mask will change to 0 in the subnetwork address
- For other bytes, use the bit-wise AND operator

29. Define Gateway.

A device used to connect two separate networks that we different communication protocols.

30. What is LSP?

In link state routing, a small packet containing routing information sent by a router to all other router by a packet called link state packet.

16 Mark Questions

1. Define routing & explain distance vector routing and link state routing. APR/15

* Distance vector routing
* Sharing information
* Routing table
* Creating the table
* Updating the table
* Updating algorithm
* Link state routing
* Information sharing
* Packet cost
* Link state packet
* Getting information about neighbours
* Initialization
* Link state database

2. Explain subnetting NOV/12

* Subnetting

* Three levels of hierarchy

* Masking

* Masks without subnetting

* Masks with subnetting

* Finding the subnetwork address

* Boundary level masking

* Non-boundary level masking

3. What is the purpose of routing? Explain flooding algorithm for routing the packets in detail.

Routing is the process by which forwarding tables are built. Forwarding is a relatively simple and well-defined process performed locally at a node, whereas routing depends on complex distributed algorithms that have continued to evolve throughout the history of networking.

Flooding Algorithm

Reliable Flooding Algorithm

4. Discuss in detail the various aspects of Ipv6

IPv6 Introduction

Addresses and Routing

Address Space Allocation

Address Notation

Packet Format

6. Explain in detail the dynamic host configuration protocol.

Configuration of IP addresses to host

Mechanism of DHCP

7. Explain OSPF in detail

Link State Routing

Reliable Flooding

Route Calculation

OSPF header format

8. Explain RIP in detail

RIP is the canonical example of a routing protocol built on the distance- vector routing algorithm.

RIP Packet Format

Example network running RIP

Unit IV
Transport Layer

Two Mark Questions

1. What is function of transport layer? **APR/14**

The protocol in the transport layer takes care in the delivery of data from one application program on one device to an application program on another device. They act as a link between the upper layer protocols and the services provided by the lower layer.

2. What are the duties of the transport layer?

The services provided by the transport layer

- End-to- end delivery
- Addressing
- Reliable delivery
- Flow control Multiplexing

3. What is the difference between network layer delivery and the transport layer delivery?

The network layer is responsible for the source-to-destination delivery of packet across multiple network links.

The transport layer is responsible for source-to-destination delivery of the entire message.

4. What are the four aspects related to the reliable delivery of data?

The four aspects are,

- Error control
- Sequence control
- Loss control
- Duplication control

5. What is meant by segment?

At the sending and receiving end of the transmission, TCP divides long transmissions into smaller data units and packages each into a frame called a segment.

6. What is meant by segmentation?

When the size of the data unit received from the upper layer is too long for the network layer datagram or data link layer frame to handle, the transport protocol divides it into smaller usable blocks. The dividing process is called segmentation.

7. What is meant by Concatenation?

The size of the data unit belonging to a single session are so small that several can fit together into a single datagram or frame, the transport protocol combines them into a single data unit. The combining process is called concatenation.

8. What are the types of multiplexing?

The types of multiplexing are,

Upward multiplexing

Downward multiplexing

9. What are the two possible transport services?

Two basic types of transport services are,

Connection service

Connectionless services

10. The transport layer creates the connection between source and destination.
What are the three events involved in the connection?

For security, the transport layer may create a connection between the two end ports. A connection is a single logical path between the source and destination that is associated ith all packets in a message. Creating a connection involves three steps:

- Connection establishment
- Data transfer & Connection release.

11. What are the techniques used in multiplexing?

The three basic techniques of multiplexing are,

Frequency-division multiplexing

Time-division multiplexing

Wave-division multiplexing

12. What is meant by congestion? **NOV/14**

Congestion in a network occur if user send data into the network at a rate greater than that allowed by network resources.

13. Why the congestion occur in network?

Congestion occurs because the switches in a network have a limited buffer size to store arrived packets.

14. How will the congestion be avoided?

The congestion may be avoided by two bits

BECN - Backward Explicit Congestion Notification

FECN - Forward Explicit Congestion Notification

15. What is the function of BECN BIT?

The BECN bit warns the sender of congestion in network. The sender can respond to this warning

by simply reducing the data rate.

16. What is the function of FECN?

The FECN bit is used to warn the receiver of congestion in the network. The sender and receiver are communicating with each other and are using some types of flow control at a higher level.

17. What is meant by quality of service? **APR/15,NOV/12**

The quality of service defines a set of attributes related to the performance of the connection. For each connection, the user can request a particular attribute each service class is associated with a set of attributes.

18. What are the two categories of QoS attributes?

The two main categories are

User Oriented

Network Oriented

19. List out the user related attributes?

User related attributes are

SCR - Sustainable Cell Rate

PCR - Peak Cell Rate

MCR- Minimum Cell Rate

CVDT - Cell Variation Delay Tolerance

20. What are the networks related attributes?

The network related attributes are,

Cell loss ratio (CLR)

Cell transfer delay (CTD)

Cell delay variation (CDV)

Cell error ratio (CER)

21. What is frame?

A frame consists of one complete cycle of time slots, including one or more slot dedicated to each sending device.

22. What is interleaving?

The switch moves from device to device at a constant rate and fixed order. This process is called interleaving.

23. What is framing bits?

One or more synchronization bits are usually added to the beginning of each frame. These bitts are called framing bits.

24. What is the difference between service point address, logical address and physical address?

Transport layer header includes a type of address called a service point address or port address which

makes a data delivery from a specific process on one computer to a specific process on another computer.

If a packet passes the network boundary we need another addressing to differentiate the source and destination systems. The network layer adds a header, which indicates the logical address of the sender and receiver.

If the frames are to be distributed to different systems on the network, the data link layer adds the header, which defines the source machine's address and the destination machine's address.

16 Mark Questions

1. Explain the duties of transport layer. **APR/15**

End to end delivery
- Addressing
- Reliable delivery
  - Error control
  - Sequence control
  - Loss control
  - Duplication control
- Flow control
- Multiplexing

2. Explain socket in detail.
- Introduction
- Explanation
- program

3. Explain UDP & TCP. **APR/15**

User Datagram Protocol(UDP)
- Source port address
- Destination port address
- Total length
- Checksum

Transmission Control Protocol(TCP)
- Source port address
- Destination port address
- Sequence number
- Acknowledgement number
- Header length
- Reserved
- Control
- Window size
- Check sum
- Urgent pointer
- Options and padding

4. Explain about congestion control. **MAY/11**

Additive Increase/ Multiplicative Decrease
Fast Retransmit and Fast Recovery
Slow Start

5. Explain leaky bucket and token bucket algorithm

Leaky bucket algorithm
Leaky bucket
Switch controlling the output rate

6. Write a note on TCP congestion avoidance mechanisms. **APR/15**

DECbit

Random Early Detection

Source-Based Congestion Avoidance

7. Discuss in detail the TCP segment header. Discuss about connection management in TCP.

MAY/11

TCP

Segment Format

TCP header format

Connection Establishment

Three-way Handshake

8. Briefly explain the techniques to improve QOS.

Need for QoS

Applications requiring QoS

Approaches to QoS Suppor

9. Explain how QoS is provided through Integrated Services

Integrated Services

RSVP

10. Explain how QoS is provided through Differentiated Services.

Differentiated Services

Expedited Forwarding

Assured Forwarding

Unit V
Application Layer

Two Mark Questions

1. What is the purpose of Domain Name System? APR/14

Domain Name System can map a name to an address and conversely an address to name.

2. Discuss the three main division of the domain name space. NOV/12

Domain name space is divided into three different sections: generic domains, country domains & inverse domain.

Generic domain: Define registered hosts according to their generic behavior, uses generic suffixes.
Country domain: Uses two characters to identify a country as the last suffix.
Inverse domain: Finds the domain name given the IP address.

3. Discuss the TCP connections needed in FTP.

FTP establishes two connections between the hosts. One connection is used for data transfer, the other for control information. The control connection uses very simple rules of communication. The data connection needs more complex rules due to the variety of data types transferred.

4. Discuss the basic model of FTP. APR/15

The client has three components: the user interface, the client control process, and the client data transfer process. The server has two components: the server control process and the server data transfer process. The control connection is made between the control processes. The data connection is made between the data transfer processes.

5. What is the function of SMTP? NOV/14 , APR/15

The TCP/IP protocol supports electronic mail on the Internet is called Simple Mail Transfer (SMTP). It is a system for sending messages to other computer users based on e-mail addresses. SMTP provides mail exchange between users on the same or different computers.

6. What is the difference between a user agent (UA) and a mail transfer agent (MTA)?

The UA prepares the message, creates the envelope, and puts the message in the envelope. The MTA transfers the mail across the Internet.

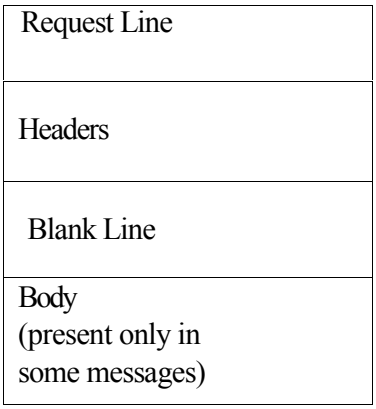
7. How does MIME enhance SMTP?

MIME is a supplementary protocol that allows non-ASCII data to be sent through SMTP. MIME transforms non-ASCII data at the sender site to NVT ASCII data and deliverers it to the client SMTP to be sent through the Internet. The server SMTP at the receiving side receives the NVT ASCII data and delivers it to MIME to be transformed back to the original data.

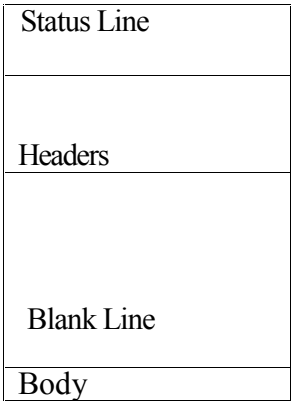
8. Why is an application such as POP needed for electronic messaging?

Workstations interact with the SMTP host which receives the mail on behalf of every host in the organization, to retrieve messages by using a client-server protocol such as Post Office Protocol , version 3(POP3). Although POP3 is used to download messages from the server, the SMTP client still needed on the desktop to forward messages from the workstation user to its SMTP mail server.

9. Give the format of HTTP request message. **APR/15**



10. Give the format of HTTP response message.



11. Write down the three types of WWW documents. **MAY/11**

The documents in the WWW can be grouped into three broad categories: static, dynamic and active.
Static: Fixed-content documents that are created and stored in a server.
Dynamic: Created by web server whenever a browser requests the document. **Active:** A program to be run at the client side.

12. What is the purpose of HTML?

HTML is a computer language for specifying the contents and format of a web document. It allows additional text to include codes that define fonts, layouts, embedded graphics and hypertext links.

13. **Define CGI**.

CGI is a standard for communication between HTTP servers and executable programs. It is used in crating dynamic documents.

16 Mark Questions

Explain the SMTP and HTTP. Give their uses, state strengths and weaknesses **APR/15**

System for sending messages to other computer users based on e-mail addresses. SMTP provides mail exchange between users on the same or different computers.

- User Agent
- Mail Transfer Agent
- Multipurpose Internet Mail Extensions
- Post Office Protocol
- HTTP transactions
- HTTP messages
- URL

1. **Explain the Email protocols in detail.** **MAY/11**

Interactions between email servers and clients are governed by email protocols. The three most common email protocols are POP, IMAP and MAPI. Most email software operates under one of these (and many products support more than one).

- POP
- IMAP
- SMTP
- MAPI

2.Explain in detail the SNMP model with relevant diagrams. (16) APR/15

Simple Network Management Protocol (SNMP) is an application–layer protocol defined by the Internet Architecture Board (IAB) in RFC1157 for exchanging management information between network devices. It is a part of Transmission Control Protocol⁄Internet Protocol (TCP⁄IP) protocol suite.

SNMP is one of the widely accepted protocols to manage and monitor network elements. Most of the professional–grade network elements come with bundled SNMP agent. These agents have to be enabled and configured to communicate with the network management system (NMS).

SNMP Components and its functionalities.

- SNMP Manager
- Managed devices
- SNMP agent
- Management Information Database Otherwise called as Management Information Base (MIB)

3. Discuss about the Domain Name System in computer networking. NOV/12

The **DNS** translates Internet domain and host names to IP addresses. DNS automatically converts the names we type in our Web browser address bar to the IP addresses of Web servers hosting those sites.

DNS implements a distributed database to store this name and address information for all public hosts on the Internet. DNS assumes IP addresses do not change (are statically assigned rather than dynamically assigned).

- Domain hierarchy
- Name server
- Name resolution

4.Write short notes on email services. MAY/12

Electronic mail or simply E-mail is very much popular now-a-days for its speedy transmission of information's and cost effectiveness. Hence information provided by a sender is delivered asynchronously to a point where it can be retrieved and processed later on by one or more recipients of the sender's choice. In an E-Mail system, there is a number and the sender keeps on dialing the desired number till he/she is successful. Once it is connected, the PC terminal of the sender sends the message to the PC terminal of the recipient at a very high speed. There is no need of any physical presence of both the sender and the receiver. The sender can enter the message and the receiver can retrieve it whenever he/she is free. The message will remain in PC's memory. The transmission of messages is usually done through landlines (telephones) or satellite communications or through marine cables. E-mail has lot of advantages to its credit.

(i) It is cost effective. Very less money is required In comparison to other transmission device.

(ii) It is time saver. Within very short time messages can be sent,

(iii) There is no need of presence of either the sender or the receiver. Once the message is entered into PC's it will remain in the receiver PC's memory.

(iv) E-mail transmission is very speedy. It is four times faster than FAX and ten Times faster than telex,

(v) There is the system of using password which each subscriber can choose to use. Hence E-mail gives security of message.

5.Describe briefly the structure, functions and features of File Transfer Protocol. NOV/12

Transfer a file from one system to another.

TCP connections

Basic model of FTP

6.Illustrate features of TELNET.What is the need for network virtual terminal. NOV/12

Telnet is a user command and an underlying TCP/IP protocol for accessing remote computers.

Characteristics of Telnet

Network Virtual Terminal

Aalim Muhammed Salegh College of Engineering

ELECTRONICS & COMMUNICATION ENGINEERING

EC6001
MEDICAL ELECTRONICS

Prepared by
K.SELVAKUMARASAMY
S. RAJESHKANNA
J. ABDUL KADER ZAKARIA

SEMESTER - VI

EC6001 **MEDICAL ELECTRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- To study about the various assist devices used in the hospitals.
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING **9**

The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9 pH, PO_2, PCO_2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood Cell Counters.

UNIT III ASSIST DEVICES **9**

Cardiac pacemakers, DC Defibrillator, Dialyser, Heart lung machine

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY **9**

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, electrical safety

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION **9**

Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine

TOTAL: 45 PERIODS

OUTCOMES:

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

- Discuss the application of electronics in diagnostic and therapeutic area.
- Measure biochemical and various physiological information.
- Describe the working of units which will help to restore normal functioning.

TEXTBOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, “Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007

REFERENCES:

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA Mc Graw-Hill, New Delhi, 2003.
2. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2004.

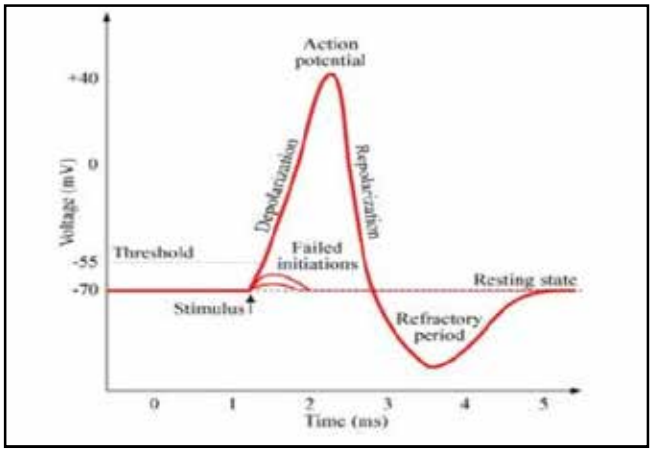
UNIT I - ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING

1. Define

a) **Resting Potential** b) **Action Potential (MAY/JUNE-2012, NOV/DEC-2012)**

Resting potential is defined as the electrical potential of an excitable cell relative to its surroundings when not stimulated or involved in passage of an impulse. It ranges from -60mV to -100mV

Action potential is defined as the change in electrical potential associated with the passage of an impulse along the membrane of a cell.



2. Define – Conduction Velocity.

Conduction velocity is defined as the rate at which an action potential moves down a fiber or is propagated from cell to cell. It is also called as Nerve conduction rate.

3. Write down the Nernst equation of action potential.

An equation relating the potential across the membrane and the two concentrations of the ion is called Nernst equation.

$$E = -\frac{RT}{nF} \ln \frac{C_1 f_1}{C_2 f_2}$$

Where,

R – gas constant(8.315×10^7 ergs/mole/degree Kelvin)

T – absolute Temperature, degrees Kelvin

n – valence of the ion (the number of electrons added or removed to ionize the atom)

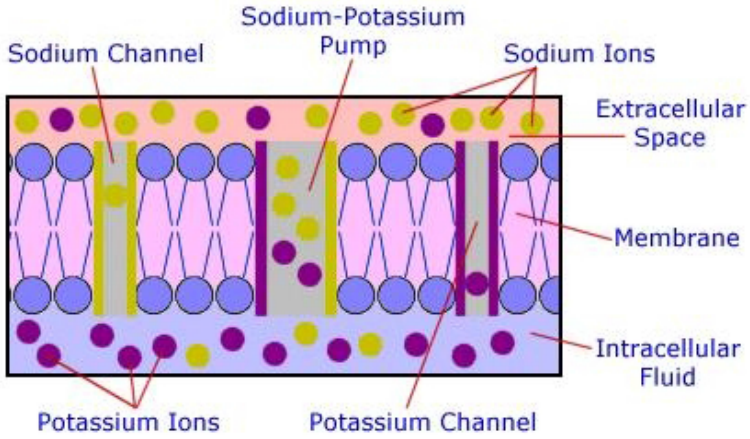
F – Faraday constant (96,500 coulombs)

C_1, C_2 – two concentrations of the ion on the two sides of the membrane

f_1, f_2 – respective activity coefficients of the ion on the two sides of the membrane

4. What is meant by sodium pump?

Sodium pump is an active process in which sodium ions are quickly transported to the outside of the cell and the cell again becomes polarized and assumes its resting potential.



5. State all or none law in respect of cell bio potential.

Regardless of the method by which a cell is excited or the intensity of the stimulus, the action potential is always the same for any given cell.

6. List the types of bioelectric potentials.

Bio electric potential related to

Heart	– ElectroCardioGram (ECG)
Brain	– ElectroEncephaloGram (EEG)
Muscle	– ElectroMyoGram (EMG)
Eye (Retina)	– ElectroRetinoGram (ERG)
Eye (Cornea - Retina)	– ElectroOculoGram (EOG)

7. Define electrode and list its types.

The devices that convert ionic potential into electronic potential are called as electrode. The types of electrode are

a) Micro electrode
b) Depth and needle electrode
c) Surface electrode

8. What are perfectly polarized and perfectly non polarized electrodes?

Electrodes in which no net transfer of charge occurs across the metal electrolyte interface is called perfectly polarized electrode.

Electrodes in which unhindered exchange of charge occurs across the metal electrolyte interface is called perfectly non polarized electrode.

9. What are the types of electrodes used in bipolar measurement?

The types of electrodes used in bipolar measurement are

a) Limb electrodes
b) Floating Electrodes
c) Skin electrodes

10. Name the electrodes used for recording EMG and ECG.

Electrodes used for recording EMG are

a) Needle electrodes
b) Surface electrodes

Electrodes used for recording ECG are

a)Limb electrodes
b)Floating Electrodes
c)Pregelled disposable electrodes
d)Pasteless electrodes

11. State the importance of biological amplifiers.

Bio signals such as ECG, EMG, EEG, EOG have low amplitude and low frequency. So, amplifier is used to boost the amplitude level of bio signals.

12. What are the requirements for bio-amplifiers? (NOV/DEC-2013, MAY/JUNE-2013)

Bio amplifiers must have

a) High input impedance
b) Isolation and protection circuit
c) High voltage gain
d) Constant gain throughout required bandwidth
e) Low output impedance
f) High CMRR

13. What are the basic components of biomedical systems?

The basic components are

a) Patient
b) Transducer
c) Signal processing equipment
d) Display
e) Control unit
f) Stimulus

14. List the lead systems used in ECG recording.

The lead systems used in ECG recording are

a) Bipolar Limb leads or Standard leads
b) Augmented unipolar limb leads
c) Chest leads or precordial leads

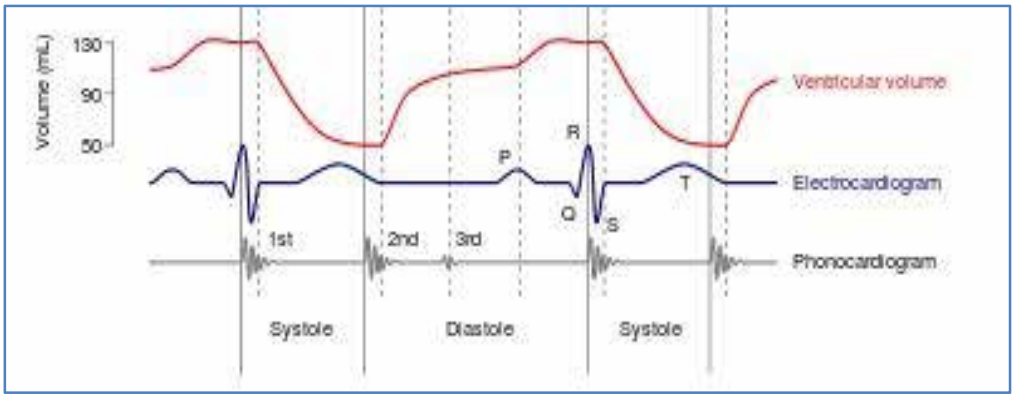
15. What is evoked potential?

