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COLLEGE OF ENGINEERING AND TECHNOLOGY

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ANGUCHETTYPALAYAM, PANRUTI - 607 106

Continuous Internal Assessment	I	Unit Test	—

Register Number	4	2	2	1	1	8	1	0	4	0	2	0

Department	CSE	Semester	05
Subject Code	CS 8493	Subject Title	operating system
Date & Session	06.02.2020	No. of Pages used	19

Name of the Hall Superintendent	Signature of the Hall Superintendent

Instruction to the Candidate: Put a tick mark (✓) for the questions attended in the tick mark column against each question in Valuation Box

PART - A			PART - B &C											
Q.No.	✓	Marks	Q.No.		i ✓	i Marks T	i Marks D	ii ✓	ii Marks T	ii Marks D	iii ✓	iii Marks T	iii Marks D	Total Marks
1	✓	2	11	a	✓	11								11
2	✓	2	11	b										
3	✓	2	12	a	✓	11								11
4	✓	2	12	b										
5	✓	2	13	a										
6	✓	2	13	b	✓	12								12
7	✓	2	14	a										
8	✓	2	14	b	✓	12								12
9	✓	2	15	a										
10	✓	2	15	b	✓	12								12
Total	20		16	a	✓	12								12
			16	b										
												Total		70

Grand Total	90	Grand Total (in words)	NINE ZERO
Name of the Examiner	V. VARALAKSHMI	Signature of the Examiner	Vanhi

PART - I

1. Purpose of system calls.

System calls provide a convenient environment for program development and execution.

System calls can be thought of as useful system calls. The provide basic functionality to users so that users do not need to write their own programs to common problems.

2. operating system and its objects.

An operating system is a powerful and usually large, program that controls and manages the hardware and other software on a computer.

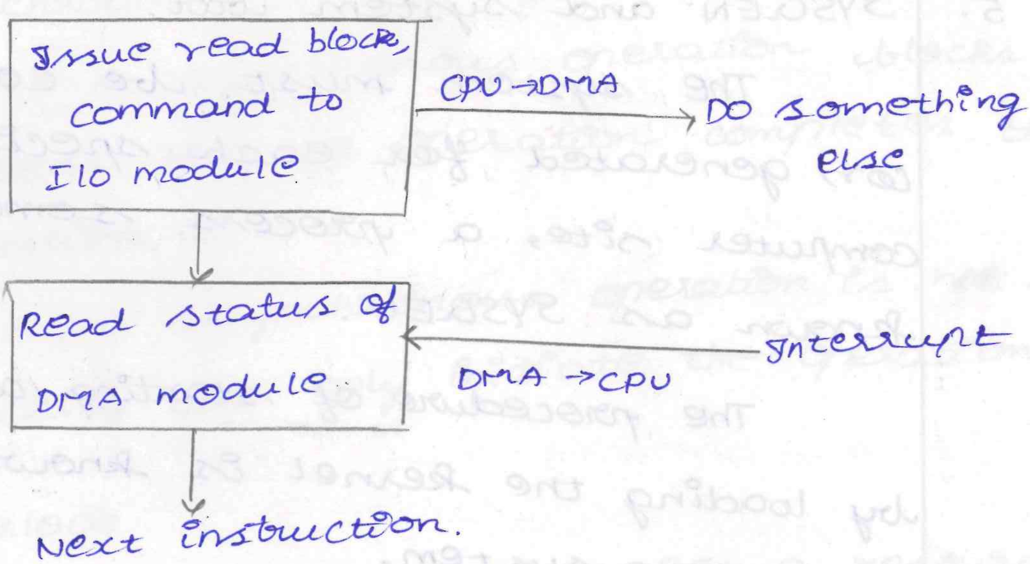
Operating system is a software that works as an interface between a user and the computer hardware.

* Convenience
* Efficiency
* Ability to evolve

3. DMA

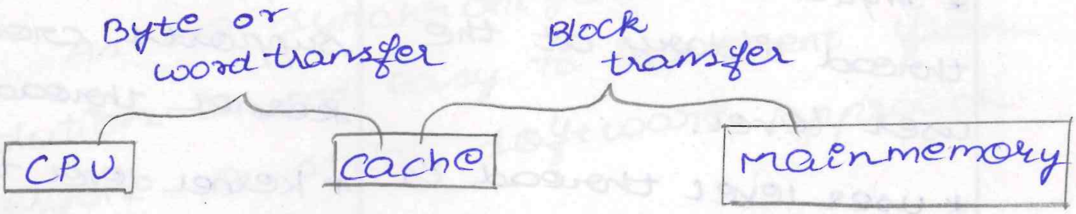
* Transfers a block of data directly to or from main memory.