The external stimuli are detected by the sense organs which cause changes in the electrical activity of the brain. Due to this, potential is developed in the brain as the response to external stimului like light, sound etc. It is called as evoked potential.

16. What is PCG?(NOV/DEC-2012)

A Phonocardiogram or PCG is a graphic display of the sounds generated by the heart and picked up by a microphone at the surface of the body. Frequency response required is 5 to 2000 Hz. It is measured by special transducer or microphone.

17. Compare the signal characteristics of ECG and PCG. (NOV/DEC-2013, MAY/JUNE-2013)



ECG wave occurrence	PCG wave occurrence
QRS Complex	1st heart sound
End of T wave	2nd heart sound
Beginning of P wave	3rd heart sound

18. What is EOG?

Electrooculogram is the measure of the variations in the corneal – retinal potential as affected by the position and movement of eye. The EOG potentials are picked up by small surface electrodes placed on the skin near the eye.

19. State the importance of PCG signals. (NOV/DEC-2013)

The importance of PCG signals are

a)Different types of heart sounds are measured.

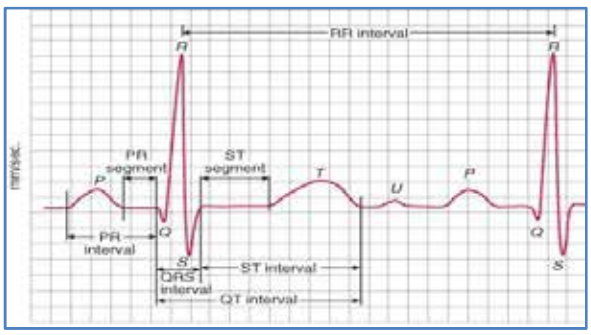
b)Additional sounds are heard between normal heart sound due to vibration setup in the blood inside the heart by sudden closure of valves.

c)The presence of higher frequencies (mumurs) in the phonocardiogram indicates a possible hear disorder such as Aortic stenosis, Mitral regurgitation, mitral stenosis etc.

20. Define latency as related to EMG.

Latency is defined as the elapsed time between the stimulating impulse and the muscle action potential. In other words it is the time delay between stimulus and response

21. Draw typical ECG waveform.



Wave	Amplitude (mV)	Duration (sec)
P	0.25	0.12– 0.22 (P – R interval)
R	1.06	0.07– 0.1
T	0.1 – 0.5	0.05– 0.15 (S – T segment)
QRS Complex	-	0.09

22. What are the important bands of frequencies in EEG and state their importance. (NOV/DEC-2012)

Waves	Frequency (Hz)	Observation
Delta(δ)	0.5 – 4	These wave occur in deep sleep in premature babies and in very serious organic brain disease.
Theta(θ)	4 – 8	These wave occurs during emotional stress in some adults particularly during disappointment and frustration.
Alpha(α)	8 – 13	They found in the normal persons when they are awake in a quiet, resting state. During sleep they disappear.
Beta(β)	13- 22	It is observed when the person is alert active, busy, or anxious thinking, active concentration.

23. What are the peak amplitude and frequency response for ECG, EEG and EMG.

Bioelectric potential	Function	Peak amplitude	Frequency response	Observation
ElectroCardioGram (ECG)	Records electrical activity of heart	0.1 to 4mV	0.05 to 120 Hz	Used to measure heart rate,arrhythmia and abnormalities
ElectroEncephaloGram (EEG)	Records electrical activity of brain	2 to 200μV	0.1 to 100 Hz	Used to analysis evoked potential, certain patterns, frequency response
ElectroMyoGram (EMG)	Records muscle potential	50μV to 1mV	5 to 2000 Hz	Used as indicator of muscle action for measuring fatigue

PART B

1. Discuss in detail the origin of bioelectric potentials with necessary diagrams.**(MAY/JUNE-2012)**
2. Draw an Electrocardiogram, labeling the critical features. Include typical amplitudes and time intervals for a normal person.With neat diagrams explain the 12 lead system in ECG measurement. **(MAY/JUNE-2013)**
3. Draw the waveform of the ACTION POTENTIAL and explain :
   (i) Depolarization
   (ii) Repolarization
   (iii) Resting Potential
   (iv) Absolute Refractory period
4. Draw the waveform of the action potential and explain.
   (i) Relative Refractory Period
   (ii) Propagation Rate
   (iii) All-or-nothing law
   (iv) Net height of the action
5. Draw the waveform of the ACTION POTENTIAL and describe Resting Potential, Depolarization, Repolarization, action potential, Absolute Refractory period and Relative Refractory Period .
6. Explain the characteristics of resting potential, with reference to Goldman's and Nernst equation. **(MAY/JUNE-2012)**
7. Draw a typical single channel ECG machine and give justification for the inclusion of each circuit block of the machine.
8. Write about standard lead system for ECG recording. Also draw a typical ECG waveform and mark the various complexes of ECG and give their durations.**(MAY/JUNE-2014)**
9. Write briefly about the recording devices for EMG. **(MAY/JUNE-2013)**
10. Draw the equivalent circuit of a pair of electrodes in electrolytic contact with a human being to measure bio-potential. Name the components. **(MAY/JUNE-2013)**
11. With neat diagram,explain the the schematic diagram of EEG machine and discuss about its function.(**NOV/DEC-2013)**
12. Explain the basic components of biomedical system with neat block diagram.
13. Write short notes on measurement of PCG. **(MAY/JUNE-2014)**
14. Distinguish a biological amplifier from a conventional amplifier with suitable equations and circuits. **(MAY/JUNE-2014)**

UNIT II - BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENTS

1. What are the typical values of blood pressure and pulse rate of an adult?
Systolic (maximum) blood pressure in the normal adult is in the range of 95 to145 mm Hg, with 120 mm Hg being average. Diastolic (lowest pressure between beats) blood pressure ranges from60 to 90 mm Hg, 80 mm Hg being average.

2. What are systolic and diastolic pressures?
The heart's pumping cycle is divided into two major parts systole and diastole. Systole is defined as the period of contraction of the heart muscles specifically the ventricular muscle at which time blood is pumped into the pulmonary artery and the aorta. Systolic pressure is 120 mm Hg(average value). Diastole is the period of dilation of the heart cavities as they fill with blood. Diastolic pressure is 80 mm Hg (average value).

3.What is the reason for decrease of cardiac output?
The reason for decrease of cardiac output may be due to low blood pressure, reduced tissue oxygenation, poor renal function, shock and acidosis.

4.Define – Cardiac Output
Cardiac output is defined as the amount of blood delivered by the heart to the aorta per minute. In case of adults during each beat, the amount of blood pumped ranges from 70 to 100 ml. for normal adults the cardiac output is about 4- 6 liters/ minute.

5. State the principle behind the indicator dilution method.
The indicator dilution method is based on the principle that a known amount of dye or radio isotope as an indicator is introduced with respect to time at the measurement site, so the volume flow of blood can be estimated.

6. What is residual volume?
Residual volume is the volume of gas remaining in the lungs at the end of maximum expiration.

7. Define – Tidal Volume
Tidal volume is also called as normal depth volume of breathing or is the volume of gas inspired or expired during each normal quiet respiration cycle.

8. What is total lung capacity?
The total lung capacity is the amount of gas contained in the lungs at the end of maximal inspiration.

9. Define – Vital Capacity
The vital capacity (VC) is the maximum volume of gas that can be expelled from the lungs after a maximal inspiration.

10. What is electrophoresis? (NOV/DEC-2012)
Electrophoresis is a method for separating and analyzing macromolecular substances such as plasma proteins. The method is based on the fact that, the molecules carry electric charges and therefore migrate in a electric field.

11. How is cardiac output is used?
Using implanted electromagnetic fine probe on the aorta, find the cardiac output per minute directly can be found by multiplying the stroke volume with the heart beat rate per minute.

12. What are the uses of gas analyzers?
Gas analyzers are used to determine the quantitative composition of inspired and expired gas to assess the lung function.

13. What are the uses of blood flow meters?
Blood flow meters are used to monitor the blood flow in various blood vessels and to measure cardiac output.

14. What are the applications of flame photometer?
Flame photometer is used to analyze urine or blood in order to determine the concentration of potassium (K), sodium (Na), calcium (Ca) and lithium (Li).

15. What are blood cells?(MAY/JUNE-2013)
The blood cells have important functions in our body. The red blood cell is used for the transport of oxygen and carbon dioxide. The white blood cells are part of the body's defense against infections and foreign substances. The platelet is involved in the clotting of blood.

16. What is the purpose PO_2 electrode is used?

PO_2 electrode is used to determine the oxygen tension in the blood. It is a piece of platinum wire embedded in an insulating glass holder with the end of wire exposed to the electrolyte into which the oxygen from the solution under measurement is allowed to diffuse through the membrane.

17. How is auto analyzer useful in medical field? (NOV/DEC-2012)
Auto analyzer is used to measure blood chemistry and display that on a graphic recorder.

18. What are korotkoff sounds?
In the Blood pressure (BP) measurement, when the systolic pressure exceeds the cuff pressure, then the doctor can hear some crashing, snapping sounds through the stethoscope. These sounds are called as korotkoff sounds.

19. What is cardiac output? What are the methods of measurement of cardiac output?
Cardiac output is the amount of blood delivered by the heart to the aorta per minute. For normal adult, the cardiac output is 4- 6 litres/min. The cardiac output is measured by using three methods. They are Fick's Method, Indicator dilation method, Measurement of cardiac output by impedance change.

20. What is stroke volume? (MAY/JUNE-2013)
Stroke volume is the volume of blood pumped from one ventricle of the heart with each beat SV is calculated using measurements of ventricle volumes from an echocardiogram and subtracting the volume of the blood in the ventricle at the end of a beat from the volume of blood just prior to the beat.

21. What are the types of heart sound?
Types of heart sounds are;
- Valve closure sounds
- Ventricular filling sounds
- Valve opening sounds
- Etra cardiac sounds

22. What is meant by 'dead air'?
The volume of air that is not available for gas exchange with the blood is known as dead air. It is less than 30% of the totalvolume.

23. Write the equation to fing pH value?
It is the logarithm of the reciporal value of H^+ ion concentration.

$$pH = -log_{10}[H^+]$$

24.Write the basic principle of electromagnetic flow meter. (MAY/JUNE-2014)

The electromagnetic operates on Faraday's law of induced e.m.f.Continuous measurement s of blood velocity can be obtained by placing the electromagnetic
Flow probe around arteries and veins.The resulting velocity can be correlated with blood flow.

25.What are the components of blood? (MAY/JUNE-2013)

Red cells, White cells, Platelets, Plasma

Part B

1. What is a coulter counter ? Explain its operation. Mention the drawbacks of the System.
2. Explain how the pH of blood is measured.
3. Define the term " Cardiac Output ". How is cardiac output measured by indicator dilution technique? Explain. **(NOV/DEC-2012)**
4. Describe , with neat diagrams, the operation of a blood cell counter working on the principle of conductivity. List the drawbacks of the system. **(NOV/DEC-2012)**
5. Give a pictorial representation of Long Volumes and capacities indicate and explain the following :
   i)Tidal Volume
   (ii) Insipiratory reserve volume
   (iii) Expiratory Reserve Volume
   (iv) Residual Volume
   (v) Vital Capacity
   (vi) Total Lung capacity
   (vii)Inspiratory capacity
   (viii)Functional residual capacity.
6. List out the physical principles based on which blood flow meters are working.
7. State the application of ultrasonic waves in measuring i) Blood flow ii)Blood pressure. **(NOV/DEC-2013)**
8. Compare DIRECT measurements and INDIRECT measurements of BLOOD PRESSURE .
9. Name the physical principles based on which the blood flow meters are used.
10. Write down the application of ELECTROPHORESIS and explain the BASIC principles involved .
11. Explain : i) Ultrasonic Blood flow meter (Doppler type) **(MAY/JUNE-2013)**
    ii)Fick's method.
12. Draw the block diagram of ultrasonic blood flow meter. Explain the method of measuring the velocity of blood flow using (i) transit time principle (ii) Doppler Effect
13. Describe a procedure for the measurement of pH in blood .
14. Explain the principle of i)Sphygmomanometer ii)Measurement of PCO3. **(MAY/JUNE-2013)**
15. Discuss the process of resipiratory measurement. **(NOV/DEC-2012)**
16. Explain i)Photometer ii)Auto analyzer. **MAY/JUNE-2014)**

UNIT –III ASSIST DEVICES

1. **What is pacemaker? (MAY/JUNE-2013)**
   A device which is capable of generating artificial pacing impulses and delivering them to heart is known as pacemaker.

2. **What are the components of pacemaker?**
   The components of the pacemaker are:
   Pulse generator
   Electrodes
   Batteries

3. **Give two important factors that demand internal pace maker's usage.**

The two important factors that demand internal pace maker's usage are
(i). Type and nature of the electrode used
(ii). Nature of the cardiac problems.
(iii). Mode of operation of the pacemaker system.

4. **Distinguish between Internal and External pacemakers.**

S.No	Internal Pacemakers	External Pacemakers
1	The pacemaker is a surgically implanted when if the skin near the chest or abdomen, with its output's leads is connected directly to the heart muscle.	The pacemaker is placed outside the body. It may be in the form of wrist watch or in the pocket, from that one terminal will go in the heart through the vein.
2	It requires open chest minor surgery to place the pacemaker	It does not require open chest surgery
3	It is used for temporary heart regularity	It is used for permanent heart regularity
4	There is no safety for the pacemaker, particularly in case of child carrying the pacemaker.	There is 100% safety for circuit from the external disturbances.

5. **Classify Pacing modes**
   Based on the modes of operation of the pacemakers, they can be classified into five types. They are:
   i) Ventricular asynchronous pacemaker(fixed rate pacemaker)
   ii) Ventricular synchronous pacemaker.
   iii) Ventri defibrillator inhibited pacemaker (demand pacemaker)
   iv) Atrial synchronous pacemaker.
   v) Atrial sequential ventricular inhibited pacemaker.

6. **What are the batteries used for implantable pacemaker?**
   The batteries used for implantable pacemakers are
   (i).Mercury cell, (ii).Lithium cells, (iii). Nuclear cell

7. **What types of electrodes are used in a defibrillator?**
   The electrodes used in a defibrillator are
   (i)Internal electrodes - Spoon shaped (ii)External electrodes –Paddle shapped

8. What are the three types of exchangers used in HEMODIALYSIS system?

The three types of exchangers used in HEMODIALYSIS systems are

i) Parallel Flow dialyzer
(ii) Coil Hemodialyser,
(iii) Hollow Fiber Hemodialyser

9. What is meant by fibrillation?

The condition at which this necessary synchronism is lost is known as fibrillation. During fibrillation the normal rhythmic contractions of either atria or the ventricles are replaced by rapid irregular twitching of the muscular wall.

10. Calculate the energy stored in 16μF capacitor of a DC defibrillator that is charged to a potential of 5000 Vdc.

Given Data:

C = 16μF
V= 5000
$E= (1/2) CV^2$
$=(1/2) \times 16 \times 10^{-6} \times 25 \times 10^6$

=200 Joules

11. Write the advantages and disadvantages of standby pacemaker.

Advantages:

Ventricular fibrillation is avoided by using this pacemaker.
Power consumption is reduced.

Disadvantages:

This pacemaker is sensitive to electromagnetic interferences
There is no synchronization between atrial and ventricular contraction.

12. What is counter shock?

The phenomenon of application of an electrical shock to resynchronize the heart is known as counter shock.

13. What is heart lung machine?

The machine which can provide extra corporeal circulation to the patient is known as Heart Lung Machine.

14. What is meant by oxygenators? (MAY/JUNE-2012)

Oxygenators does the function of the lungs. The other name of oxygenator is artificial lung. It should oxygenate 5 litres of blood per minute.

15. Name the types of oxygenators.

The different types of oxygenators are:

Bubble oxygenators
Membrane oxygenators
Liquid – Luquid oxygenators
Film oxygenators

16. Define systole and diastole pressure. (MAY/JUNE-2012)

Systole is the period of contraction of the ventricular muscular,pressure is 120mmofHg and diastole is the period of dilation of the heart chambers as they fill with blood,pressure is 80mmof Hg.

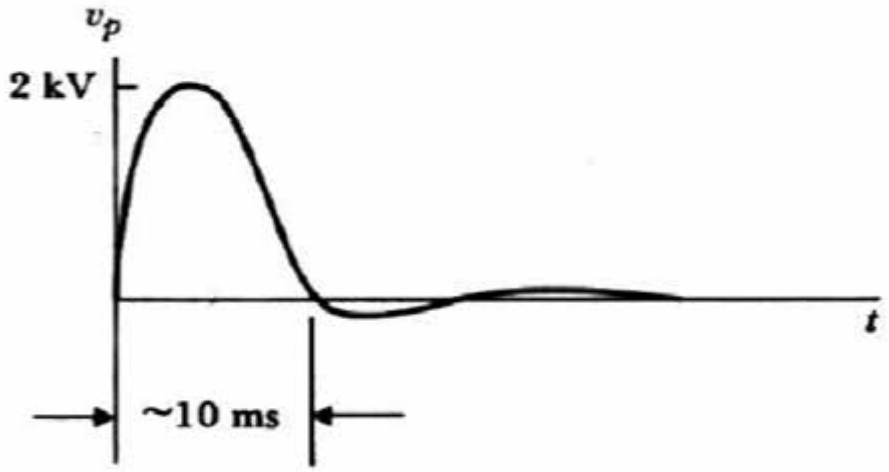
17.What is tele-stimulation? NOV/DEC-2012)

Tele-stimulation is the measurement of biological signals over long distance.

18.What is meant by demand pacemaker? (NOV/DEC-2013)

The pacemaker which provide the impulses based on the patient's need is known as demand pacemaker.

19. Draw the typical discharge pulse of a DC-defibrillator. (MAY/JUNE-2014)



PART B

1. Explain the different types of pacemaker. **(MAY/JUNE-2014) (NOV/DEC 2012)**
2. Explain the working principle of DC Defibrillator with neat diagram. **(MAY/JUNE-2013) (MAY/JUNE-2012)**
3. Explain AC Defibrillator with neat diagram.
4. Discuss about the heart lung machine model with necessary diagram.
5. With respect to the Defibrillator draw the following waveform :

   DC fibrillator discharge waveform

   Dual peak monophasic defibrillator discharge waveform

   Truncated defibrillator discharge waveform .
6. Draw the basic circuit diagram of a capacitive discharge type of cardiac defibrillator and explain the working principle.
7. Discuss various types of defibrillator electrodes.
8. What is meant by Demand Pacemaker ? How is it different from other types of pacemakers ? State the merits and demerits of this pacemaker. **(MAY/JUNE-2014)**

9. Explain R – Wave inhibited pacemaker. **(MAY/JUNE-2013)**
10. Explain the function of synchronized DC defibrillator with neat block. Or How is atrial fibrillation arrested? Explain with the help of relevant diagram of the setup.
11. Explain the principle of extra corporeal dialysis with neat diagram.
12. Explain the principle of Intra corporeal dialysis with neat diagram.

    Show how tele-stimulation is achieved and write the merits and demerits of E-health. **(MAY/JUNE-2014)**

UNIT IV – PHYSICAL MEDICINE AND BIOTELEMETRY

1. **What is Diathermy? List its types. (NOV/DEC-2012)**
   Diathermy is the treatment process by which cutting, coagulation, blending etc. of tissues are obtained.
   Types:
   - Shortwave diathermy
   - Microwave diathermy
   - Ultrasonic diathermy
   - Surgical diathermy

2. **What is the use of high frequency current in diathermy?**
   The use of high frequency current is to avoid the intense muscle activity and the electrocution hazard which occurs if low freuencis are used,

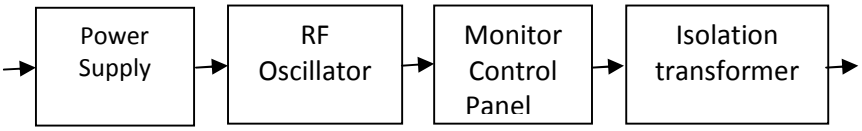
3. **What is meant by the term Hemostasis?**
   The concurrent use of continuous RF current for cutting and a RF wave burst for coagulation is called as Hemopstasis.

4. **What do you mean by galvanic current?**
   Galvanic current is a constant current or direct current. The maximum amount of current passed through the body is about 0.3 to 0.5 mA/cm^2 of electrode surface. The duration of the passage of current is about 10 to 20 minutes. The passage of current creates the movement of ions. It is used for the preliminary treatment of paralysis and for the disturbance of blood flow in the arteries and veins.

5. **What is interrupted galvanic current?**
   Interrupted galvanic current pulses are a series of negative going rectangular pulses. The pulse duration is about 100 msec with a repetition rate of 12 to 70 per minute.

6. **What is the frequency of currents used in surgical diathermy units?**
   A frequency of 300 – 3000 kHz is used in surgical diathermy. At these frequencies, large current flow into the cells causing it to vaporize and thereby causing a rupture of the tissue close to the cutting electrode.

7. **Draw the block diagram of short wave diathermy unit.**



8. **What is Dia-pulse shortwave diathermy?**
   Dia-pulse shortwave diathermy is a diathermy in which instead of RF continuous wave RF pulse of 65s and pulse interval of 1600s are used.

9. **What is the frequency of operation of ultrasound diathermy? What is the reason for this frequency selection?**
   The amount of ultrasonic energy absorbed by the tissue depends upon the frequency of ultrasonic waves. Normally the frequency range of 800 kHz to 1 MHz is the suitable frequency for ultrasonic therapy.
   This frequency is selection because, a greater depth of massage can be obtained without any pain to the patient.

10. **Name few diseases that can be cured by ultrasonic diathermy.**
    The few diseases that can be cured by ultrasonic diathermy are
    Neuritis
    Arthritis
    Skin Ulcers

11. **What is microwave diathermy?**
    Healing of the tissues is produced due to absorption of the microwave energy. The frequency range used is 450 MHz.

12. **State the different types of radiation generated from radio isotopes. (NOV/DEC-2013)**
    Different types of radiation generated from radio isotopes are
    Alpha Emission
    Beta Emission
    Gamma Emission

13. **What is meant by ionizing radiation?**
    The rays coming out from x – rays or radioactive materials has the characteristics of ionizing the gases through which it travels. This is known as ionizing radiation.

14. **What is the need for ionizing radiation?**
    The ability of ionizing radiation to penetrate materials that are opaque to visible light is utilized in numerous techniques in medical diagnosis. The ionizing effects of radiation are also used for the treatment of certain diseases, such as cancer. It is used in imaging as an aid to diagnose or as a screening tool.

15. **List the characteristics of X-ray.**
    Characteristics of X-ray are
    i. They travel in a straight line with the speed of light in vacuum.
    ii. They expose photographic films.
    iii. They ionize gases
    v. They penetrate matter.They cause emissions of electron from metals.
    vi. They are not deviated by electric or magnetic fields.

16. Distinguish between hard X-ray and soft X-ray.

S. No.	Soft X-rays	Hard X-rays
1	Low penetrating power	High penetrating power
2	They have long wavelength	They have short wavelength
3	Low frequency	High frequency
4	Mainly used for diagnostic purpose, such as detecting fractures and the presence of foreign matter like bullet in human body.	Mainly used for therapeutic purpose, such as treating certain types of skin disease and cancer.

17. What is angiography?

Angiography is a medical imaging technique in which an X – ray picture is taken to visualize the inner opening of blood filled structures, including arteries, veins and the heart chambers. An X-ray contrast medium is injected into the blood vessel and an X-ray called an angiogram is taken.

18. What is radiation therapy? (NOV/DEC-2012)

Certain diseases and tumors can be treated by ionizing effect of x-rays. The use of radiation for the treatment of disease is called as radiation therapy. In dermatology soft x-rays are used for the treatment of skin diseases. Hard x-rays are used in treatment of deep seated tumors.

19. Name two equipments used in radiation therapy.

Equipments used in radiation therapy are

Cobalt 60 machine

Medical linear accelerator machine

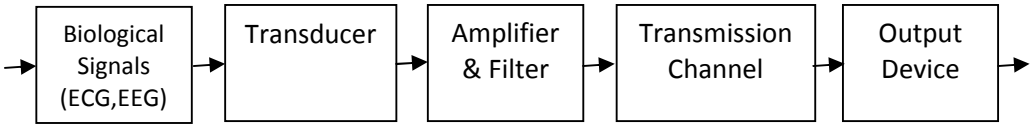
20. What is the modulation techniques used for biotelemetry? Mention the reason for adopting that modulation scheme.

The two different modulation techniques used for biotelemetry are

i)Double Modulation ii)Pulse Width Modulation

The purpose behind this **double modulation,** it gives better interference free performance in transmission, and this enables the reception of low frequency biological signals. The sub modulators can be a FM (frequency modulation) system, or a PWM (pulse width modulation) system or a final modulator is practically always an FM system.

21. Draw the block diagram of a Bio-Telemetry system. (MAY/JUNE 2012)



22. What are the advantages of biotelemetry system? (MAY/JUNE 2012)

The advantages of biotelemetry systems

(i) It is used to record the biosignals over while patient is engaged in his normal activities

(ii) The medical attendant or computer can easily diagonise the nature of Disease by seeing the telemeter biosignals without attending patient Room

(iii) Patient is not disturbed during recording.

(iv) For recording on animals, particularly for research, the biotelemetry is greatly used.

23. Specify the frequencies used for biotelemetry.

Wireless telemetry system uses modulating systems for transmitting biomedical signals. Two modulators are used here. A lower frequency sub-carrier is employed in addition to very- high frequency (VHF). This transmits the signal from the transmitter.

24. What is a radio-pill? (MAY/JUNE 2012)

The radio pill is capable of measuring various parameters that are available in the tract. With the help of radio pill type devices, it is possible for us to measure or sense temperature, pH, enzyme activity, and oxygen tesion values. These measurements can be made in associated with transducers. Pressure can be sensed by using variable inductance, temperature can be measured by using temperature-sensitive transducer.

25. What is principle of telestimulation? (NOV/DEC-2012)

Telestimulation is the measurement of biological signals over long distance.

26. List the applications of Bio-Telemetry. (MAY/JUNE-2013)

i)Radio tracking ii)Cardiac monitoring iii)Study of animal migration.

27.List the two types of multiplexing involved in multichannel wireless telemetry. (NOV/DEC-2013)

i)Frequency division multiplexing ii)Time division multiplexing.

28.What are the essential requirements of FM telemetry receiver? (MAY/JUNE-2014)

LPF, Subcarrier demodulator, BPF.

PART B

1. Write short notes on surgical diathermy or explain the function of surgical diathermy and various modes of operation.**(MAY/JUNE 2013)**
2. Describe the principles involved in the diathermy unit. .**(NOV/DEC 2012)**
3. Explain the basic principle of operation of an ultrasonic diathermy unit. List out its applications.
4. Describe the principles involved in the shortwave diathermy unit. .**(NOV/DEC 2012)**
5. Explain the different types of electro surgery techniques employed in a diathermy unit.
6. Explain a bio-telemetry system with a block diagram. .**(NOV/DEC 2012)**
7. What is Bio Telemetry? Explain the working of single channel ECG telemetry system. **(NOV/DEC-2013)**
8. Explain the working of a multichannel telemetry system with neat block diagram. **(MAY/JUNE-2013) (NOV/DEC-2012)**
9. Describe the various applications of telemetry.
10. Discuss about the radio pill with the help of an example.
11. Write short notes on Microwave diathermy. **(MAY/JUNE-2014)**

UNIT V

RECENT TRENDS IN MEDICAL INSTRUMENTATION

1. What is medical thermography? Mention its applications. (NOV/DEC 2012)

Thermography is the process of recording true thermal image of the surfaces of objects under study. It displays images representing the thermal radiation of skin areas. Thermogram contain both qualitative and quantitative information relevant to the image itself and to temperature. Medical applications of thermography

i) Tumors
ii) Inflammation
iii) Diseases of peripheral vessels
iv) Orthopedic diseases

2. List the types of lasers used in medical field.

The types of lasers used in medical fields are

i). Pulsed Nd-YaG laser
ii). Continuous laser. Co_2 laser
iii). Continuous wave organ ion laser

3. Define - Let-go current

Let – go current is the minimum current to produce muscular contraction.

For men—about 16mA
For Women—about 10.5 mA

4. Define – Micro Shock (NOV/DEC 2012)

A physiological response to a current alied to the surface of the heart that results in unnecessary stimulation like muscle contractions or tissue injury is called as microshock.

5. What are the advantages of performing surgery using LASER?

The advantages of performing surgery using LASER are

i) Highly sterile
ii) Non-contact surgery
ii) Highly localized and precise
iv) Prompt surgery
v) Short period of surgical time

6. Define – Macro Shock. (MAY/JUN-2013)

A physiological response to a current applied to the surface of the body that produces unwanted stimulation like tissue injury or muscle contractions is called as macro shock.

7. What are the applications of laser in medicine?

Laser is used in ophthalmology (eye problem), Gynecology (fertility), Plastic surgery, skin cancer etc.

8. What are the types of thermography?

The types of thermography are

i) . Infrared thermography
ii) Liquid crystal thermography
iii). Microwave thermography

9. What are the different types of current that are used for medical applications? (MAY/JUN-2014)

The different types of current are Threshold current, pain current, let-go current, paralysis current, fibrillation and defibrillation current.

10. Define - Endoscopes and mention some of its types. (NOV/DEC 2012)

Endoscope is a tubular optical instrument to inspect or view the body cavities which are not visible to the naked eye normally.Types of endoscopes are cardioscope, bronchoscope, laparoscope, otoscope, gastroscope etc.

11. What are the devices used to protect against electrical hazards?

i).Ground fault interrupt
ii). Isolation transformer

12. What are the two methods of shortwave diathermy?

The two methods of shortwave diathermy are
i) Capacitive method
ii) Inductive method

13. What is the purpose of using resuscitation unit?

Resuscitation unit is generally used in intensive care unit (ICU). In modern hospitals the resuscitation units are in the form of a mobile trolley.

14. List the applications of Endoscope.

Endoscopes are used in hospitals for examination, treatment of disease and surgery.

15. What is the use of laparoscope?

The laparoscope is used for analyzing abdominal related diseases and to perform operations in the abdominal region.

PART B

1. What is Thermography? Discuss the different thermographic techniques with suitable diagrams. **(MAY/JUNE 2013)**
2. Discuss the working principle of an infrared thermoraphy with neat block diagram.
3. List out the applications of thermography.**(NOV/DEC 2012)**
4. Explain the various methods of endoscopes with suitable diagram.
5. Explain the principles involved in endoscopy unit with relevant diagram. **(MAY/JUNE 2013)** .**(NOV/DEC 2012), (MAY/JUNE-2014)**
6. Explain the different types of lasers used in medicine.
7. Write short notes on argon laser and Co_2 laser.
8. Discuss in detail about the different applications of Lasers in medicine.
9. Discuss about electrical safety in medical equipment.
10. Write short notes on Macro shock Hazards and Micro shock Hazards .
11. What is Cryogenic Technique ?How is it useful in the hospital ? Expalin. What are the precautions to be followed during application ?
12. What are the methods by which the electrical safety of the patient in the hospital is ensured ? Discuss in detail.

Aalim Muhammed Salegh College of Engineering

ELECTRONICS & COMMUNICATION ENGINEERING

EC6601

VLSI DESIGN

SEMESTER - VI

EC6601- VLSI DESIGN

Regulations 2013

QUESTION BANK

UNIT I - MOS TRANSISTOR PRINCIPLE

2- Marks with Answers

1. **What are the advantages of MOSFET in digital design?**
   - MOSFET performs very well as a switch
   - Introduces little parasitic effects
   - High integration density combined with a relatively "simple" manufacturing process
   - More economical
2. **What are the types of MOSFET?**
   - The NMOS transistor consists of*n*+ drain and source regions, embedded in a*p*-type substrate. The current is carried byelectrons moving through an *n*-type channel between source and drain.
   - The PMOS transistor consists of p+ drain and source regions, embedded in a n-type substrate. The current is carried by holes moving through a *p*-type channel between source and drain.
   - In a complementary MOS technology(CMOS), both NMOS and PMOS are present.
3. **What is meant by depletion region?**
   The region which is free of carriers is called as depletion region.
4. **What is meant by threshold voltage? [Nov/Dec 2014]**
   The value of V_{GS} at which the strong inversion occurs (i.e inversion of substrate type between source and drain) is called as threshold voltage(V_T).

   $$V_T = V_{T0} + \gamma(\sqrt{|-2\phi_F + V_{SB}|} - \sqrt{|-2\phi_F|})$$

   V_T is a function of difference in work-function between gate and substrate material, the oxide thickness, the Fermi voltage, the charge of impurities trapped at the surface between channel and gate oxide, and the dosage of ions implanted for threshold adjustment.
5. **What are the different regions of operation of NMOS and PMOS and specify its conditions?[May/June 2014]**
   NMOS:
   - Cut off region (Vgsn<Vtn)
   - Linear or resistive region(Vgsn>Vtn; Vdsn<Vgsn-Vtn)
   - Saturation region(Vgsn>Vtn; Vdsn>Vgsn-Vtn)

   PMOS:
   - Cut off region (Vgsp>Vtp)
   - Linear or resistive region(Vgsp<Vtp; Vdsp>Vgsp-Vtp)
   - Saturation region(Vgsp<Vtp; Vdsp<Vgsp-Vtp)

6. **Give the drain current equation for three different regions of operation.**
   Cut off region:
   $I_D=0$
   Linear or resistive region:

$$I_D = k'_n \frac{W}{L}\left[(V_{GS}-V_T)V_{DS}-\frac{V_{DS}^2}{2}\right] = k_n\left[(V_{GS} \quad V_T)V_{DS} \quad \frac{V_{DS}^2}{2}\right]$$

k'_n is called the *process transconductance parameter* and equals

$$k'_n = \mu_n C_{ox} = \frac{\mu_n \varepsilon_{ox}}{t_{ox}}$$

   Saturation region:

$$I_D = \frac{k'_n}{2}\frac{W}{L}(V_{GS}-V_T)^2$$

7. **What is meant by channel length modulation?[May/June 2011; May/June 2013]**

   Ideally, I_{ds} is independent of V_{ds} for a transistor in saturation, making the transistor a perfect current source. The p–n junction between the drain and body forms a depletion region with a width L_d that increases with V_{db}. The depletion region effectively shortens the channel length to

   $L_{eff}=L-L_d$

   Including the channel length modulation effect in saturation region, ID can be expressed as

$$I_D = \frac{k'_n}{2}\frac{W}{L}(V_{GS}-V_T)^2 \qquad (1+\lambda V_{DS})$$

8. **What is meant by velocity saturation effect? [May/June 2013]**
   At low fields, the velocity increases linearly with the field. However, at high field strengths, the carriers fail to follow this linear model. In fact, when the electrical field along the channel reaches a critical value, the velocity of the carriers tends to saturate due to scattering effects (collisions suffered by the carriers).
9. **What is meant by sub threshold condition?**
   The long-channel transistor I-V model assumes current only flows from source to drain when *Vgs* > *Vt*. In real transistors, current does not abruptly cut off below threshold, but rather drops off exponentially. This is called as sub threshold conduction.

$$I_D = I_S e^{\frac{V_{GS}}{nkT/q}}\left(1-e^{-\frac{V_{DS}}{kT/q}}\right)$$

10. **What are the secondary effects of MOS transistor?**
    - Drain-induced barrier lowering(DIBL)
    - Punch-through
    - Hot-carrier effect
    - CMOS latchup
    - Channel length modulation

- Velocity saturation
- Sub threshold conduction
- Body effect

11. What is meant by DIBL?

Drain-induced barrier lowering or **DIBL** is a short-channel effect in MOSFETs referring originally to a reduction of threshold voltage of the transistor at higher drain voltages.

12. What is meant by punch through?

Punch through in a MOSFET is an extreme case of channel length modulation where the depletion layers around the drain and source regions merge into a single depletion region. The field underneath the gate then becomes strongly dependent on the drain-source voltage, as is the drain current. Punch through causes a rapidly increasing current with increasing drain-source voltage.

13. What is meant by hot carrier effect?

Under pinch-off condition, also known as ``saturated case", hot carriers traveling with saturation velocity can cause parasitic effects at the drain side of the channel known as ``Hot Carrier Effects" (HCE). These carriers have sufficient energy to generate electron-hole pairs by Impact Ionization. The generated bulk minority carriers can either be collected by the drain or injected into the gate oxide. Carrier injection into the gate oxide can lead to hot carrier degradation effects such as threshold voltage changes due to occupied traps in the oxide.

14. What is meant by CMOS latch up? [May/June 2012; May/June 2015]

CMOS latch up is a type of short circuit occurs, where the combination of wells and substrates results in the formation of parasitic n-p-n-p structures. Triggering these thyristor-like devices leads to a shorting of the VDD and VSS lines, usually resulting in a destruction of the chip.

15. What are the CMOS latch up prevention techniques?

- Resistances of nwell and p-substrate of CMOS should be minimized. This can be achieved by providing numerous well and substrate contacts, placed close to the source connections of the NMOS/PMOS devices.
- Devices carrying a lot of current (such as transistors in the I/O drivers) should be surrounded by guard rings.

16. What is meant by body effect?[Nov/Dec 2014]

When a voltage V_{sb} is applied between the source and body, it increases the amount of charge required to invert the channel, hence, it increases the threshold voltage. The threshold voltage can be modeled as

$$V_t = V_{t0} + \gamma\left(\sqrt{\phi_s + V_{sb}} - \sqrt{\phi_s}\right)$$

where V_{t0} is the threshold voltage when the source is at the body potential, Φs is the surface potential at threshold.

17. What is meant by gate capacitance?

The gate capacitor can be viewed as a parallel plate capacitor with the gate on top and channel on bottom with the thin oxide dielectric between. Therefore, the capacitance is $C_g=C_{ox}$ WL

18. What is meant by lateral diffusion?

Ideally, the source and drain diffusion should end right at the edge of the gate oxide. In reality, both source and drain tend to extend somewhat below the oxide by an amount *xd*, called the *lateral diffusion*.

19. What are the components of gate capacitance?

- Intrinsic capacitance C_{gc}(over the channel)
- Overlap capacitance C_{gol}(to the source and drain)

20. What are the three components of intrinsic capacitance?

The intrinsic capacitance has three components representing the different terminals connected to the bottom plate:

- Cgb (gate-to-body)
- Cgs (gate-to-source)
- Cgd (gate-to-drain)

21. **Give the average distribution of channel capacitance of MOS transistor for different operation regions**.

Operation Region	C_{GCB}	C_{GCS}	C_{GCD}	C_{GC}	C_G
Cutoff	$C_{ox}WL$	0	0	$C_{ox}WL$	$C_{ox}WL+2C_oW$
Resistive	0	$C_{ox}WL/2$	$C_{ox}WL/2$	$C_{ox}WL$	$C_{ox}WL+2C_oW$
Saturation	0	$(2/3)C_{ox}WL$	0	$(2/3)C_{ox}WL$	$(2/3)C_{ox}WL+2C_oW$

22. What is meant by junction capacitance or diffusion capacitance?

A junction capacitive component is contributed by the reverse-biased source-body and drain body *pn*-junctions. The depletion-region capacitance is nonlinear and decreases when thereverse bias is raised

- The *bottom-plate* junction, which is formed by the source region (with doping *ND*) and the substrate with doping *NA*. The total depletion region capacitance for this component equals *Cbottom = CjWLS*, with *Cj* the junction capacitance per unit area.
- The *side-wall* junction, formed by the source region with doping *ND* and the *p*+ channel- stop implant with doping level NA^+.

23. What is the necessity of device model? What are the different popular device models?[May/June 2013]

The complexity of the behavior of the short-channel MOS transistor and its many parasitic effects has led to the development of a wealth of models for varying degrees of accuracy and computing efficiency. The most popular device models are LEVEL 1 model, LEVEL 2 model, LEVEL 3 model, BSIM MODEL.

24. What are the causes for changes in threshold voltage?

The *threshold voltage VT* can vary for numerous reasons: changes in oxide thickness, substrate, poly and implant impurity levels, and the surface charge.

25. What is meant by scaling? What are the different types of scaling?[Nov/Dec 2014]

The process of reducing the transistor size is called as scaling. Different types of scaling are

- Full scaling(constant electrical field scaling)
- Fixed voltage scaling
- General scaling

26. What is meant by full scaling or constant electrical field scaling?

In full scaling method, voltages and dimensions are scaled by the same factor *S*. The goal is to keep the electrical field patterns in the scaled device identical to those in the original device. Keeping the electrical fields constant ensures the physical integrity of the device and avoids breakdown or other secondary effects. This scaling leads to greater device density (*Area*), higher performance (*Intrinsic Delay*), and reduced power consumption (*P*).

27. What is meant by fixed voltage scaling?

In fixed voltage scaling method, dimensions are scaled by the same factor *S* but the voltage is maintained as constant.

28. What are the interconnect parameters?

Resistance, capacitance and inductance.

29. What is meant by fringing capacitance of the wire?

The capacitance between the side-walls of the wires and the substrate, called the *fringing capacitance.*

30. What are the components of wire capacitance?

- Parallel plate capacitance
- Fringing capacitance

31. What is meant by sheet resistance?

$R_{\square} = \rho/t$ is the sheet resistance. Unit is Ω/square.

32. What is meant by skin effect?

It is the tendency of alternating current to flow mostly near the outer surface of the electrical conductor such as metal wire. The effect is more and more pronounced as the frequency increases. The main problem with the skin effect is that it increases the effective resistance of the wire.

33. What is meant by skin depth?

The *skin depth* □ is defined as the depth where the current falls off to a value of *e*-1 of its nominal value, and is given by

$$\delta = \sqrt{\frac{\rho}{\pi f \mu}}$$

with *f* the frequency of the signal and □ the permeability of the surrounding dielectric

34. What is meant by silicide?

A silicide is a compound material formed using silicon and a refractory metal. This creates a highly conductive material that can withstand high-temperature process steps without melting.

Examples of silicides are WSi2, TiSi2, PtSi2, and TaSi.

35. What is meant by polycide?

Polycide is the combination of polysilicon and a silicide.

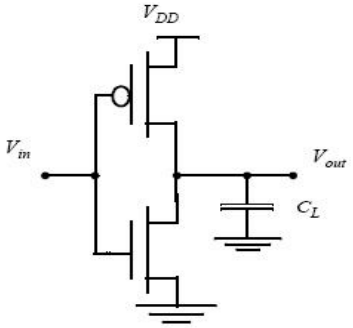
36. What is meant by elmore delay?[Nov/Dec 2014]

The Elmore delay at node *i* is then given by the following expression:

$$\tau_{Di} = \sum_{k=1}^{N} C_k R_{ik}$$

The Elmore delay is equivalent to the first-order time constant of the network.

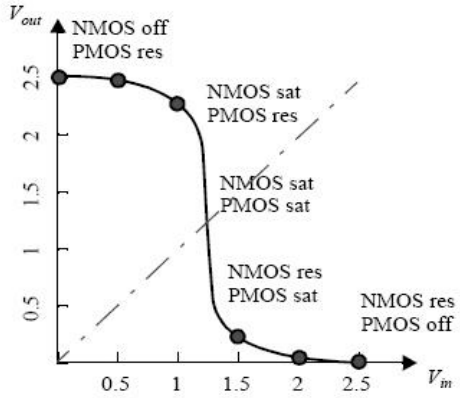
37. Draw the circuit of static CMOS inverter.