* An interrupt is sent when the transfer is complete.



Cache memory

* processor speed faster than memory access speed.
* contains copy of portion of main memory



4) Interrupt differ from trap.

Hardware interrupt are called interrupts, while software interrupts are called exceptions (or) traps

An interrupt can be used to signal the completion of an I/o to obviate the need for device polling.

5. SYSGEN and system boot.

The system must be configured (or) generated for each specific computer site, a process sometimes known as SYSGEN.

The procedure of starting a computer by loading the kernel is known as booting the system.

6.

user level thread	kernel - level thread
* user-level thread are faster to create and manage.	* kernel-level threads are slower to create and manage.
* Implementation is by a thread library at the user level.	* Operation system supports creation of kernel thread.
* user level thread is generic and can run on any operation system.	* kernel level thread is specific to the operating system.

7. States of process.

* New
* Ready
* Running
* waiting
* Terminated.

8. Synchronous and Asynchronous communication

* A synchronous operation blocks a process till the operation completes the operation.

* An asynchronous operation is non-blocking and only initiate the operation.

9. Deadlock

A process must request a resource before using it. A process may request as many resources as it requires to fulfill its task.

10. Mutex locks.

As the synchronization hardware solution is not easy to implement from everyone, a strict software approach called mutex locks.

PART - B

11(a) Basic elements of computer.

1. Processor

* Control operation, performs data processing.

* Two internal registers.

-> Memory Address Register (MAR)

-> Memory Buffer Register (MBR)

* I/O Address register

* I/O Buffer register.

2. Main memory

* Volatile

-> Data is typically lost when power is removed.

* Referred to as a real memory (or) primary memory.

* consists of a set of locations defined by sequential number of addresses.

3. I/O modules.

* moves data between the computer and the external environment such as.

-> storage (eg: hard drive)

-> communication equipments

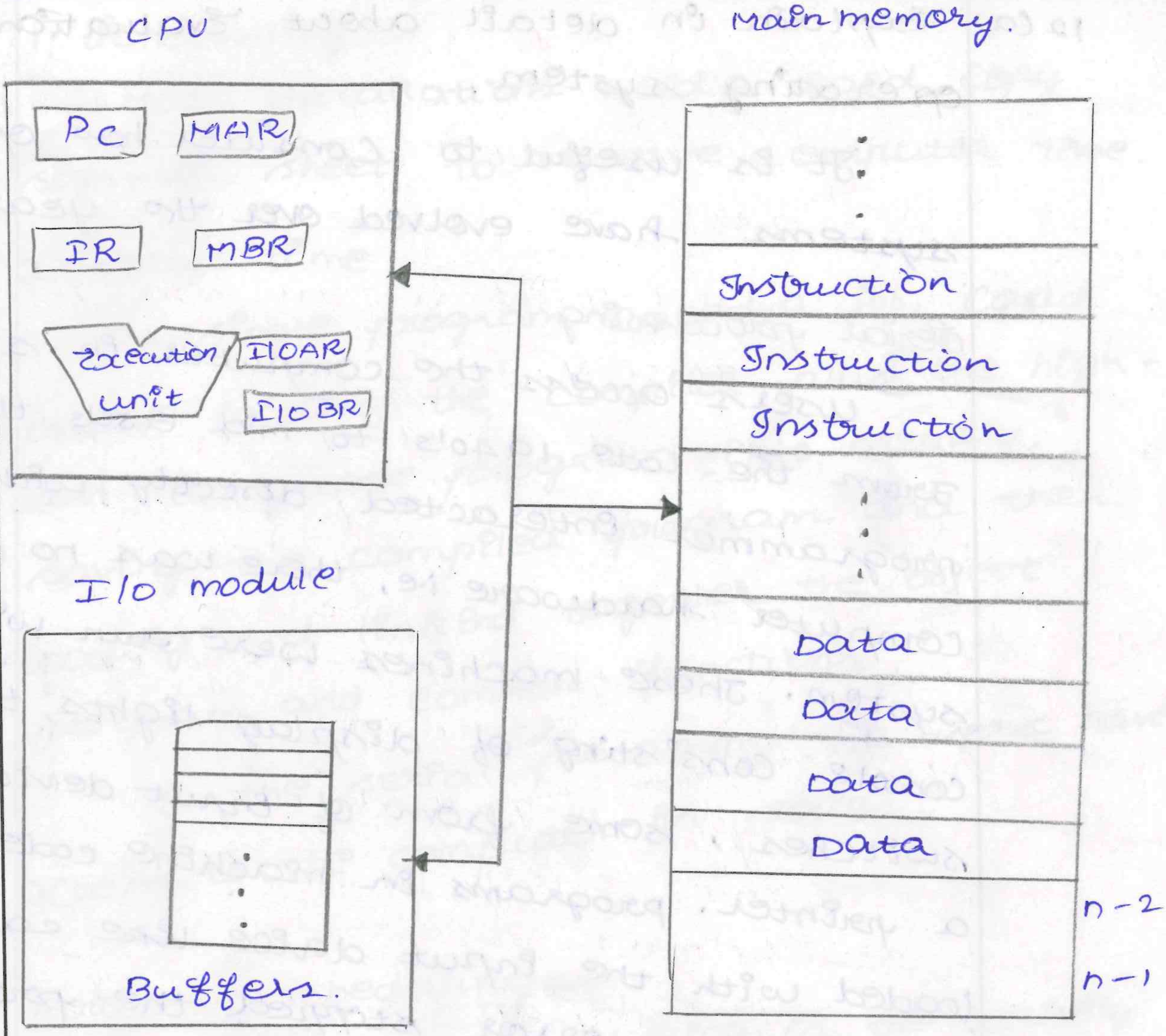
-> Terminals.