38. What is the difference between ratioless logic and ratioed logic?

The logic levels are not dependent upon the relative device sizes, so that the transistors can be minimum size. Gates with this property are called *ratioless.* This is in contrast with *ratioed logic*, where logic levels are determined by the relative dimensions of the composing transistors.

39. Draw the voltage transfer characteristics of CMOS inverter. [May/June 2015]



40. What is meant by switching threshold?

The switching threshold, *VM*, is defined as the point where *Vin = Vout*.

41. What are the properties of static CMOS circuit?

- The high and low output levels equal *VDD* and *GND*, respectively; in other words, the voltage swing is equal to the supply voltage. This results in high noise margins.
- The logic levels are not dependent upon the relative device sizes, so that the transistors can be minimum size. Gates with this property are called *ratioless.*

- In steady state, there always exists a path with finite resistance between the output and either *VDD* or *GND*. The CMOS inverter, therefore, has a *low output impedance*.
- The *input resistance* of the CMOS inverter is extremely high
- No direct path exists between the supply and ground rails under steady-state operating conditions means that the gate does not consume any static power.

42. Give some of the ways by which propagation delay of a gate can be minimized.

- Reduce CL
- Increase the W/L ratio of the transistors
- Increase VDD.

43. What are the two components of power dissipation of static CMOS circuits?[May/June 2012; May/June 2015]

- Dynamic dissipation due to
  - charging and discharging load capacitances as gates switch
  - "short-circuit" current while both pMOS and nMOS stacks are partially ON
- Static dissipation due to
  - subthreshold leakage through OFF transistors
  - gate leakage through gate dielectric
  - junction leakage from source/drain diffusions
  - contention current in ratioed circuits

44. Give some low power design techniques.

- Reducing VDD has a quadratic effect on Pdyn.
- reduction in the switching activity
- Lowering the physical capacitance. This means that transistors should be kept to minimal size whenever possible or reasonable.

45. What is meant by power delay product?

The PDP stands for the **average energy consumed per switching event.**

$$PDP = C_L V_{DD}^2 f_{max} t_p = \frac{C_L V_{DD}^2}{2}$$

46. What is meant by energy delay product?

$$EDP = PDP \times t_p = P_{av} t_p^2 = \frac{C_L V_{DD}^2}{2} t_p$$

47. What is meant by logical effort?

Logical effort of a gate is defined as the ratio of the input capacitance of the gate to the input capacitance of an inverter that can deliver the same output current.

48. What is meant by parasitic delay?

The parasitic delay of a gate is the delay of the gate when it drives zero load.

49. What is meant by fan out or electrical effort?

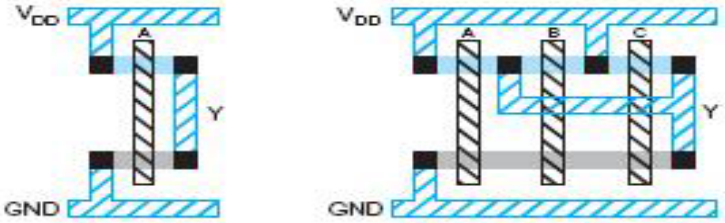
A gate driving *h* identical copies of itself is said to have a *fanout* or *electrical effort* of *h*.

50. What is meant by layout rule or design rule?[May/June 2015]

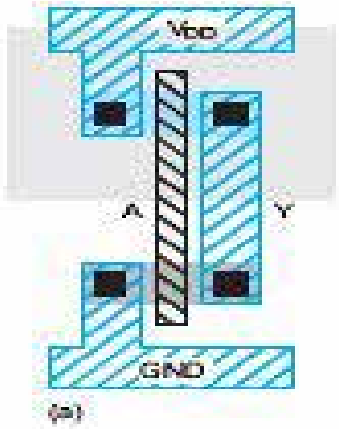
Layout rules, also referred to as *design rules*, and can be considered a prescription for preparing the photomasks that are used in the fabrication of integrated circuits. The rules are defined in terms of *feature sizes* (widths), *separations*, and *overlaps*. The main

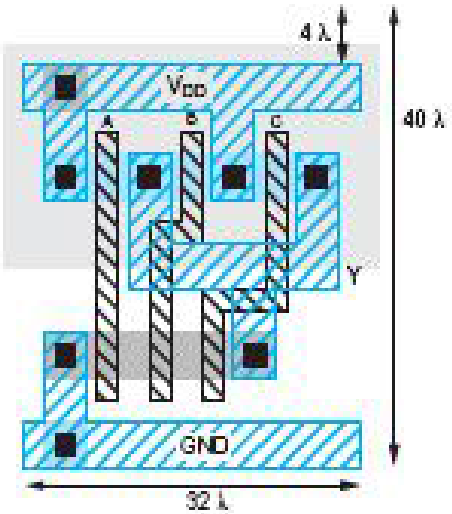
objective of the layout rules is to build reliably functional circuits in as small an area as possible.

51. Draw the stick diagram of static CMOS inverter and 3 input NAND gate.



52. Draw the layout of static CMOS inverter and 3 input NAND gate.





16 Marks

1. Derive the current equation for n-MOS transistor for different operating regions(16)[Nov/Dec 2014]

   (or)

   Derive the equations for MOS transistor considering channel length modulation and velocity saturation (16)

   (or)

   Derive I-V (Current- Voltage) characteristics of n-MOS transistor.(16)[May/June 2013]

   Describe the secondary effects of MOS transistor(16))[May/June 2012]
2. Explain C-V (Capacitance-Voltage) characteristics of MOS transistor(8)

   (or)

   Explain MOS structure capacitances and obtain MOSFET capacitance model(8)
3. Explain SPICE models for the MOS transistor (16)
4. Explain process parameters of MOS transistor in detail (16)
5. Explain Interconnect parameters (16)

   (or)

   Explain electrical properties of CMOS circuits (16)
6. Explain in detail about technology scaling on MOS devices (8) [Nov/Dec 2012]
7. Explain in detail about Interconnect scaling (8)[Nov/Dec 2012]
8. Explain DC transfer characteristics of CMOS inverter (8)[May/June 2012; Nov/Dec 2012; May/June 2013; May/June 2015]

   (or)

   Explain in detail about static behavior of static CMOS inverter (8)
9. Derive expression for propagation delay of CMOS inverter (8)
10. Draw the stick diagram and layout of
    (a) 2- input NOR gate (8)
    (b) 2- input NAND gate (8)
    (c) 3- input NOR gate (8)
    (d) 3- input NAND gate (8)
    (e) $Y = \overline{AB + CD}$ (8)

UNIT II – COMBINATIONAL LOGIC CIRCUITS

2- Marks with Answers

1. What are the advantages of Differential Cascode Voltage Switch Logic(DCVSL) ?

- DCVSL circuit style exhibits a rail-to-rail swing. In steady state, none of the stacked pull-down networks and load devices are simultaneously conducting and hence the static power dissipation is eliminated.
- It provides *differential (or complementary) outputs*. Both the output signal (*Vout*1) and its inverted value (*Vout*2) are simultaneously available. This is a distinct advantage, as it eliminates the need for an extra inverter to produce the complementary signal.
- A differential implementation of a complex function reduces the number of gates required by a factor of two. The number of gates in the critical timing path is often reduced as well.
- The approach prevents some of the time-differential problems introduced by additional inverters.

2. State the disadvantages of Differential Cascode Voltage Switch Logic(DCVSL) .

- The circuit is ratioed since the sizing of the PMOS devices relative to the pull-down devices is critical to functionality, not just perfor mance. During the transition, there is a period of time when PMOS and PDN are turned on simultaneously, producing a short circuit path.
- In addition to the problem of increase complexity in design, this circuit style still has a power-dissipation problem that is due to cross-over currents.
- The differential nature virtually doubles the number of wires that has to be routed, leading very often to unwieldy designs .
- The dynamic power dissipation is high.

3. What is pass transistor logic style ? List its advantages.[May/June 2012; Nov/Dec 2013]

- Pass-transistor logic, reduces the number of transistors required to implement logic by allowing the primary inputs to drive gate terminals as well as source/drain terminals.
- Fewer transistors are required to implement a given function.
- The reduced number of devices has the additional advantage of lower capacitance.

4. What are the disadvantages of pass transistor style?

- Pass transistor has reduced voltage swing.
- While the circuit exhibits lower switching power, it may consumes static power when the output is high
- The reduced voltage level may be insufficient to turn off the PMOS transistor of the subsequent CMOS inverter.

5. What are the solutions to voltage drop problem in pass transistor style ?

- Level Restoration : Use of a *level restorer*, which is a single PMOS configured in a feedback path. All voltage levels are either at *GND* or *VDD*, and no static power is consumed.
- Multiple threshold transistors: technology solution to the voltage-drop problem associated with pass-transistor logic is the use of multiple-threshold devices.Using *zero threshold* devices for the NMOS pass-transistors eliminates most of the threshold drop, and passes a signal close to *VDD*.

- Transmission gate logic.

6. What are the advantages of Dynamic gate logic style ?

- The *number of transistors* (for complex gates) is substantially lower than in the static case: $N + 2$ versus $2N$.
- It is *non-ratioed.*
- It only consumes *dynamic power.*
- The logic gates have *faster switching speeds*.

7. What are the factors that offset the advantage of lower dissipation in dynamic gate ?

Power dissipation in dynamic gate is offset by following considerations: (i)The clock power of dynamic logic can be significant, particularly since the clock node has a guaranteed transition on every single clock cycle; (ii) the number of transistors is higher than the minimal set required for implementing the logic; (iii) short-circuit power may exist when leakage-combatting devices are added (as will be discussed further); (iv) and, most importantly, dynamic logic generally displays a higher switching activity due to the periodic *precharge* and *discharge* operations.

8. What are the issues in dynamic design?

- Charge leakage
- Charge sharing
- Backgate/capacitive coupling
- Clock feedthrough

9. Illustrate charge leakage in dynamic gate.

The operation of a dynamic gate relies on the dynamic storage of the output value on a capacitor. If the pull-down network is *off*, the output should ideally remain at the precharged state of *VDD* during the evaluation phase. However, this charge gradually leaks away due to leakage currents, eventually resulting in a malfunctioning of the gate.

10. What is bleeder transistor ?

Leakage is caused by the high impedance state of the output node during the evaluate mode, when the pull down path is turned off. The leakage problem van be counteracted by reducing the output impedance on the output node during evaluation. This is often done by adding a *bleeder transistor*. The only function of the bleeder—a pseudo-NMOS-like pull-up device—is to compensate for the charge lost due to the pull-down leakage paths.

11. What is clock feedthrough in dynamic gate ?

A special case of capacitive coupling is clock-feedthrough, an effect caused by the capacitive coupling between the clock input of the precharge device and the dynamic output node. The coupling capacitance consists of the gate-to-drain capacitance of the precharge device, and includes both the overlap and the channel capacitances. This capacitive coupling causes the output of the dynamic node to rise above *VDD* on the low-to-high transition of the clock, assuming that the pull-down network is turned off. Subsequently, the fast rising and falling edges of the clock couple onto the signal node.

12. What are the effects of clock feedthrough ?

The danger of clock feedthrough is that it may cause the (normally reverse-biased) junction diodes of the precharge transistor to become forward-biased. This causes electron injection into the substrate, which can be collected by a nearby high impedance node in the **1** state, eventually resulting in faulty operation. CMOS latchup might be

another result of this injection. For all purposes, high-speed dynamic circuits should be carefully simulated to ensure that clock-feedthrough effects stay within bounds.

13. What is domino logic ?

A Domino logic module consists of an n-type dynamic logic block followed by a static inverter . During precharge, the output of the *n*type dynamic gate is charged up to *VDD*, and the output of the inverter is set to 0. During evaluation, the dynamic gate conditionally discharges, and the output of the inverter makes a conditional transition from 0 →1.

14. What are the major components of power dissipation in CMOS ?[May/June 2011; Nov/Dec 2013]

- Static power dissipation
- Dynamic power dissipation

15. What are the sources of static power dissipation ?

Static dissipation due to

- subthreshold leakage through OFF transistors
- gate leakage through gate dielectric
- junction leakage from source/drain diffusions
- contention current in ratioed circuits

16. What are the sources of dynamic power dissipation ?

Dynamic dissipation due to

- charging and discharging load capacitances as gates switch
- "short-circuit" current while both pMOS and nMOS stacks are partially ON.

16 Marks

1. Explain in detail about Complementary CMOS design or Ratioless logic design (16)
2. Derive expressions for minimal path delay of a combinational network ?(8)
3. Write short notes on Logical effort of complex CMOS gates. (8)[Nov/Dec 2012; May/June 2013]
4. Write short notes on Elmore delay model (8)
5. Write short notes on propagation delay of complementary CMOS gates.(8)
6. Implement the combinational function $F = \overline{D + A.(B + C)}$ using complementary CMOS logic (8) [May/June 2012]
7. Explain in detail about Ratioed Logic (16)
8. What are the sources of power consumption in CMOS logic gates.(8)
9. Explain in detail the factors which are a strong function of the power consumption in CMOS logic gates.(8)
10. Brief about pass transistor logic (8)
11. Write short notes on transmission gates (8)
12. Explain in detail about static CMOS design (16)
    Hint : Consolidate important from Q: 1 to 11
13. Explain in detail about basic principles of dynamic logic (8)

14. Explain signal integrity issues in dynamic design (8)
15. Illustrate Domino logic (or) explain cascading of dynamic gates (8).
16. Illustrate np-CMOS logic style (8)
17. Explain in detail about Dynamic CMOS design (16) [Nov/Dec 2012; May/June 2013; Nov/Dec 2014]
    Hint : Consolidate important from Q : 13 to 16
18. Write short notes on low power design principles.(8)[May/June 2012; Nov/Dec 2014]

UNIT III – SEQUENTIAL LOGIC CIRCUITS

2- Marks with Answers

1. **What are the timing metrics of a register in sequential circuits ?**

There are three important timing parameters associated with a register.

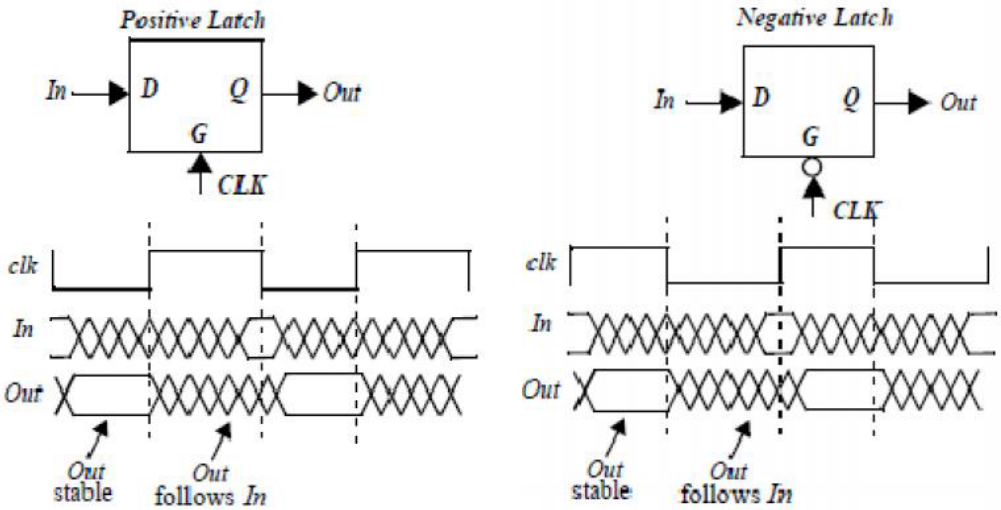
- Set-up time(t_{su}) : It is the time that the data inputs (D input) must be valid before the clock transition (this is, the 0 to 1 transition for a positive edge-triggered register).
- Hold time (t_{hold}): is the time the data input must remain valid after the clock edge.
- Contamination/Minimum propagation delay : The data at the D input is copied to the Q output after a worst-case propagation delay (with reference to the clock edge) denoted by $t_{c\text{-}q}$.

2. **What is a latch ?[May/June 2012; Nov/Dec 2014]**

A latch is an essential component in the construction of an edge-triggered register. It is level-sensitive circuit that passes the D input to the Q output when the clock signal is high. This latch is said to be in transparent mode. When the clock is low, the input data sampled on the falling edge of the clock is held stable at the output for the entire phase, and the latch is in hold mode. The inputs must be stable for a short period around the falling edge of the clock to meet set-up and hold requirements

3. **Illustrate positive and negative latch.**

A positive latch passes the D input to the Q output when the clock signal is high. A negative latch passes the D input to the Q output when the clock signal is low as shown in the figure.



4. **What is a register ?**

Contrary to level-sensitive latches, edge-triggered registers only sample the input on a clock transition — 0-to-1 for a positive edge-triggered register, and 1-to-0 for a negative edge-triggered register. They are typically built using the latch primitives. A most-often recurring configuration is the master-slave structure that cascades a positive and negative

latch. Registers can also be constructed using one-shot generators of the clock signal ("glitch" registers), or using other specialized structures.

5. **Define bistable circuit/ flip flop. [May/June 2013; Nov/Dec 2011]**
   The cross-coupling of two inverters results in a bistable circuit. A bistable circuit has two stable states. In absence of any triggering, the circuit remains in a single state (assuming that the power supply remains applied to the circuit), and hence remembers a value. A trigger pulse must be applied to change the state of the circuit. Another common name for a bistable circuit is flip-flop.
6. **What is a static register ? What is its disadvantage ?**
   Storage in a static sequential circuit relies on the concept that a cross-coupled inverter pair produces a bistable element and can thus be used to memorize binary values. This approach has the useful property that a stored value remains valid as long as the supply voltage is applied to the circuit, hence the name static. The major disadvantage of the static gate, however, is its complexity.
7. **What is a dynamic transmission-Gate edge triggered registers?**
   A fully dynamic positive edge-triggered register based on the master-slave concept is shown in Figure. When CLK = 0, the input data is sampled on storage node 1, which has an equivalent capacitance of C1 consisting of the gate capacitance of I1 , the junction capacitance of T1 , and the overlap gate capacitance of T1 . During this period, the slave stage is in a hold mode, with node 2 in a high-impedance (floating) state. On the rising edge of clock, the transmission gate T2 turns on, and the value sampled on node 1 right before the rising edge propagates to the output Q (note that node 1 is stable during the high phase of the clock since the first transmission gate is turned off). Node 2 now stores the inverted version of node 1. This implementation of an edge-triggered register is very efficient as it requires only 8 transistors.

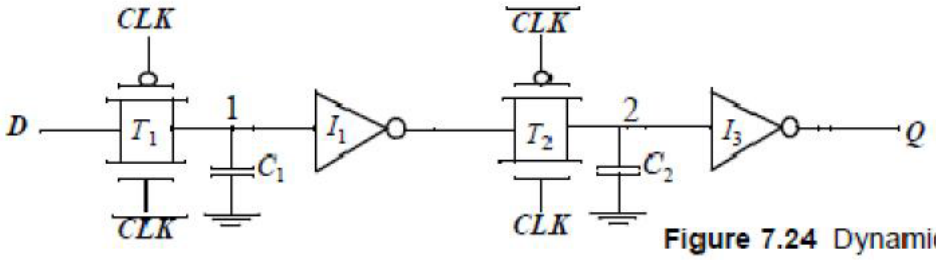


Figure 7.24 Dynamic *edge-triggered* register.

8. **Define clock skew.**
   The spatial variation in arrival time of a clock transition on an integrated circuit is commonly referred to as clock skew. The clock skew between two points i and j on a IC is given by δ (i,j) = ti - tj , where t i and t j are the position of the rising edge of the clock with respect to a reference. The clock skew can be positive or negative depending upon the routing direction and position of the clock source.
   - $\delta > 0$—This corresponds to a clock routed in the same direction as the flow of the data through the pipeline
   - $\delta < 0$—When the clock is routed in the opposite direction of the data, the skew is negative.
9. **Define Clock jitter.**
   Clock jitter refers to the temporal variation of the clock period at a given point — that is, the clock period can reduce or expand on a cycle-by-cycle basis. Cycle-to-cycle jitter

refers to time varying deviation of a single clock period and for a given spatial location i is given as Tjitter,i(n) = Ti , n+1 - Ti,n - TCLK, where Ti,n is the clock period for period n, Ti , n+1 is clock period for period n+1, and TCLK is the nominal clock period.

10. What are the sources of clock skew and jitter ?

The sources of skew and jitter are

- Clock signal generation
- Manufacturing device variation(oxide, dopant and lateral variations)
- Interconnect variations
- Environmental variations(temperature and power supply)

11. What are the timing parameters of memory ?

- Read-access time
- Write-access time
- Cycle time

12. What is read access time ?

The time it takes to retrieve(read) from the memory is called read-access time, which is equal to the delay between the read request and the moment the data is available at the output.

13. What is write-access time ?

It is the time elapsed between the read request and the moment the data is available at the output.

14. What is cycle-time ?

The cycle time is the minimum time required between the successive reads or writes.

15. How are semiconductor memories classified ?

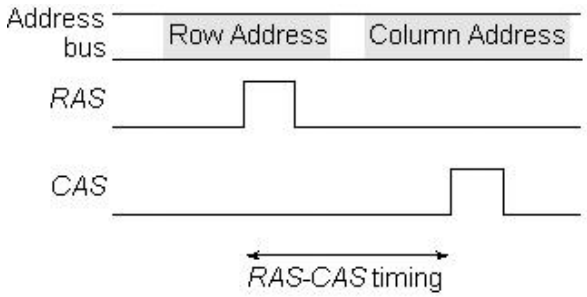
Read-Write Memory		Non-Volatile Read-Write Memory	Read-Only Memory
Random Access	**Non-Random Access**	EPROM E^2PROM FLASH	Mask-Programmed Programmable (PROM)
SRAM DRAM	FIFO LIFO Shift Register CAM		

16. What are the advantages of hierarchial memory architecture ?

- Shorter wires within blocks
- Block address activates only one block which contributes to power savings.

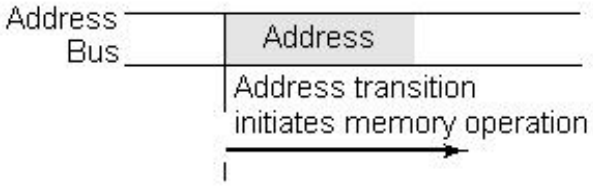
17. What is multiplexed addressing ?

Multiplexed addressing is used by DRAM designers. Smaller number of pins needed since row and column addresses are sent sequentially. Strobe signals RAS and CAS are used to read them.



18. What is self timed approach or complete addressing?

Self timed approach is used by SRAM. Complete address is presented at once with sensing circuits to detect transitions on the address bus. No external timing signals are needed. All the internal timing signals such as the enabling of the decoders and sense amplifiers are derived from the internally generated transition signal.



19. What is floating gate transistor (FAMOS) ?

FAMOS is a non-volatile Read-Write memory which is similar to traditional MOS device, except that an extra polysilicon strip is inserted between gate and channel. This strip is not connected to anything and is called as floating gate. The extra gate doubles the gate oxide thickness tox , which results in reduced device transconductanace as well as increased threshold voltage. The threshold voltage is programmable.

20. What is EPROM?

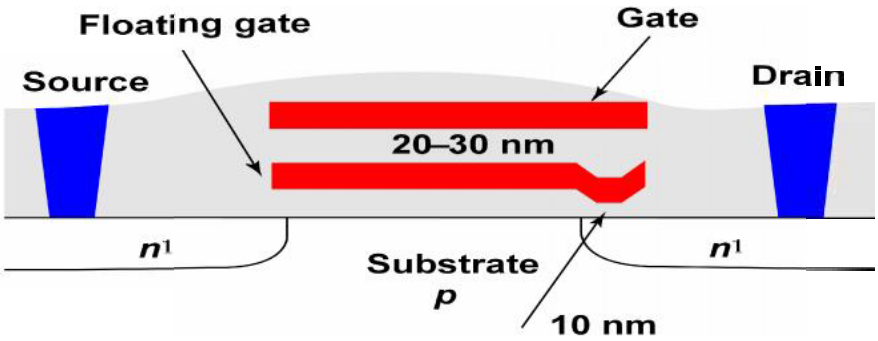
EPROM(Erasable Programmable Read-Only Memory) is erased by shining ultraviolet light through a transparent package window UV makes the oxide slightly conductive by generation of electron-hole pairs. The erasure process is slow (seconds to minutes). Programming takes 5-10 msec . Erasing can be repeated up to a thousand times. Threshold is difficult to control after many erasures so special on-chip circuitry is required to control it. High current required during programming.

21. What is FLOTOX transistor EEPROM or FLOTOX E2PROM ?

The EEPROM approach uses tunneling mechanism to inject or remove charges from a floating gate. A modified floating gate device called FLOTOX (floating-gate tunneling oxide) transistor is used as a programmable device that supports an electrical-erasure procedure.

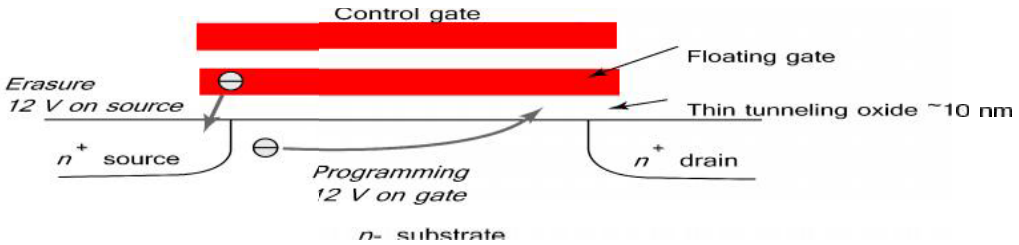
22. What is Fowler-Nordheim tunneling ?

The FLOTOX structure is similar to FAMOS device, except that a portion of the dielectric separating the floating gate from the channel and drain is reduced in thickness to about 10nm or less as shown in figure. When a voltage of approximately 10V(equivalent to an electrical field of around 10^9 V/m) is applied over the thin insulator, electrons travel to and from the floating gate through the mechanism called Fowler-Nordheim tunneling.



23. What is flash EEPROM ?

Flash EPROM combines density of EPROM with versatility of EEPROM. Programming is performed by avalanche hot-electron injection (fast 1-10msec).Erasure of the complete chip is done using **tunneling** (careful control >100ms) as shown in Figure.



24. What is CAM or Contents-Addressable or Associative Memory (CAM) ?

A CAM is a special type of memory that stores data, but also has the ability to compare all the stored data, but also has the ability to compare all the stored data in parallel with incoming data in an efficient manner.

25. What are the functions of sense amplifiers ?

Sense amplifiers play a major role in the functionality, performance and reliability of memory circuits such as :

- Amplification
- Delay reduction
- Power reduction
- Signal restoration

26. What are the techniques for active power reduction in DRAM?

- Half VDD precharge
- Boosted word line
- Increased capacitor area or value
- Increasing the cell size.

16 Marks

1. Explain static latches and registers (16) [May/June 2011; Nov/Dec 2012]
2. Explain dynamic latches and registers (16)
3. Explain in detail about pipelining in sequential circuits (16)[Nov/Dec 2014; May/June 2012]
4. Explain in detail about synchronous timing basics (16)

   (or)

   Explain in detail about Clock skew and Clock jitter (16)
5. Explain in detail about clock distribution strategies (8)
6. Explain in detail about Memory architecture and building clocks (16)
7. Write short notes on Read only memories.(8)
8. Write short notes on non-volatile Read-Write memories (8)
9. Explain in detail about SRAM (8)
10. Explain in detail about DRAM (8)
11. Briefly explain about memory control circuits (16)
12. Write short notes on Address decoders (8)
13. Write short notes on Sense amplifiers (8)
14. Write short notes on voltage references (8)
15. Compare synchronous and asynchronous design (8)

UNIT IV- DESIGNING ARITHMETIC BUILDING BLOCKS

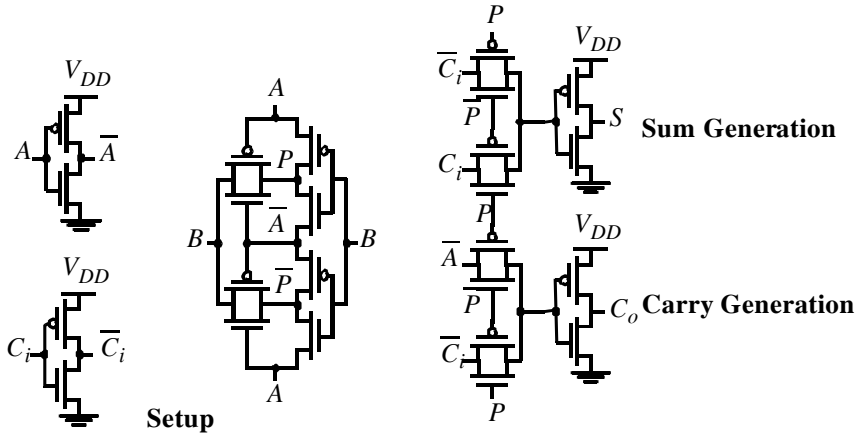
2- Marks with Answers

1. **Define datapath.**
   Datapath is the core of a processor where all computations are performed. It consists of interconnection of basic combinational functions, such as arithmetic and logical operators.
2. **What is the propagation delay of N-bit ripple carry adder.**
   The delay in a N- bit ripple carry adder is linearly proportional to the number of bits N.

$$t_d = O\ N$$

$$t_{adder} = N - 1\ t_{carry} + t_{sum}$$

   The delay is found to increase for adders with wide data paths.
3. **What are the disadvantages of static adder circuit ?**
   - Increased area
   - Decrease in speed
4. **What are the factors that contribute to decrease in speed in static CMOS circuits?**
   - Tall PMOS transistor stacks are present in both carry and sum generation circuits.
   - Intrinsic load capacitance is large
   - The signal propagates through two inverting stages in carry-generation circuit.
5. **What is a transmission gate based adder cell?**
   It is based on propagate-generate model and utilizes multiplexers and XOR's as shown in figure below



6. **What is carry-lookahead principle ?**
   The rippling effect present in the previous forms of adder such as ripple carry adder is eliminated in carry look ahead adder. The addition time is independent of the number of bits.
7. **What is an array multiplier and estimate the delay of NxM array multiplier ?**
   Array multiplier performs the following functions : Partial product generation; partial-product accumulation and final addition. The delay is given by :

$$t_{mult} = M - 1 + N - 2\ t_{carry} + N - 1\ t_{sum} + t_{and}$$

8. **What is carry save multiplier ?**
   In carry save multiplier, the carry bits are not immediately added. Instead, they are saved for the next adder stage. In the final stage, carries and sums are merged in a fast carry propagate adder stage.
   Advantage : Worst case critical path is shorter and is uniquely defined by,

$$t_{mult} = t_{merge} + N - 1\ t_{carry} + t_{and}$$

9. **What are the advantages and disadvantages of Wallace tree multiplier ?**
   Advantages:
   - Realizes substantial hardware savings for large multipliers.
   - The propagation delay is reduced, equal to $O(log_{\frac{3}{2}}(N)$

   Disadvantages:
   - Irregular structure

10. **What is a barrel shifter ?**
    It consists of array of pass transistors, where the number of rows equals the word length of data and the number of columns equals the maximum shift width. The propogation delay is theortically constant and independent of the shift value.

16 Marks

1. Explain the architecture and working principle of ripple carry adder.
2. Discuss in detail about the various carry look ahead adder structures.
3. Compare and describe the various high speed adder architectures.
4. Describe the array multiplier architecture.
5. Describe the carry save multiplier architecture.
6. Describe the Wallace tree multiplier architecture.
7. Describe Barrel shifter and its operation in detail.
8. Analyse the speed and area tradeoff perspectives in adder and multiplier structures.

UNIT V- IMPLEMENTATION STRATEGIES

2- Marks with Answers

1. Give the different types of ASIC.

- Full custom ASICs
- Semi-custom ASICs
  * standard cell based ASICs
  * gate-array based ASICs
- Programmable ASICs
  * Programmable Logic Device (PLD)
  * Field Programmable Gate Array (FPGA)

2. What is the full custom ASIC design?

A full custom IC includes some logic cells that are customized and all mask layers that are customized.

Eg) microprocessor

3. What is the standard cell-based ASIC design?

A cell-based ASIC (CBIC) USES PREDESIGNED LOGIC CELLS KNOWN AS STANDARD CELLS. The standard cell areas also called flexible blocks in a CBIC are built of rows of standard cells. The ASIC designer defines only the placement of standard cells and the interconnect in a CBIC. All the mask layers of a CBIC are customized and are unique to a particular customer.

4. What are the features of standard cell based design ASIC?

- All mask layers are customized transistors and interconnect.
- Custom blocks can be embedded.
- Manufacturing lead time is about eight weeks.

5. What is the difference between cell based and gate array based ASIC.

Both cell-based and gate-array ASICs use predefined cells, but there is a difference we can change the transistor sizes in a standard cell to optimize speed and performance, but the device sizes in a gate array are fixed. This results in a trade-off in performance and area in a gate array at the silicon level. The trade-off between area and performance is made at the library level for a standard-cell ASIC.

6. What are the different types of gate array based ASIC?

- Channeled gate array
- Channel less gate array
- Structured gate array

7. Differentiate between channeled & channel less gate array.

Channeled Gate Array	Channel less Gate Array
1. Only the interconnect is customized	Only the top few mask layers are customized.
2. The interconnect uses predefined spaces between rows of base cells.	No predefined areas are set aside for routing between cells.
3. Routing is done using the spaces.	Routing is done using the area of transistors unused.
4. Logic density is less.	Logic density is higher.

8. What are the important features of structured gate array?

- Only the interconnect is customized.
- Custom blocks can be embedded.
- Manufacturing lead time is between two days and two weeks.

9. What is a FPGA?

A field programmable gate array (FPGA) is a programmable logic device that supports implementation of relatively large logic circuits. FPGAs can be used to implement a logic circuit with more than 20,000 gates whereas a CPLD can implement circuits of upto about 20,000 equivalent gates.

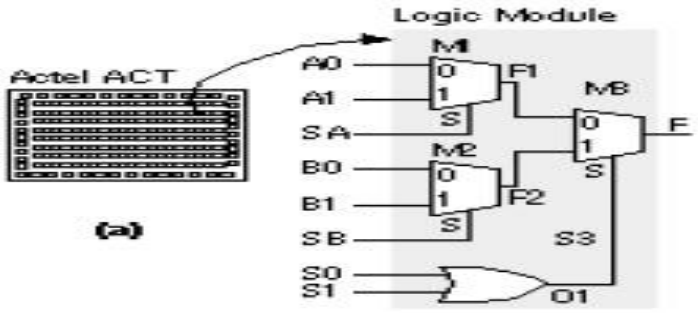
10. What are the essential characteristics of FPGA.

- None of the mask layers are customized.
- A method for programming the basic logic cells and the interconnect.
- The core is a regular array of programmable basic logic cells that can implement combinational as well as sequential logic (flip-flops).
- A matrix of programmable interconnect surrounds the basic logic cells.
- Programmable I/O cells surround the core.
- Design turnaround is a few hours.

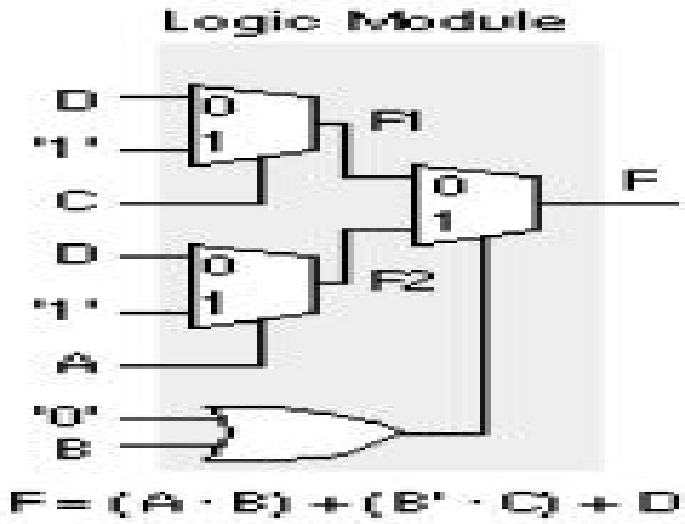
11.What is an antifuse?

An antifuse is normally high resistance (>100MΩ). On application of appropriate programming voltages, the antifuse is changed permanently to a low-resistance structure (200-500Ω).

12. Give the ACT1 logic module.



13. Draw the ACT1 logic module for the expression F=A.B +B'.C +D



14.What are macros?

The logic cells in a gate-array library are often called macros.

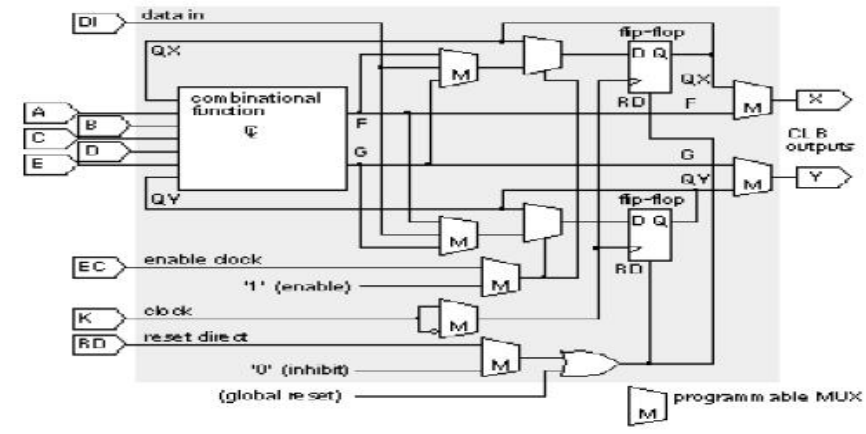
15.What are Programmable Interconnects ?

In a PAL, the device is programmed by changing the characteristics if the switching element. An alternative would be to program the routing.

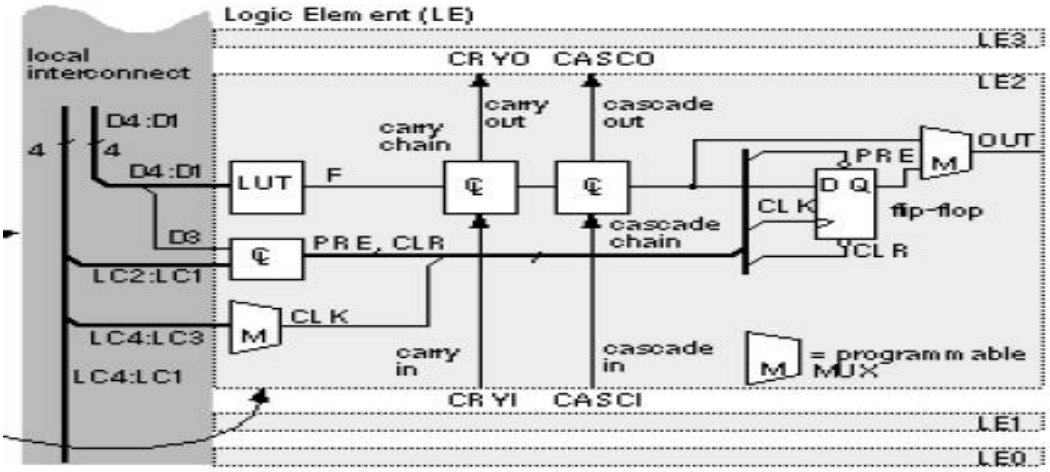
16. Give the steps in ASIC design flow.

a. Design entry b. Logic synthesisSystem partitioning c. Prelayout simulation. d. Floorplanning e. Placement f. Routing g. Extraction 1. Postlayout simulation

17. Give the XILINX Configurable Logic Block .



18. Give the ALTERA FLEX architecture.



16 Marks

1. Briefly explain about Full custom design (8)
2. Write in detail about Semi-custom design (8)
3. Explain in detail about standard cells and libraries (16)
4. Explain ACTEL ACT FPGA architecture (8)
5. Explain Xilinx LCA FPGA architecture (8)
6. Explain Altera FLEX and Altera MAX FPGA architecture (8)
7. Brief about ACTEL ACT interconnect (8)
8. Brief about Xilinx LCA interconnect (8)
9. Explain Altera FLEX and Altera MAX interconnect (8)

Aalim Muhammed Salegh
College of Engineering

ELECTRONICS & COMMUNICATION ENGINEERING

EC6602
ANTENNA AND WAVE PROPAGATION

SEMESTER - VI

EC6602 ANTENNA AND WAVE PROPAGATION L T P C
3 0 0 3

OBJECTIVES:

- To give insight of the radiation phenomena.
- To give a thorough understanding of the radiation characteristics of different types of antennas
- To create awareness about the different types of propagation of radio waves at different frequencies

UNIT I FUNDAMENTALS OF RADIATION **9**

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

UNIT IIAPERTURE AND SLOT ANTENNAS **9**

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas ,Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis

UNIT IIIANTENNA ARRAYS **9**

N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array

UNIT IV SPECIAL ANTENNAS **9**

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR

UNIT V PROPAGATION OF RADIO WAVES **9**

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation

TOTAL: 45 PERIODS

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

- Explain the various types of antennas and wave propagation.
- Write about the radiation from a current element.
- Analyze the antenna arrays, aperture antennas and special antennas such as frequency independent and broad band

TEXT BOOK:

1. John D Kraus," Antennas for all Applications", 3rd Edition, Mc Graw Hill, 2005.

REFERENCES:

1. Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice
   Hall of India, 2006
2. R.E.Collin,"Antennas and Radiowave Propagation", Mc Graw Hill 1985.
3. Constantine.A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006.
4. Rajeswari Chatterjee, "Antenna Theory and Practice" Revised Second Edition New Age International Publishers, 2006.
5. S. Drabowitch, "Modern Antennas" Second Edition, Springer Publications, 2007.
6. Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.
7. H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint,
   Springer Publications, 2007.

EC6602-ANTENNA AND WAVE PROPAGATION

UNIT I – FUNDAMENTALS OF RADIATION

1. Define an antenna.

Antenna is a transition device or a transducer between a guided wave and a free space wave or vice versa. Antenna is also said to be an impedance transforming device.

2. Define vector potential.

Magnetic vector potential is a quantity whose curl gives the magnetic flux density.

$B = \nabla \times A$

Where A is the magnetic vector potential.

$$A = \mu/4\pi \int J/r \, dv$$

J=current density
r=distance

3. What is meant by radiation pattern?

Radiation pattern is the relative distribution of radiated power as a function of distance in space. It is a graph which shows the variation in actual field strength of the EM wave at all points which are at equal distance from the antenna. The energy radiated in a particular direction by an antenna is measured in terms of FIELD STRENGTH.(E Volts/m)

4. Define gain APRL/MAY2011

The ratio of maximum radiation intensity in given direction to the maximum radiation intensity from a reference antenna produced in the same direction with same input power. i.e

Gain (G) = Maximum radiation intensity from test antenna
Maximum radiation intensity from the reference antenna with same input power.

5.Define Directivity? APRL/MAY 2011

The directivity of an antenna is equal to the ratio of the maximum power density P(q,f)max to its average value over a sphere as observed in the far field of an antenna.

D = P(q,f)max / P(q,f)av. Directivity from Pattern.

D = 4π / WA. . Directivity from beam area(WA).

6.What are the different types of aperture.?

i) Effective aperture.
ii) Scattering aperture.
iii) Loss aperture.
iv) Collecting aperture.
v). Physical aperture.

7.Define different types of aperture.?

Effective aperture(Ae).

It is the area over which the power is extrated from the incident wave and delivered to the load is called effective aperture.