* specified by an I/O address register (I/O AR)

4. System Bus.

communication among processors, main memory and I/O modules. Indicates the top level components of a computer.

To exchange data with memory, two memory registers [1. Memory Address Register (MAR) and 2. Memory Buffer Register (MBR)] used similarly an I/O Address Register (I/O AR) is specifies a particular device.



An I/O Buffer Register (I/OBR) is used for the exchange of data between an I/O module and the processor.

An I/O module transfers data from external devices to processor and memory and vice versa.

12 (a) Explain in detail about Evaluation of operating system.

It is useful to consider how operating systems have evolved over the years.

Serial processing

users access the computer in series. From the late 1940's to mid 1950's the programmer interacted directly with the computer hardware i.e, there was no operating system. These machines were run with a console consisting of display lights, toggle switches, some from of input device and a printer. programs in machine code are loaded with the input device like card reader. If an error stopped the program, the error condition was indicated by the lights.

main problem here is the set up time. That is, single program needs to load source program onto memory, saving the compiled program.

The early systems presented two main problems.

1. Scheduling

Most installations used a hard copy sign-up sheet to reserve computer time.

2. Setup time

A single program, called a job, could involve loading the compiler plus the high-level language program into memory, saving the compiled program and then loading and linkend together the object program and common functions.