Scattering aperture(As.)
It is the ratio of the reradiated power to the power density of the incident wave.
Loss aperture. (Ae).
It is the area of the antenna which dissipates power as heat.
Collecting aperture. (Ae).
It is the addition of above three apertures.
Physical aperture. (Ap).
This aperture is a measure of the physical size of the antenna.

8. Define Aperture efficiency?
The ratio of the effective aperture to the physical aperture is the aperture efficiency.
i.e Aperture efficiency = hap = Ae / Ap
(dimensionless).

9. What is meant by effective height?
The effective height h of an antenna is the parameter related to the aperture.It may be defined as the ratio of the induced voltage to the incident field. i.e H= V / E.

10. Define Radiation intensity?
The power radiated from an antenna per unit solid angle is called the radiation intensity U (watts per steradian or per square degree). The radiation intensity is independent of distance.

11.What is meant by antenna beam width?
Antenna beamwidth is a measure of directivity of an antenna. Antenna beam width is an angular width in degrees, measured on the radiation pattern (major lobe) between points where the radiated power has fallen to half its maximum value .This is called as "beam width" between half power points or half power beam width.(HPBW).

12. What is radiation resistance ?
The antenna is a radiating device in which power is radiated into space in the form of electromagnetic wave.
$W' = I^2 R$
$Rr = W'/ I^2$ Where Rr is a fictitious resistance called called as radiation resistance.

13. Define self impedance
Self impedance of an antenna is defined as its input impedance with all other antennas are completely removed i.e away from it.

14. Define mutual impedance
The presence of near by antenna no.2 induces a current in the antenna no.1 indicates that presence of antenna no.2 changes the impedance of the antenna no.1.This effect is called mutual coupling and results in mutual impedance.

15. What are the field zone?
The fields around an antenna may be divided into two principal regions.
i. Near field zone (Fresnel zone)

ii. Far field zone (Fraunhofer zone)

16.What is meant by Polarization.?

The polarization of the radio wave can be defined by direction in which the electric vector E is aligned during the passage of atleast one full cycle. Also polarization can also be defined the physical orientation of the radiated electromagnetic waves in space.The polarization are three types. They are Elliptical polarization ,circular polarization and linear polarization.

17. What is meant by front to back ratio.?

It is defined as the ratio of the power radiated in desired direction to the power radiated in the opposite direction.

i.e FBR = Power radiated in desired direction / power radiated in the opposite direction.

18. Define antenna efficiency.?

The efficiency of an antenna is defined as the ratio of power radiated to the total input power supplied to the antenna.

Antenna efficiency = Power radiated / Total input power

19. What is meant by reciprocity Theorem.? MAY/JUNE 2013

If an e.m.f is applied to the terminals of an antenna no.1 and the current measured at the terminals of the another antenna no.2, then an equal current both in amplitude and phase will be obtained at the terminal of the antenna no.1 if the same emf is applied to the terminals of antenna no.2.

20. What is meant by cross field.?

Normally the electric field E is perpendicular to the direction of wave propagation. In some situation the electric field E is parallel to the wave propagation that condition is called Cross field.

21.Define axial ratio

The ratio of the major to the minor axes of the polarization ellipse is called the Axial Ratio(AR).

22. What is meant by Beam Area.?

The beam area or beam solid angle or WA of an antenna is given by the normalized power pattern over a sphere.

$$\Omega_A = \int\int_{4\pi} P_n(\theta,\varphi)\, d\Omega$$

Where $d\Omega = \sin\theta\, d\theta\, .d\varphi$

23. What is duality of antenna?

It is defined as an antenna is a circuit device with a resistance and temperature on the one hand and the space device on the other with radiation patterns, beam angle ,directivity gain and aperture.

24.State Poynting theorem.

It states that the vector product of electric field intensity vector E and the magnetic filed intensity vector H at any point is a measure of the rate of energy flow per unit area at that point.The direction of power flow is perpendicular to both the electric field and magnetic field components.

25.What is point source?

It is the waves originate at a fictitious volumeless emitter source at the center 'O' of the observation circle.

26.What is a Short Dipole?

A short dipole is one in which the field is oscillating because of theoscillating voltage and current.It is called so, because the length of the dipole is short and the current is almost constant throughtout the entire length of the dipole.It is also called as Hertzian Dipole which is a hypothetical antenna and is defined as a short isolated conductor carrying uniform alternating current.

27.How radiations are created from a short Dipole?

The dipole has two equal charges of opposite sign oscillating up and down in a harmonic motion. The charges will move towards each other and electric filed lines were created. When the charges meet at the midpoint, the field lines cut each other and new field are created. This process is spontaneous and so more fields are created around the antenna. This is how radiations are obtained from a short dipole

28.Why a short dipole is also called an elemental dipole? MAY/JUNE 2013

A short dipole that does have a uniform current will be known as the elemental dipole.Such a dipole will generally be considerably shorter than the tenth wave length maximum specified for a short dipole.Elemental dipole is also called as elementary dipole,elementary doublet and hertzian dipole.

29.What is a Infinitesimal Dipole?

When the length of the short dipole is vanishingly small,then such a dipole is called a infinitesimal dipole. If dl be the infinitesimally small length and I be the current, then Idl is called as the current element.

30.Why a short dipole is called a oscillating dipole?

A short dipole is initially in neutral condition and the moment a current starts to flow in one direction,one half of the dipole require an excess of charge and the other a deficit because a current is a flow of electrical charge.Then ,there will be a voltage between the two halves of the dipole.When the current changes its direction this charge unbalance will cause oscillations. Hence an oscillating current will result in an oscillating voltage. Since, in such dipole, electric charge oscillates ,it may be called as Oscilllating electric dipole.

31.What do you understand by retarded current?

Since,the short electric dipole is so short, the current which is flowing through the dipole is assumed to be constant throughtout its length. The effect of this current is not felt instantaneous at a distance point only after an interval equal to the time required for the wave to propagate over the distance r is called the retardation time.

32.Define induction field.

The induction field will predominate at points close to the current element ,where the distance from the centre of the dipole to the particular point is less.This field is more effective in the vicinity of the current element only.It represents the energy stored in the magnetic field surrounding the current element or conductor.This field is also known as near field.

33.Define Radiation field.

The radiation field will be produced at a larger distance from the the current element ,where the distance from the centre of the dipole to the particular point is very large. It is also called as distant field or far field.

34.At what distance from the dipole is the induction field equal to the radiation field?

As the distance from the current element or the short dipole increases,both induction and radiation fields emerge and start decreasing. However,a distance reaches from the conductor at which both the induction and radiation field becomes equal and the particular distance depends upon the wavelength.The two fields will thus have equal amplitude at that particular distance.

35.Define Radiation Resistance

It is defined as the fictitious resistance which when inserted in series with the antenna will consume the same amount of power as it is actually radiated.The antenna appears to the transmission line as a resistive component and this is known as the radiation resistance.

36.What is a dipole antenna?

A dipole antenna may be defined as a symmetrical antenna in which the two ends are at equal potential relative to the midpoint.

37.What is a half wave dipole?

A half wave antenna is the fundamental radio antenna of metal rod or tubing or thin wire which has a physical length of half wavelength in free space at the frequency of operation.

38.What is the radiation resistance of a half wave dipole.

The radiation resistance of a half wave dipole is given by Rr=73 ohm.

39. Give the expression for the effective aperture of the half wave dipole.

The effective aperture of the half wave dipole is 0.131^2.

40. Give the expression for the effective aperture of the short dipole.

The effective aperture of the short dipole is 0.1191^2.

41. What is meant by isotropic radiator?
Isotropic radiator is a radiator which radiates fields uniformly in all the directions. It is also called as omni-directional radiator or unipole.

42. What is Yagi uda antenna?
It is an array of driven element, reflector and one or more directors.

43. What do you meant by parasitic element?
The passive elements which are not directly connected to the transmission line but are electrically coupled are called as parasitic element.

44.What do you meant by driven element?
Driven elements are active elements where the power from the transmitter is fed or which feeds the received power to the receiver.

45. What is the purpose of using more directors in yagi uda antenna?
To increase the gain more directors are used.

46. Why folded dipole antenna is used in Yagi uda antenna?
Folded dipole antenna has high input impedance. If the distance between driven and parasitic element is decreased, it will load the driven element. So, input impedance of driven element reduces. But this will be compensated.

47. What is beam antenna?
If three element array are used, hen such type of yagi uda is referred to as beam antenna.

48. Which antenna is referred to as super gain or super directive antenna?
Yagi uda antenna.

16 MARK QUESTIONS

1. Derive the field quantities and draw the radiation pattern for hertzian dipole . **NOV/DEC 2012**
2. Derive the field quantities and draw the radiation pattern for half wave dipole.
3. Explain the following terms with respect to antenna: **APRL/MAY2011**
   Gain
   Directivity
   Effective aperture
   Radiation resistance
   Bandwidth
   Beam width
   Input impedance
   Polarization
   Half power beam width

4. State and prove reciprocity theorem. Explain any two applications of reciprocity theorem.**MAY/JUNE 2013**
5. Explain the construction &Working principle of Yagi-uda antenna **MAY/JUNE 2014**
6. Write short notes on antenna temperature.

UNIT II-APERTURE AND SLOT ANTENNA

1. **What is meant by slot antenna?**
   - **Slot antennas** are used typically at frequencies between 300 MHz and 24 GHz.
   - Slot antenna is an opening cut in a sheet of conductor, which is energized through a coaxial cable or wave guide.
   - Radiation patterns are roughly omni directional.
   - The polarization of the slot antenna is linear.
2. **Which antenna is complementary to the slot antenna?**
   Dipole antenna is complementary to the slot antenna. Metal and air regions of the slot are interchanged for the dipole.
3. **What are differences between slot antenna and complementary dipole antenna?**
   - Polarizations are different. Electric field vertically polarized for the slot, horizontally polarized for its complementary dipole.
   - Radiation from the backside of the conducting plane of the slot antenna has opposite polarity from that of dipole antenna.
4. **Define Babinet's principle. NOV/DEC 2011**
   The field at any point behind a plane having a screen, if added to the field at the same point when the complementary screen is substituted, is equal to the field at the point when no screen is present.
5. **Give some applications of slot antenna.**
   They have found many applications on aircraft and missiles.
6. **What is meant by boxed in slot antenna?**
   If slot antenna kept in box at a depth '**d' (d~λ/4)-** will radiates in one direction. This is called as boxed in slot antenna. Box- in Slot Antenna is used in airport.
7. **What are the types of horn antenna?**
   - E-plane horn
   - H-plane horn
   - Pyramidal horn
   - Sectoral horn
   - Conical horn
   - Exponential horn
8. **What is meant by E plane horn?**
   A sectoral horn flared in the direction of the electric or E-field in the waveguide.

9. What is meant by H plane horn?

A sectoral horn flared in the direction of the magnetic or H-field in the waveguide.

10. What is meant by Pyramidal horn?

A horn antenna with the horn in the shape of a four-sided pyramid, with a rectangular cross section. They are a common type, used with rectangular waveguides, and radiate linearly polarized radio waves.

11. What is meant by Sectoral horn?

A pyramidal horn with only one pair of sides flared and the other pair parallel. It produces a fan-shaped beam, which is narrow in the plane of the flared sides, but wide in the plane of the narrow sides. These types are often used as feed horns for wide search radar antennas.

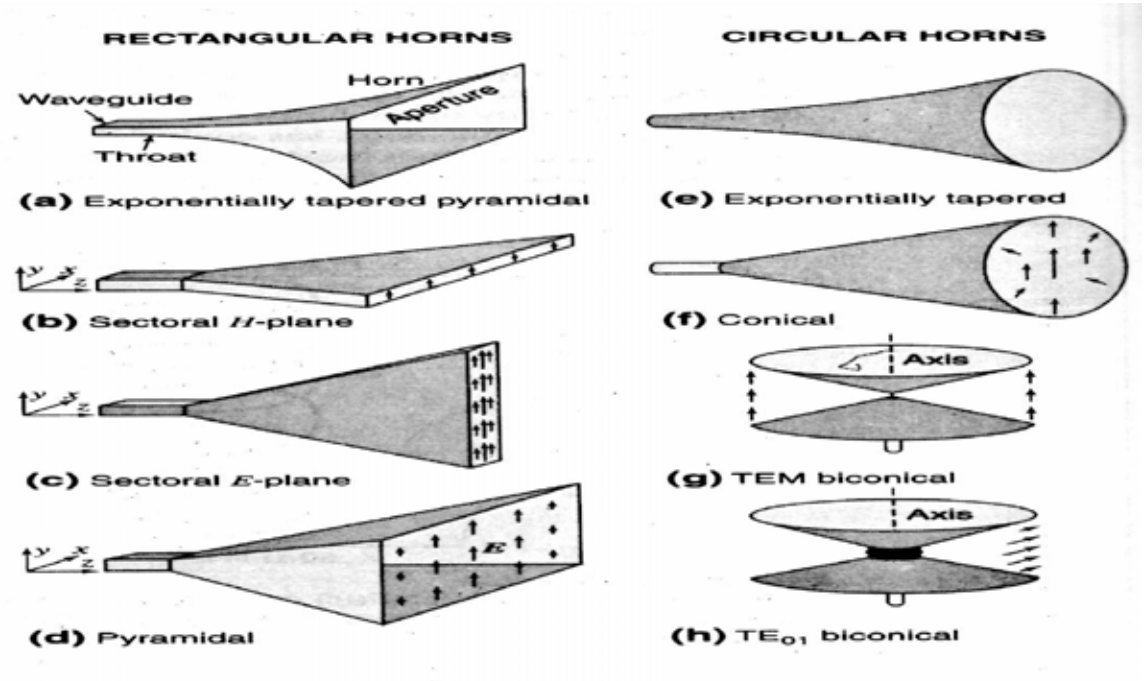
12. What is meant by Conical horn?

A horn in the shape of a cone, with a circular cross section. They are used with cylindrical waveguides.

13. What is meant by Exponential horn?

A horn with curved sides, in which the separation of the sides increases as an exponential function of length. Also called a *scalar horn*, they can have pyramidal or conical cross sections. Exponential horns have minimum internal reflections, and almost constant impedance and other characteristics over a wide frequency range. They are used in applications requiring high performance, such as feed horns for communication satellite antennas and radio telescopes.

14. Give the structures of different types of horn antenna.



15. What are the design parameters of horn antenna?

L- length of the horn
δ- Path length
θ- Flare angle
a -Aperture of the horn

16. What are the advantages of using reflectors?

- Used to modify the radiation pattern
- Reduces or eliminates the backward radiation

17. What are the types of reflectors?

- Large Flat Sheet
- Small Flat Sheet
- Thin Linear Reflector
- Active Corner Reflector
- Passive Corner Reflector
- Parabolic Reflector
- Hyperbolic Reflector
- Circular Reflector

18. What are the characteristics of reflector antenna?

- Effective area of reflector antenna:

$$Ae = \eta_I A_p$$

- Projected physical aperture:

$$Ap = \frac{\pi D2}{4}$$

- Gain:

$$Gain = \eta I(\pi D / \lambda)2$$

- Loss in efficiency due to due to radiation in undesired direction
- Spillover loss
- Focal point errors
- Feed horn side lobes
- Imperfections in parabolic surface
- Feed line
- Larger dish has more gain than smaller
- Clear line of sight is important

19. What is back lobe radiation?

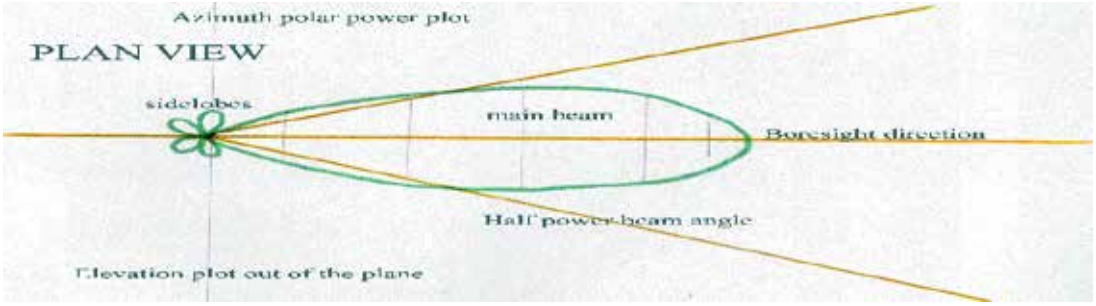
Some radiations from the primary radiator occurs in the forward direction in addition to the desired parallel beam. This is known as back lobe radiation.

20. What are the various feeds used in reflectors?

- Dipole antenna
- Horn feed

- End fire feed
- Cassegrain feed

21. Draw the radiation pattern for parabolic antenna.



22. What are secondary antenna?

Antennas that are not radiators by themselves are called secondary antenna. Eg. Cassegrain, hyperbolic antenna.

23. Define uniqueness theorem. NOV/DEC 2014

A field in a lossy region is uniquely specified by the sources within the region plus the tangential components of the electric field over the boundary, or the tangential components of the magnetic field over the boundary, or the former over part of the boundary and the latter over rest of the boundary.

24. Define field equivalence principle or Huygens principle.

Each point on a primary wavefront can be considered to be a new source of a secondary spherical wave and that a secondary wavefront can be constructed as the envelope of these secondary spherical waves.

25. What are the advantages of microstrip patch antenna?

- Light weight and low volume.
- Low profile planar configuration which can be easily made conformal to host surface.
- Low fabrication cost, hence can be manufactured in large quantities.
- Supports both, linear as well as circular polarization.
- Can be easily integrated with microwave integrated circuits (MICs).
- Capable of dual and triple frequency operations.
- Mechanically robust when mounted on rigid surfaces.

26. What are the disadvantages of microstrip patch antenna?

- Narrow bandwidth
- Low efficiency
- Low Gain
- Extraneous radiation from feeds and junctions
- Poor end fire radiator except tapered slot antennas
- Low power handling capacity.
- Surface wave excitation.

27. What are the feed techniques of micro strip antenna?

- Micro-strip line.
- Co-axial probe
- Aperture coupling
- Proximity coupling

28. What are the advantages and disadvantages of micro strip line feed?

Advantages:

- Easy to fabricate
- Easy to match by controlling inset position
- Easy to model

Disadvantages:

- Spurious feed line radiation and surface wave excitation

29. What are the advantages and disadvantages of probe line feed?

Advantages:

- Easy to fabricate
- Easy to match by controlling position

Disadvantages:

- Requires via hole
- Adds probe inductance(matching is difficult with thicker substrates)

30. What are the advantages and disadvantages of aperture coupled feed?

Advantages:

- Can give broader bandwidth
- Allows independent optimization of feed substrate

Disadvantages:

- More difficult to fabricate
- Some spurious radiation due to slot

31. What are the advantages and disadvantages of proximity coupled feed?

Advantages:

- Can give broader bandwidth
- Low spurious radiation

Disadvantages:

- More difficult to fabricate

16 MARK QUESTIONS

1. Explain the construction and working principle of slot antenna and derive the impedance.
2. With neat diagram explain the principle of parabolic reflector antenna and various types of feed used. **NOV/DEC 2013/NOV/DEC 2012**
3. Explain the working principle of microstrip antenna.
4. Explain the working principle of horn antenna and draw the various types of horn used**. MAY/JUNE 2014**

UNIT III-ANTENNA ARRAYS

1. **Why Arrays are required?**
   - When desirable characteristics cannot be done by single antenna.
   - To modify radiation pattern without changing mechanical structure
   - Overall radiation pattern is vector sum of radiation pattern of individual elements.
2. **What are the types of antenna array?**
   - Linear Arrays
   - Non-Linear Arrays
   - Uniform Arrays
   - Non-Uniform Arrays
3. **What are the types of linear array?**
   - Broadside Arrays
   - End-fire arrays
4. **What is meant by pattern multiplication?**
   Normalized field pattern of an array is given as a product of normalized field pattern of single element and array factor.
   $$f_n(\theta,\phi) = E_n(\theta,\phi) \times AF_n(\theta,\phi)$$
5. **What is the advantage of pattern multiplication? NOV/DEC 2011**
   Useful tool in designing antenna ._It approximates the pattern of a complicated array without making lengthy computations.
6. **By what parameters array factor depends on?**
   - Number of Elements in the array
   - Geometrical Arrangement

- Relative excitation magnitude
- Relative excitation phase

7. What is meant by N-element uniform array?

An array of identical elements with identical magnitudes is known as uniform array.

The AF of an N-element linear array of isotropic sources is

$$AF = 1 + e^{j(kd\cos\theta+\beta)} + e^{j2(kd\cos\theta+\beta)} + \ldots + e^{j(N-1)(kd\cos\theta+\beta)}.$$

$$AF = \sum_{n=1}^{N} e^{j(n-1)\psi}$$

where $\psi = kd\cos\theta + \beta$

$$AF_n = \frac{1}{N}\left[\frac{\sin\left(N\frac{\psi}{2}\right)}{N\sin\left(\frac{\psi}{2}\right)}\right]$$

8. What is meant by broad side array?

- All sources are fed in phase
- Radiation pattern is perpendicular to array axis.

it follows that the maximum of the AF occurs when

$$\psi = kd\cos\theta + \beta = 0.$$

$$\boxed{\psi = \beta = 0}.$$

9. What is meant by end fire array?

- Sources are fed in opposite phase
- Radiation Pattern is in the direction of array axis [either θ = 0 degree or 180 degree]

$$\psi = kd\cos\theta + \beta\big|_{\theta=0^\circ} = kd + \beta = 0 \text{ (for max. } AF).$$

$$\boxed{\beta = -kd, \quad \text{for} \quad \theta_{\max} = 0^\circ},$$

$$\psi = kd\cos\theta + \beta\big|_{\theta=180^\circ} = -kd + \beta = 0 \text{ (for max. } AF),$$

$$\boxed{\beta = kd, \quad \text{for} \quad \theta_{\max} = 180^\circ}.$$

10. What is meant by phased or scanning array?

Phased or scanning array is one in which the maxima is controlled by changing the phase shift 'β' among the successive elements.

11. Compare uniform and non uniform array?

the uniform BSA – relatively high directivity, but the side-lobe levels are high;

Dolph–Tschebyscheff (Chebyshev, Чебышев) BSA – for a given number of elements maximum directivity is next after that of the uniform BSA; side-lobe levels are the lowest in comparison with the other two types of arrays for a given directivity;

binomial BSA – does not have good directivity but has very low side-lobe levels (when $d = \lambda/2$, there are no side lobes at all).

12. What is point source?

It is the waves originate at a fictitious volume less emitter source at the center 'O' of the observation circle.

13. What is meant by uniform linear array?

An array is linear when the elements of the array are spaced equally along the straight line. If the elements are fed with currents of equal magnitude and having a uniform progressive phase shift along the line, then it is called uniform linear array .

14. What is collinear array?

In this array the antenna elements are arranged coaxially by mounting the elements end to end in straight line or stacking them one over the other with radiation pattern circular symmetry. Eg. Omnidirectional antenna.

15. What is Parasitic array?

In this array the elements are fed parasitically to reduce the problem of feed line. The power is given to one element from that other elements get by electro magnetic coupling.
Eg. Yagi uda antenna.

16. Define beam width of major lobe?

It is defined the angle between the first nulls (or) it is defined as twice the angle between the first null and the major lobe maximum direction.

17. What is the need for the Binomial array.?

The need for a binomial array is

i)In uniform linear array as the array length is increased to increase the directivity, the secondary lobes also occurs.

ii) For certain applications, it is highly desirable that secondary lobes should be eliminated completely or reduced to minimum desirable level compared to main lobes.

18. Define power pattern.?

Graphical representation of the radial component of the pointing vector Sr at a constant radius as a function of angle is called power density pattern or power pattern.

19. What is meant by similar Point sources.?

Whenever the variation of the amplitude and the phase of the field with respect to the absolute angle for any two sources are same then they are called similar point sources. The maximum amplitudes of the individual sources may be unequal.

20. What is meant by identical Point sources.?

Similar point sources with equal maximum amplitudes are called identical point sources.

21. What is tapering of arrays?

Tapering of array is a technique used for reduction of unwanted side lobes .The amplitude of currents in the linear array source is nonuniform; hence the central source radiates more energy than the ends. Tapering is done from center to end.

22. What is a binomial array?

It is an array in which the amplitudes of the antenna elements in the array are arranged according to the coefficients of the binomial series.

23. What are the advantages of binomial array?

Advantage: No minor lobes

Disadvantages:

- Increased beam width .
- Maintaining the large ratio of current amplitude in large arrays is difficult

24. What is the difference between isotropic and nonisotropic source .

Isotropic source radiates energy in all directions but non-isotropic source radiates energy only in some desired directions. ._Isotropic source is not physically realizable but non-isotropic source is physically realizable.

25. Define Side Lobe Ratio

Side Lobe Ratio is defined as the ratio of power density in the principal or main lobe to the power density of the longest minor lobe.

26. List the arrays used for array tapering .

Binomial Array: Tapering follows thecoefficient of binomial series

Dolph Tchebycheff Array: Tapering follows the coefficient of Tchebycheff polynomial

16 MARK QUESTIONS

1. An array of N element spaced λ/2 derive the field quantitative and draw its radiation pattern.
2. Compare the Broadside Array and End Fire Array. **MAY/JUNE 2014/MAY/JUNE 2013**
3. Explain the Binomial Arrays in detail. **MAY/JUNE 2013**
4. For an array N element feed with signal of equivalent amplitude and phase, determine the maxima and minima directions. Draw the radiation pattern.
5. Obtain the expression for the field and the radiation pattern produced by a 2 element array of infinitesimal dipole with distance of separation λ/2 & currents of equal magnitude and phase shift 180°.
6. Obtain the expression for the field and the radiation pattern produced by a 2 element array of infinitesimal dipole with distance of separation λ/2 and currents of equal magnitude and same phase.
7. Explain about pattern multiplication. **MAY/JUNE 2013**

UNIT IV-SPECIAL ANTENNAS

1. What are the fundamental antenna parameters?

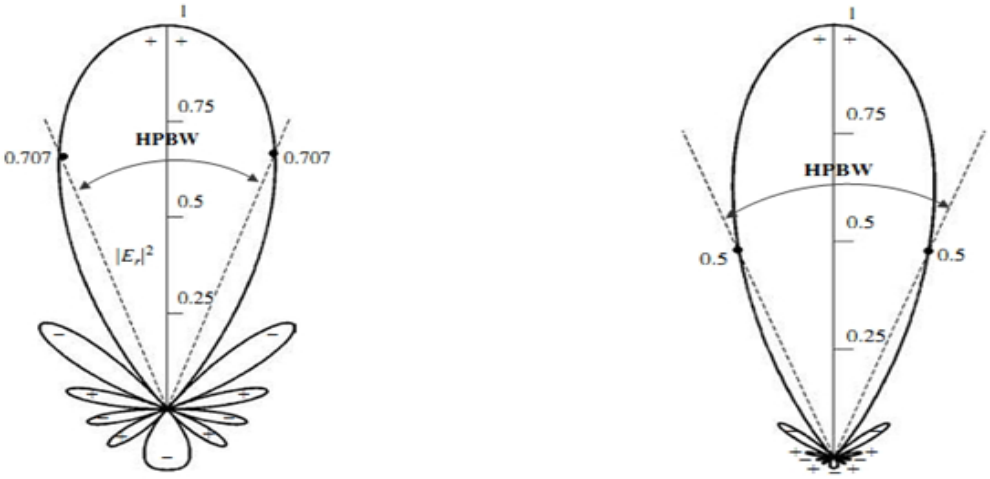
- Radiation pattern
- Directivity
- Gain

2. Define radiation pattern.

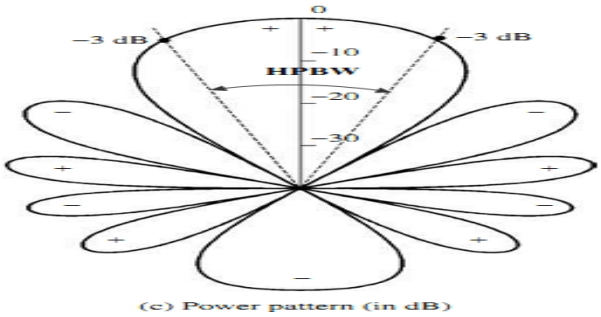
R**adiation pattern** defines the variation of the power radiated by an antenna as a function of the direction away from the antenna and observed from the antenna's far field.

3. **What are the radiation pattern types?**
   - Radiation Pattern-Linear Scale
     - Field Pattern- Plot of Electric or Magnetic field vs. Angular space
     - Power Pattern- Plot of square of Electric or Magnetic field vs. Angular space
   - Radiation Pattern- Logarithmic Scale
     - Power Pattern- Plot of Electric or Magnetic field in dB vs. Angular space
4. **Give the field pattern and power pattern in linear scale.**

Field Pattern **Power Pattern**



5. **Give the radiation pattern in logarithmic scale.**



(c) Power pattern (in dB)

6. **What are the radiation types?**
   Isotropic-a hypothetical antenna having equal Radiation pattern in all direction
   Directional-Radiating/Receiving radiations more effectively in some direction
   Omni directional-Non directional Pattern in a given plane and directional Pattern in any orthogonal plane
7. **What is meant by directivity?**
   Ratio of radiation intensity in a given direction to the radiation intensity averaged over all directions (Total Radiated Power).
8. **What is meant by partial directivity?**

Part of the radiation intensity corresponding to a given polarization divided by radiation intensity averaged over all direction.

9. **What is meant by gain?**
   Ratio of radiation intensity in a given direction to that of radiation intensity that would be obtained if power accepted by the antenna were radiated isotropically.

$$\text{Gain} = 4\pi \frac{\text{radiation intensity}}{\text{total input (accepted) power}}$$

10. **What is meant by relative gain?**
    The ratio of Power Gain in a given direction to Power gain of a reference antenna in a reference direction(lossless isotropic source).

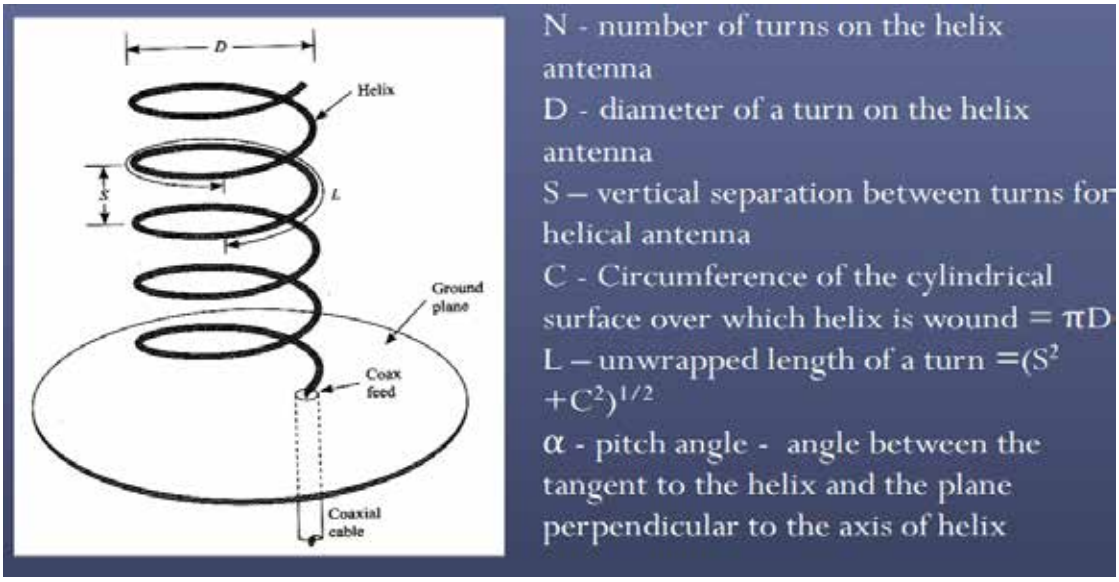
$$G = \frac{4\pi U(\theta, \phi)}{P_{in}(\text{lossless isotropic source})} \quad \text{(dimensionless)}$$

11. **What is meant by absolute gain?**
    Gain that includes losses arising from impedance mismatch and Polarization losses is called as absolute gain.
12. **Why measure antenna characteristics?**
    - To check whether the designed Antenna confirms to the design specification.
    - Electromagnetic Interference (EMI)
    - Electromagnetic Compatibility (EMC)
13. **What is meant by anechoic chamber? NOV/DEC 2012**
    - Indoor Facility
    - High Isolation from External Environments
    - Suitable for Highly Sensitive measurements
    - Indoor enclosures made up of EM absorbing materials
    - Carbon impregnated polyurethane foam pyramids

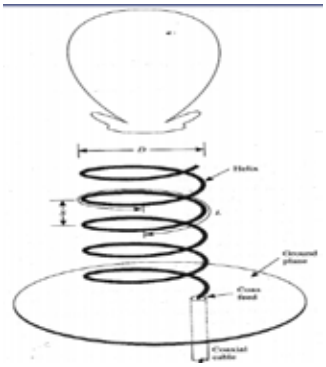
14. **What is meant by frequency independent antenna?**
    An antenna with primary electrical characteristics that vary insignificantly with frequenc over an extremely wide range is called as frequency independent antenna. Frequency independent antennas are used for shortwave radio communications, telemetry, and radio astronomy.
    Eg. Spiral antenna, log periodic antenna
15. **What is meant by helical antenna? NOV/DEC 2012**
    A **helical antenna** is an antenna consisting of a conducting wire wound in the form of a helix. In most cases, helical antennas are mounted over a ground plane. The feed line is

connected between the bottom of the helix and the ground plane. Helical antennas can operate in one of two principal modes — normal mode or axial mode.

16. What are the geometric parameters of helical antenna?



17. What is meant by axial mode helix?



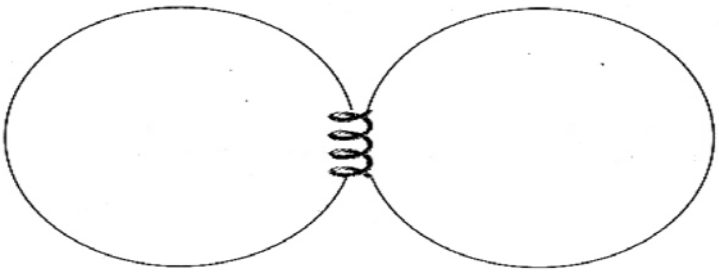
- Radiates maximum energy along its axis.
- Radiation pattern-one major lobe and several minor lobes.
- Produces circularly polarized waves.
- Highly directional.
- Popular for satellite communication in VHF and UHF band.

18. What is meant by normal mode helix?

- Helical antenna operates in normal mode if dimensions are small compared to the wavelength that is $D << \lambda$ and $NL < \lambda$.
- Radiation pattern is minimum along the axis of the helix and maximum in a plane normal to the axis.
- Radiation pattern is a figure of eight rotated about the axis of the helix – similar to that of the dipole of length $l < \lambda$ or a loop of radius $a << \lambda$.
- If $C = (2S\lambda)^{1/2}$ or $\tan\alpha = [(\pi D)/(2\lambda)$ – radiates circularly polarized waves.

- Popular for mobile and wireless handset applications.

19. Draw the radiation pattern of normal mode helix.



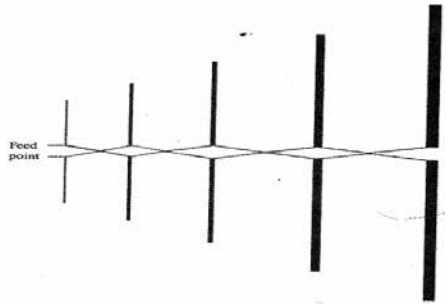
20. What is meant by log periodic dipole array?

- Consists of dipoles of different lengths kept parallel to each other with different spacings.
- All dipoles are excited by a feed network.
- In Log-periodic array, electrical characteristics such as input impedance, gain etc., vary periodically in the logarithm of the frequency domain .

21. What are the feed systems of log periodic dipole array?

- 2 wire transmission line
- Criss crossed feed

22. What is meant by criss crossed feed system?



- Criss-crossing – spacing between the two wires changes all along the length of the feed line – characteristic impedance – does not remain constant.
- Criss-crossed feed – maximum radiation along the direction of shortest dipole and good input match.

16 MARK QUESTIONS

1. Explain the geometry of a log periodic antenna. How wideband operation is possible with this antenna. Give the design equations. **APRL/MAY 2015/NOV DEC2012**
2. With neat sketch explain the operation of Helical antenna .**MAY/JUNE 2014/ NOV/DEC 2012**
3. Explain the working principle of spiral antenna.

4. Write short notes on **MAY/JUNE 2014/MAY/JUNE 2013**
   Gain measurement
   Radiation pattern measurement
   Polarization measurement
   VSWR measurement

UNIT V – PROPAGATION OF RADIO WAVES

1. Define Sky wave.

Waves that arrive at the receiver after reflection in the ionosphere is called sky wave.

2. Define Tropospheric wave.

Waves that arrive at the receiver after reflection from the troposphere region is called Tropospheric wave. (i.e. 10 Km from Earth surface).

3. Define Ground wave.

A wave propagated over other paths near the earth surface is called ground wave propagation.

4. What are the types of Ground wave?

Ground wave classified into two types.

i. Space wave
ii. Surface wave.

5 What is meant by Space Wave?

It is made up of direct wave and ground reflected wave. Also includes the portion of energy received as a result of diffraction around the earth surface and the reflection from the upper atmosphere.

6. What is meant by Surface Wave?

Wave that is guided along the earth's surface like an EM wave is guided by a transmission is called surface wave. Attenuation of this wave is directly affected by the constant of earth along which it travels.

7. What is meant by fading?

Variation of signal strength occurs on line of sight paths as a result of the atmospheric conditions and it is called .It cannot be predicted properly.

8. What are the types of fading?

i. Inverse bending.
ii. Multi path fading.

9. What is inverse and multi path fading?

Inverse bending may transform line of sight path into an obstructed one. Multi path fading is caused by interference between the direct and ground reflected waves as well as interference between two are more paths in the atmosphere.

10. What is meant by diversity reception?

To minimize the fading and to avoid the multi path interference the technique used are diversity reception. It is obtained by two ways.

i. Space diversity reception.
ii. Frequency diversity reception.
iii. Polarization diversity.

11. Define frequency diversity Reception.

This method takes advantage of the fact that signals of slightly different frequencies do not fade synchronously. This fact is utilized to minimize fading in radio telegraph circuits.

12. Define polarization diversity reception.

It is used in normally in microwave links, and it is found that signal transmitted over the same path in two polarizations have independent fading patterns in broad band dish antenna system, Polarization diversity combined with frequency diversity reception achieve excellent results.

13. What is meant by Faraday's rotation? NOV/DEC 2011NOV/DEC 2011

Due to the earth' s magnetic fields, the ionosheric medium becomes an isotropic and the incident plane wave entering the ionosphere will split into ordinary and extra ordinary waves/modes.

When these modes re-emerge from the ionosphere they recombine into a single plane wave again. Finally the plane of polarization will usually have changed, this phenomenon is known as Faraday's rotation.

14. What are the factors that affect the propagation of radio waves?

i. Curvature of earth.
ii. Earth's magnetic field.
iii. Frequency of the signal.
iv. Plane earth reflection.

15. Define gyro frequency.

Frequency whose period is equal to the period of an electron in its orbit under the influence of the earth's magnetic flux density B.

16. Define critical frequency .NOV/DEC 2011

For any layer, the highest frequency that will be reflected back for vertical incidence is $fc = 9\sqrt{N_m}$

17. Define Magneto-Ions Splitting.

The phenomenon of splitting the wave into two different components (ordinary and extra-ordinary) by the earth's magnetic field is called Magneto-Ions Splitting.

18. Define LUHF.

The lowest useful HF for a given distance and transmitter power is defined as the lowest frequency that will give satisfactory reception for that distance and power.

It depends on

i. The effective radiated power
ii. Absorption character of ionosphere for the paths between transmitter and receiver.
iii. The required field strength which in turn depends upon the radio noise at the receiving location and type of service involved.

19. Define Refractive index.

$\mu=\sqrt{(1-81N/f^2)}$

where N=number of electrons per cubic meter

f=frequency in Hz

20. Define maximum Usable Frequency.

The maximum Frequency that can be reflected back for a given distance of transmission is called the maximum usable frequency (MUF) for that distance.

MUF = fc sec i

21. Define skip distance. NOV /DEC 2012

The distance with in which a signal of given frequency fails to be reflected back is the skip distance for that frequency.The higher the frequency the greater the skip distance.

22. Define Optimum frequency?

Optimum frequency for transmitting between any two points is therefore selected as some frequency lying between about 50 and 85 percent of the predicted maximum usable frequency between those points.

16 MARK QUESTIONS

1. Derive the expression for refractive index of ionosphere and critical frequency. Explain about various layers of ionosphere. **NOV/DEC 2014/NOV DEC 2012**
2. Derive the expression for calculating field strength at a distance in space wave Propagation.**MAY/JUNE 2014**
3. Explain in detail about ionosphere propagation. **APRL/MAY 2015**
4. Write short notes on i) Ground wave propagation ii) space wave propagation.**MAY/JUNE 2014**
5. Derive the expression for Permitivity and conductivity of ionized gas.
6. Explain the different types of Diversity technique.
7. Define and explain for ionospheric region
   i) Critical frequency ii) MUF iii) Skip zone iv) virtual height of a layer v)optimum working frequency **MAY/JUNE 2014**
8. Explain the structure of the ionosphere with neat diagram. Explain Troposcatter Propogation.**APRL/MAY 2015/NOV DEC 2012**
9. Explain the effect of earth's magnetic field on ground wave propogation **NOV/DEC 2014**
10. Explain in detail:Duct Propogation,Troposcatter,Sky Wave Propogation.

Aalim Muhammed Salegh
College of Engineering

ELECTRONICS & COMMUNICATION ENGINEERING

MG 6851
PRINCIPLES OF MANAGEMENT

SEMESTER - VI

MG6851 PRINCIPLES OF MANAGEMENT LT P C
3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques
– Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure
– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT VCONTROLLING 9

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES :

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, 10th Edition, Prentice Hall (India) Pvt. Ltd., 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” 7th Edition, Pearson Education, 2011.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata Mc Graw Hill, 1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.

MG 6851 PRINCIPLES OF MANAGEMENT

QUESTION BANK

PART A (QUESTIONS & ANSWERS)

UNIT-I

1) What is Management?

Management is the process of giving direction and controlling the various activities of the people to achieve the objectives of an organization.

2) Define: Management.

According to Knootz and Weihrich "Management is the process of designing and maintaining of an environment in which individuals working together in groups efficiently accomplish selected aims".

3) Write some characteristics of Management?

Management is a continuous process. Manager use the resources of organization both physical as well as human achieve the goal. Management aims act achieving the organization goals by ensuring effective use of resources.

4) Write any two points favor for management as a science

- Management principle should be verified.
- Reliable basis for predicting future.

5) What is time study?

The movement which takes minimum time is the best one.

6) What is motion study?

Taylor suggested the eliminating wasteful movements and performing only necessary movement.

7) What is authority?

It is the power given to a person to get work from his subordinates.

8) What is responsibility?

It is the amount of work from a man by his superior.

9) Comment: Management is both –A science and an art

Management is a science because it contains general principles. It is also an art because it requires certain personal skills achieve desired result.

10) What is centralization?

The organization is centralized when the power is concentrated with one person.

11) What is decentralization?

If the power is fully distributed to the subordinates of the organization.

12) What is Esprit-de-corps?

This means union is strength. In organization employees should be harmony and unity.

13) Write some important functions of top level management?