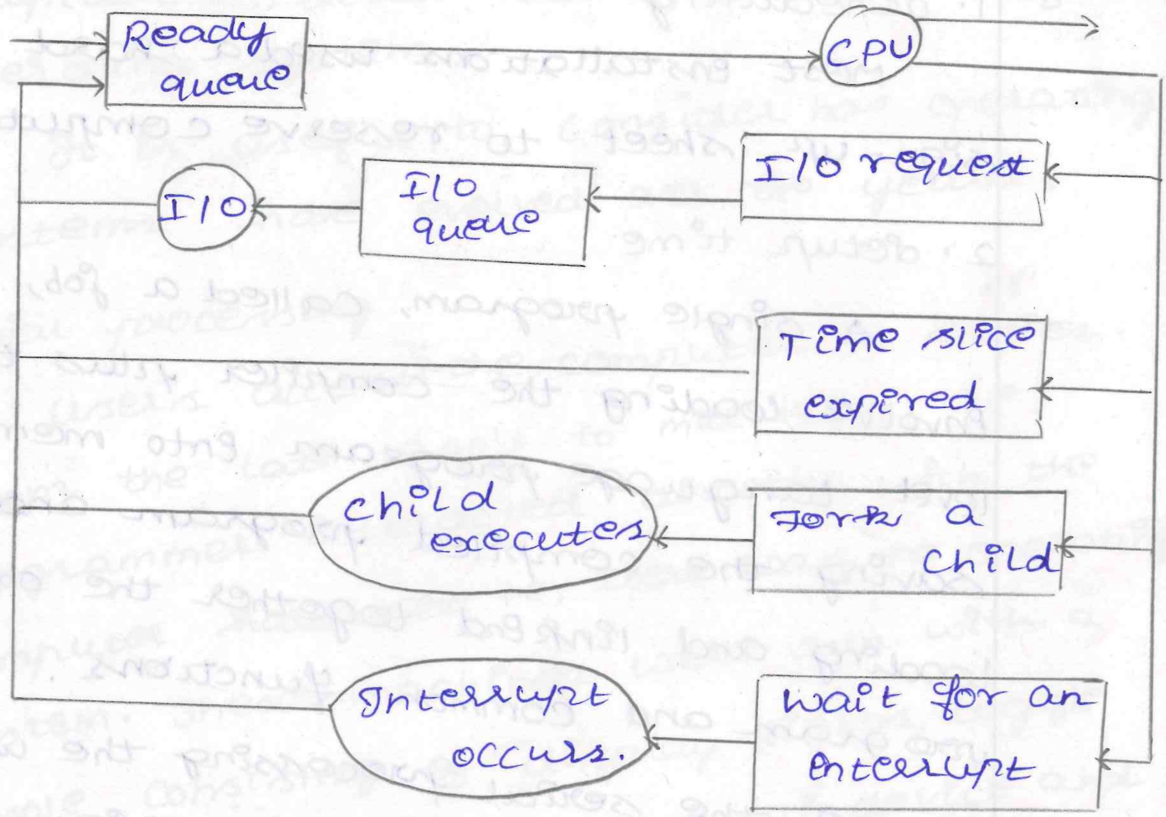
In the serial processing the users have access to the computer in series.

13 (b) Process scheduling

The process scheduling is the activity of the process manager that handles the removal of the running process from the CPU and the selection of another process on the basis of a particular strategy.

Scheduling Queues.

Scheduling queues refer to queues of process or device. When the process enter the system, then this process is put into a job queue. This queue consist of all processes in the system.



A common representation of process scheduling is a queuing diagram.

* Queue is represented by rectangular box.
* The circles represent the resources that serve the queues.
* The arrows indicate the process flow on the system.

Queues are of two types.

* Ready Queue
* Device Queue.

Two state process model

Two state process model refers to running and non-running states which are ~~described~~ now.

Running state

When new process is created by operating system that process enters into the system as in the running state.

Non-running state.

Process that are not running are kept in the queue, waiting for their turn to execute.

Schedulers

Schedulers are specials system softwares which handle process scheduling in various ways. There are three types of schedulers. They are:

Long term scheduler

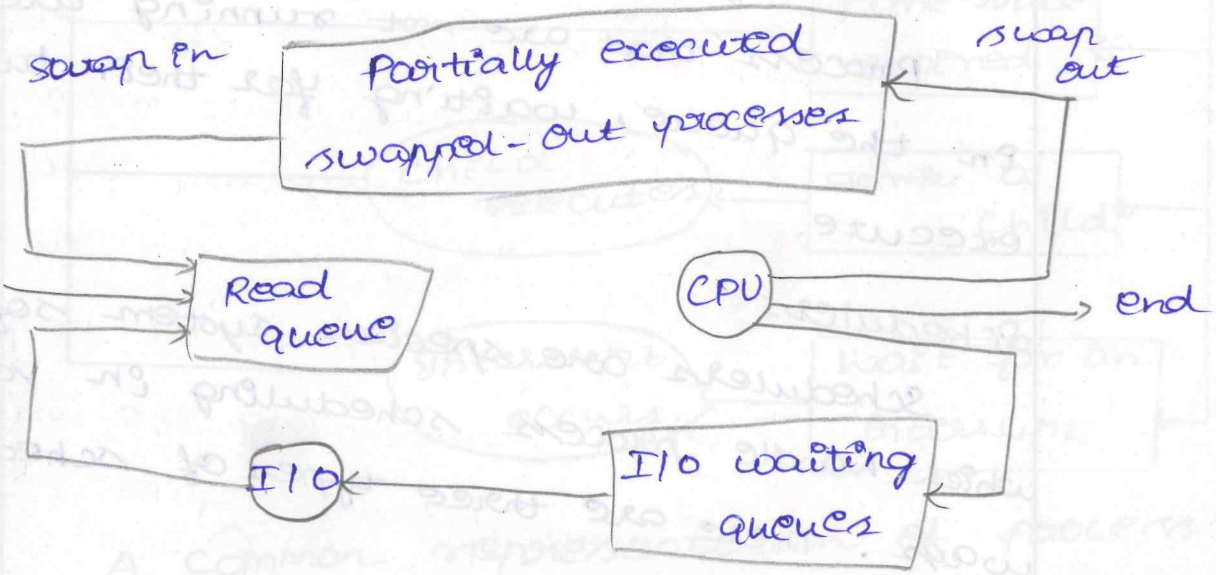
It is also called as job scheduler. Long term scheduler determines which programs are admitted to the system for processing. Job scheduler selects processes from the queue and loads them into memory for execution. Process loads into the memory CPU scheduling.