- Top level management.
- Middle level management.
- Lower level management.

14) Write some important functions of top level management?

- To formulate goals and policies of the company.
- To formulate budgets.
- To appoint top executives.

15) Write the functions of management?

- Planning.
- Organizing.
- Staffing.
- Coordinating.
- Controlling.

16) Define sole trade?

The sole proprietorship is that form of business organization which owned and controlled by a single individual.

17) What is partnership?

A partnership is an association of two or more persons to carry on business and to share its profit and losses.

18)What is Joint Stock Company?

Joint Stock Company is association of many persons who contribute money worth to common stock and explaining source trade and also share the profit and losses.

19) What is private limited company?

A private limited company is a company which has a minimum paid up capital dory be prescribed.

20) White is a co-operative society?

It is a voluntary association of persons for mutual benefit and it aims is accomplished through self heap and collective effort.

21) Distinguish between management and administration?

S.NO	Administration	Management
1	It is higher level function	It is lower function
2	It refers to the owners of the organization	It refers to the employees
3	It is concerned with decision making	It is concerned with execution of decision
4	It acts through the management	It acts through the organisation

22) What are the essential skills needed for the managers ?

a) Technical skill

b) Human skill

c) Conceptual skill

23) Define Management? (Nov Dec 2014)

Refer above Q.1 for solution

24) Point out any three difference between administration and management ? (Nov Dec 2014)

Refer above Q.21 for solution

25) What is the basic role of managers? (Apr May 2015)

Refer above Q.15 for solution

26) Define scientific management? (Apr May 2015)

The employees should be scientifically selected and trained. Due to scientific selection and training, an employee has the opportunity of earning a high rate of pay.

PART B

1. Explain briefly about the various functions of Management.
2. What are the Henry Fayol's 14 principles of management? Explain.
3. Explain briefly about the different factors affecting the organizational environment.
4. Explain the overall development of management thought.
5. Management: Science or Art – Discuss.
6. Compare Management and administration.
7. Explain in detail about the different types of business organization.
8. Write the characteristics and limitations of classical approach.
9. What are the different responsibilities of managers in effective management? Explain.
10. Discuss in detail about the recent trends in management concepts.
11. Enumerate fayol's principles of management. How are they different from taylors principles? Comment on them in brief.
12. Explain the roles and social responsibility of a manager.
13. Explain the evolution of management thought by different experts in management.
14. Discuss the management functions as related to trends and challenges in management of global scenario.
15. a. Enumerate Fayols principlesz of management ? How are they different from Taylors principles? Comment on them in brief. **(Nov Dec 2014)**
16. Explain the roles and social responsibility of a manager? **(Nov Dec 2014)**
17. Explain in detail about Henry Fayol's conbtribution towards classical approach towards management? **(Apr May 2015)**
18. a Discuss the relative importance of each type of the skills to lower, middle and upper level managers ? **(Apr May 2015)**

    b. Describe the motion study as used by the Gilbreths.

UNIT II

PART- A

1) Define planning.

Planning is the process of selecting the objectives and determining the course of action required to achieve these objectives.

2) What is the main objective of planning?

Planning is a primary function of organization It helps in achieving objectives It done to cope with uncertainty and change helps in facilitating control It helps in coordination Planning increases organization effectiveness. Planning guides in decision making.

3) Define "Mission"

Mission may be defined as "a statement which defines the role that an organization plays in the society"

4) Define "objectives"

The term "objective" or "goals" are often used interchangeably. Objective are the end results towards which the activities of attain its objectives.

5) What is mean by strategy `

Strategy of an organization is the programmers of action and deployment of resources to attain its objectives.

6) What are the factors to be considered while formulating strategies ?

Mission and objectives of an organization. Values, aspiration and prejudices of top level management Opportunities and threads of the external environment. Strength and weakness of the firm in various aspects such as funds, organization structure, human talent, technology etc.

7) Define "policies"

Policies are general statement or understanding which provide guidance in decision making to various managers.

8) What is procedure?

Procedure is a chronological order of action required to implement a policy and to achieve an objectives.

9) What is programme?

Programme is a broad term which includes goals , polices , procedure , rules , task assignment , step to be taken, resources to be employed to carryout a given course of action.

10) Define budgets.

A budget is a statement of expected result in numerical terms and therefore, it may be referred as a numerical programmer.

11) What is objective?

Objectives are the aims, purposes or goals that an organization wants to achieve over varying period of time.

12) What is MBO?

MBO is a process whereby the superior and the superior and the subordinate manager of an enterprise jointly identify its common goals, define each individuals major areas of responsibility in terms of result expected of him, and use these measures as guides for operating the unit and the contribution of each of its members is assessed.

13) What is meant by "strategy"?

A strategy may also be defined as a special type of plan prepared for meeting the challenge posted by the activities of competitors and other environmental forces.

14) What are the major kinds of strategies and policies?

Growth, Finance, organization, personnel, products or service and market.

15) Write down any four factors which lead to fail of strategic planning.

Managers are inadequately prepared for strategic planning. The information for preparing the plans is insufficient for planning for action. The goals of the Organization are too vague. The business units are not clearly identified**.**

16) What is planning premises?

The assumptions about future derived from forecasting and used in planning are known as planning premises.

38) What are the practices made in making effective premising?

Selection of premises. Collection of information. Development of alternative premises for contingency planning. Verification of the consistency of premises. Communication of planning premises.

17) Explain the term decision and decision making?

A decision may be a direction to other to do or not to do…Decision making is defined as the process of choosing a course of action from among alternatives to achieve a desired goal. It is one of the functions of management and also a core process of planning the management executive takes a number of decisions every day. Thus, decisions may be

rational or irrational. The best one is selected out of the available alternatives.

18) How would you evaluate the importance of a decision?

Decision making is a selection process. The best alternative is selected out of many available alternatives. Decision –making is a goal –oriented process. Decisions are made to achieve some goal or objective. Decision making is the end process. It is preceded by detailed discussion and selection of alternatives. Decision making is a human and rational process involving the application of intellectual ablates. It involves deep thinking and foreseeing things. Decision making is a dynamic process. An individual takes a number of decisions each day.

19) Mention the three approaches generally adapted by managers in selections an alternative?

Quantitative and Qualitative analysis. Marginal analysis. Cost effectiveness analysis.

20) Define Programmed decision.

It is also called as structured decisions. The reason is that these types of decisions are taken frequently and they are repetitive in nature. Such decisions are taken by middle and low level managers, and have a short term impact.

21) Define Corporate Planning. (Nov Dec 2014)

The planning adapted by corporate sector (Big industries) for administration, production and coordination is corporate planning.

22) Write short notes on policy making. (Nov Dec 2014)

The policy which is adopted at the requirement of the industry and it will be suitable for implementing in the organization. This should be clear and precise for understanding purpose for employees and workers.

23) What is main purpose of planning? (Apr May 2015)

Refer Q2 above.

24) Distinguish strategic planning and tactical planning? (Apr May 2015)

A strategic plan is an outline of steps designed with the goals of the entire organization as a whole in mind, rather than with the goals of specific divisions or departments.

A tactical plan is concerned with what the lower level units within each division must do, how they must do and who is incharge at each level.

PART B

1. Explain the overall decision making process.
2. Explain in detail about the various forecasting methods.
3. Explain the process of MBO.
4. Explain in detail about the TOWS matrix and SWOT analysis.
5. Define policies with its types. Explain the planning premises with types.
6. Explain the relationship of planning and controlling.
7. Discuss in detail about the performance appraisal.
8. Name the classifications of planning practices.
9. Discuss the various factors affecting the decision making process.
10. Explain briefly about the major kinds of strategies.
11. Explain the overall decision making process.
12. Explain in detail about the various forecasting methods.
13. Explain the process of MBO.
14. Explain in detail about the TOWS matrix and SWOT analysis.
15. Define policies with its types. Explain the planning premises with types.

16. Explain the relationship of planning and controlling.
17. Discuss in detail about the performance appraisal.
18. Name the classifications of planning practices.
19. Discuss the various factors affecting the decision making process.
20. Explain briefly about the major kinds of strategies.
21. What is planning? Describe the steps involved in planning.
22. Explain the importance of planning and the steps involved in planning process.
23. Explain the decision making process. Then also discuss how decision making under different conditions are made.
24. What is planning? Describe the steps involved in planning?

(Nov Dec 2014)

25. Explain in detail about MBO. **(Nov Dec 2014)**
26. a. Discuss some of the tools for developing organizational strategies.

(Apr May 2015)

b. Explain the steps involved in decision making process.

27. a. Elaborate the different types of organizational plans.

b. What do you understand by management by objectives (MBO)? What are the advantages and limitations? **(Apr May 2015)**

UNIT III

PART-A

1) Define Organizing

Organizing is the process of identifying and grouping of activities required to attain objectivities , delegating authority, creating the responsibility and establishing relationship for the people to work effectively.

2) What do you understand by effective organizing?

Effective organizing focuses on finding in present organizing avoids organizational inflexibility and makes the staff work effective by avoiding conflicts by clarification.

3) How informal organization characteristics differ from formal organization?

It arises without any external cause. It is created on the basis of some similarity among the member. The bases of similarity may be age, sex, place of birth, caste, religion, liking/ disliking etc Informal organization has no place in the organization chart. It is one of the parts of total organization.

4) What is span control?

Span of control means the number of people managed effective by a single superior in an organization. The term "Span of control" is also known as "Span of management", "span of authority" ,and "Span of responsibility" . But span of management is a better term because control and supervision are elements of management.

5) What is matrix structure?

Matrix structure is a hybrid organizational form, containing characteristics of both project and functional structures.

6) How can we define power?

"Power is the probability that one actor with in the relationship will be in a position to carry out his own despite resistance".

7) What is line authority?

Line authority is the direct authority which a superior exercises over a number of subordinates to carry out orders and instruction. IN

organization process, authority is delegated to the individuals to perform the activities.

8) What is staff authority?

The relationship between a staffs manager with whom he works depends in part on the staff duties.

9. Define staffing.

Staffing is the part of the management process which is concerned with the procurement utilization, maintenance and development of large satisfied work force on the organization.

10. Define Human resource planning. "

Human resource planning is the process by which an organization ensures that it has the right number and all kind of people at the right place at the right time, capable of effectively and efficiently completions, those tasks that will help the organization achieve its overall objectives".

11. What is job analysis?

Job analysis is a detailed study of a job to identify the skills, experience and aptitude required for the job.

12) What is job design?

The job design is usually broad enough to accommodate people's needs and desires.

13) Define: Recruitment.

Flippo defines recruitment as "The process of searching for prospective employees and stimulating to apply for jobs in the organization".

14) What is selection?

Selection is the process of finding out the most suitable candidate to the job out of the candidates attracted.

15) What is grading method?

It is one of the trait-based appraisal methods. The actual performance of the employees is measured against these grades. This method is generally useful for promotion based on performance.

16) What is mean by resources allocation?

Manager is responsible for allocation of money, material and human resource in the organization. He utilizes minimum resource to give maximum profit to the organization.

17) Define the Peter Principle.

The principle states that every person in a hierarchy tends to rise to the level of his incompetence.

18) Define: Training

According to B.Flippo "Training is the act of increasing the knowledge and skill of an employee for doing a particular job".

19) Define; Organizational conflict.

According to step "conflict is a process in which an effort is purposefully made by one person or unit to block another that result in frustrating the attainment of others goals of the furthering of his or her interests.

20) What is managerial grid?

Managerial grid is behavioral theory of leadership. It plays an important role in managerial behavior in organizational development.

21) List out the source of authority.

a) Formal authority theory b) Acceptance authority theory c) Competence theory

22) Define authority? (Nov Dec 2014)

It is a process which enables a person to assign work to others and delegate them with adequate authority to do it. Authority means power given to a person to extract work from the subordinates.

23) What is staffing? (Nov Dec 2014)

Refer Q. 9 above

24) What do you understand by assessment centers? (Apr May 2015)

The top levels of any organization monitor the activities of workers periodically and assess their performance and efficiency.

25) Give an example of how functional authority works in an organization? (Apr May 2015)

The president in any organization has the authority to manage the organization.

PART-B

1. Explain briefly about the various types of Departmentation.
2. Explain briefly about the various types of Organizational structures.
3. Discuss the span of management/managerial effectiveness.
4. Explain briefly about the overall selection process.
5. Discuss briefly the various steps involved in organizing.
6. List out the difference between Formal and Informal organization.
7. List out the basic activities of human resource development.
8. Name the types of centralization.
9. Explain about the organizational culture.
10. Explain about the human resource planning.

11. Explain the difference between line and staff organization with an example. Discuss its merits and demerits.

12. Explain the process involved in selecting and recruiting a graduate trainee in organization.

13. Describe the various bases for departmentation and suggest a scheme of departmentation for a large marketing organization with a field network all over the country.

14. Describe the various bases for departmentation and suggest scheme of departmentation for a large marketing organization with a field network all over the country? **(Nov Dec 2014)**

15. Explain selection and recruitment process? **(Nov Dec 2014)**

16. a. Describe a case in which matrix organization structure will be effective? Also discuss the advantages and limitations of matrix organization?

(Apr May 2015)

b. Compare formal and informal organizations.

17. a. "Delegation is the ability to get result through others"- Discuss. Explain the steps and guidelines to be followed while delegating authority.

b. Explain the various methods of delegating. **(Apr May 2015)**

UNIT IV

PART-A

1) Define creativity.

Creativity is defined as the ability to produce new and useful ideas through the components in novel and non obvious ways. Creativity exists throughout the populations, largely independent of age, sex and education.

2) What is a SCAMPER tool?

SCAMPER is a checklist that helps us to think of changes. We can make to an existing product to create a new one. These changes can be used either as direct suggestions or as starting points for lateral thinking.

3) What is meant by reframing matrix?

Reframing Matrix is a simple technique that helps to look at business problems from a number of different viewpoints. It expands the range of creative solutions that you can generate. The approach relies on the fact that different people with different experience approach problems in different ways.

4) State the function of mind mapping tool?

This tool is similar to concept fan except looking one step back from main topic .A mind map consists of a central word or concept with 5 to10 main ideas that relate to that word , similar to creating a spider-web.

5. Mention the use of DO IT process for creativity?

DO IT is a process for creativity. Techniques explained earlier in this chapter focus on specific aspects of creative thinking. DO IT bundles them together introduce formal methods of problem definition and evaluation. These help you to get the best out of the creativity techniques. DO IT is an acronym that stands for: D – Define problem O – Open mind and apply creative techniques I _ Identify best solution T _ Transform.

7) Differentiate innovation and invention.

Innovation means the use of creative ideas. Invention means really finding new things which are not already available.

8) How can be harmonizing objectives achieved?

Mutual trust. Cooperation and understanding. Worker's participation in management, and Balancing the objectives of the organization with those of individuals.

9) Define "multiplicity of roles".

Individuals are not only the productive factor in management's plans. They are members of social system of many organizations.

10) What is meant by Brain storming?

Brainstorming is an excellent way of developing many creative solutions to a problem. It works by focusing on a problem, and then coming up with very many radical solutions to it . The essence of brainstorming is a creative conference, ideally of a to 8 to12 people meeting for less than an hour to develop a long listed without criticism on a backboard or newsprint as they are offered ; one visible idea leads to others. At the end of this session, participants are asked how the ideas could be combined or improve.

11) Define motivation.

According to koonts and O'Donnell, "Motivation is a general terms applying to the entire class of drives, desires, needs wishes and similar forces that induce an individual or a group of people to work".

12) Names the steps involved in motivation process.

- Analysis of situation.
- Preparing, selecting and applying a set of appropriate motivating tools. Follow up.

13) What are the types of motivation?

- Positive motivation
- Negative motivation
- Extrinsic motivation
- Intrinsic motivation

14) What is Laissez-Faire?

Complete freedom is given to the subordinates so that they plan, motivate, control and otherwise be responsible for their own actions.

15) Mention the various elements in the process of communication.

a) Sender b) Communication channel c) Symbol d) Receiver e) Noise and feedback in communication.

16) Classify the methods of communication.

a) Formal communication b) Informal communication

Formal communication: flows through a proper channel. It refers the way in which the information is sent and it has a recognized position in organizational structure.

Informal communication: People who know each other in the organization talk together informally. Whenever they meet each other, they normally talk about the happenings in the organization known as 'grapevine'.

17. Write short notes on laissez Faire leader? (Nov Dec 2014)

Refer Q 14 above.

18. Write short notes on elements of communications? (Nov Dec 2014)

Refer Q 15 above.

19. How does leadership differ from management? (Apr May 2015)

Management is the process of giving direction and controlling the various activities of the people to achieve the objectives of an organization.

Leadership is an integral part of management and plays a vital role in managerial operations.

20. Define job enlargement? (Apr May 2015)

This is the process of creating new job for employment.

PART-B

1. Explain briefly about three theories of Motivation.
2. Explain in detail about the various functions of Leader.
3. Discuss in detail about the Creativity and Innovation.
4. Explain the various types of Leadership with its different styles.
5. Discuss in detail about the process and types of Motivation.
6. Explain the different characteristics of a Leader.
7. List the tools and techniques used in operating management system.
8. Explain briefly about MIS.
9. Explain the different barriers and breakdowns of communication process.
10. Explain in detail about the different types of Budgets.
11. Difference between Motivation and Satisfaction.
12. Describe any one motivation theory and suggest how the motivation theory might aid in getting managers to motivate their staff.
13. Explain the different types of communication. What steps can be taken to overcome such barriers.
14. Describe any one motivation theory and suggest how the motivation theory might aid in getting managers to motivate their staff. **(Nov Dec 2014)**
15. Explain different barriers of communication. What steps can be taking to overcome such barriers. **(Nov Dec 2014)**
16. a. Explain the types of formal organizational communication?

b. Discuss the obstacles to the leaders flexibility and leaders styles based on them. **(Apr May 2015)**

17. Does motivation important for organization development/achievement? Justify your answer with Maslow's hierarchy of needs? **(Apr May 2015)**

UNIT V

PART-A

1) Define control?

According to Knootz "Controlling to the measurement and correction of performance in order to make sure that enterprise objectives and the plans devised to attain them are accomplished".

2) Why need of control in the organization?

- Control process is universal.
- Control is a continuous process.
- Control is action based.
- Control is forward looking.

3) Why need of control in the organization?

- Control can minimize the mistake.
- To discover the deviations in the management

4) What are the Inter –relationship between planning and end with control?

The management process of adjusting future action on the basis of information about past performance. Control helps in achieving them.

5) What is Feedback Control?

Feedback control is the process of adjusting future action on the basis of information about past performance.

6) What is management by exception?

Actual performance compare with the standard performs deviations which cannot significant should be avoided.

7) What is concurrent control?

This control measures for taking corrective action while a programme meet any obstacle in this activities.

8) What is feed forward control?

It is preventive in nature. This control involves evaluation of inputs and taking corrective action before a particular operation is completed.

9. What is direct labour Budget?

Direct labor Budget reveals the expected labor requirements during the budget period.

10. What is fixed Budget?

In this budget in which targets are rigidly fixed .This is a forecast of the targets for the coming fear prepared well in advance.

11. What is flexible budget?

A flexible budget is a budget designed to change in the level of activity.

12) What is Internal Audit?

Internal audit is done by an internal auditor who is an employee of the organization. He examines the objectives, policies, plans procedures and performance of the management

13) Define Productivity?

Productivity is a measure of how much input is required to produce a given output .i.e. the ratio (output/input) is called productivity.

14) Define: OR

Operation Research is a systematic analysis of a problem through scientific methods ,carried out by appropriate specialists ,working together. As a team, finding an optimum and the most appropriate solution to meet the given set of constraints.

15) What is JIT?

Just in Time Inventory system. In this method the suppliers deliver the materials to the production spot just in time to be assembled .This method reduces cost of inventory.

16) What is value engineering?

It is a special type of cost reduction and product improved technique.

17) What is preventive control?

An efficient manager applies the skills in managerial philosophy to eliminate undesirable activated which are the reasons for poor management.

18) Define: Multinational Corporation?

"An enterprise which own or control production or service facilities outside the country in which they are based".

19) What is ethnocentric attitude?

The manager orientation and managerial activities, operations was based on that of the parent company.

20) What is polycentric attitude?

Polycentric attitude manager orientation was host country orientation.

21) What is budgetary control?

According to J Bhatti, "A system which uses budgets as a means of planning and controlling all aspects of producing and selling commodities/services".

22) What are the budgetary controls? (Nov Dec 2014)

Refer Q 21

23) Define purchase control? (Nov Dec 2014)

It is the control of expenditure for purchasing raw materials, equipments for production process in an industry.

24) List the basic types of control? (Apr May 2015)

i. Feedback or historical control

ii. Concurrent control

iii. Feed forward control

25) What are the potential pitfalls of budgets? (Apr May 2015)

Inflexibility, Inaccuracy, distribution of goal, hiding inefficiencies & expenditure.

PART – B

1. Explain the difference between Japanese and US Management.
2. Explain in detail about MNCs.
3. Discuss in detail about the techniques used for improving Productivity.
4. Explain the term 'Reporting".
5. Explain in detail the preventive control mechanism towards achieving a unified global management theory.
6. Impact of IT in Management concept – Discuss.

7. Discuss in briefly about the various functions of MNC.
8. Explain in detail about the Globalization and Liberalization.
9. Explain in detail reporting and ROI.
10. Write down the management concept in Germany.
11. What is control? Discuss the phases in control.
12. Explain different budgetary and non-budgetary control techniques.
13. What is the following?
    a) Purchase control
    b) Maintenance control
    c) Quality control
14. What is control? Discuss the phases in control. (**Nov Dec 2014**)
15. Explain different budgetary control techniques? **(Nov Dec 2014**)
16. a. Explain the relationship between controlling and overall management. Discuss the steps in controlling process? **(Apr May 2015)**
    b. Describe the potential barriers to successful controlling?
17. Discuss briefly about
    I) Break Even Analysis
    II) Budget as a tool for organization control. **(Apr May 2015)**

.....