Short time scheduler.

Short term scheduler is also called as CPU scheduler. Its main objective is to increase the system performance in accordance with chosen set of criteria.

Medium term scheduler.

Medium term scheduler is part of the swapping. It removes the process from the memory



Context switch

Context switch times are highly dependent on hardware support. some hardware systems employ two or more sets of the processor registers to reduce the amount of the context switching time. when the process is switched, the following information is stored.

* Program counter
* Scheduling information
* Base and limit register value
* Currently used register
* Changed state
* I/O state
* Accounting

14(b) Inter process communication

* Mechanism for processes to communicate and to synchronous their action.

* Message system - processes communicate with each other without resorting to shared variables.

* IPC facility provides two operations:

1. Send - message size fixed or variable

2. Receive (message)

* If P and Q wish to communicate, they need to establish a communication link between them.

* exchange messages via send / receive

* Implementation of communication link

* Physical (eg: shared memory, hardware bus)

* Logical (eg: Logical properties)

Message passing system:

Message sent a process can be of either fixed or variable size. If only fixed size message can be sent, the system-level implementation is straight forward. On the other hand, variable size messages require a more complex system level implementation, but the programming task becomes simpler.

* Direct or indirect communication
* Symmetric or asymmetric communication
* Automatic or explicit buffering.
* Send by copy or send by reference
* Fixed - sized or variable - sized messages
* Synchronous or Asynchronous communication

Direct or Indirect communication:

In the direct communication, each process that wants to communicate must explicitly name the recipient or sender of communication.

Send (P, message) - send a message to process P

Recieve (Q, message) - Recieve a message from Q

Indirect communication.

With indirect communication, the messages are sent to and received from mailboxes. A mailbox can be viewed abstractly as an object into which messages can be placed by processes from which messages can be removed.

Send (A, message) - send a message to mail box A

Received (A, message) - Received a message mail box A.

Symmetric or Assymmetric communication

Process P sender	Process Q Receiver
.	.
.	.
send (Q, message);	receive (P, Q message);
.	.
.	.

In the symmetric naming, both sender and receiver must name the other for communication

Automatic or explicit buffering.

Automatic Buffering:

Automatic buffering provides a queue with indefinite length, thus ensuring the sender will never have to block while waiting to copy a message.

Explicit Buffering:

Explicit buffering specifies how large the buffer; In this situation, the sender may be blocked while waiting for available space in the queue.

15(b) Semaphores

In 1965, Dijkstra proposed a new and very significant technique for managing concurrent process by using the value of a simple integer variables of synchronize the progress of iterating processes. This integer variable is called semaphore. So it is basically a synchronizing tool and is accessed only through two low standard atomatic operation, wait and signal designated by p() and v() respectively.

The classical definition of wait and signal are:

wait: Decrement the value of its argument S as soon as it would become non-negative.

Signal: Increment the value of its argument, S as an individual operation

Properties of semaphores.

1. Simple
2. works with many processes
3. can have many different critical sections with different semaphores.
4. each critical section has unique access semaphores
5. can permit multiple process into the critical section at once, if desirable.

Types of semaphores

Semaphores are mainly of two types.

1. Binary semaphore

It is a special form of semaphore used for implementing mutual exclusion, hence it is often called mutex. A binary semaphore is initialized to 1 and only takes the value 0 and 1 during execution of a program.

2. Counting semaphores.

These are used to implement bounded concurrency.

Limitations of semaphores.

1. priority inversion is a big limitation on semaphores.

2. Their use is not enforced, but is by convention only.

3. With improper use, a process may block indefinitely, such a situation is called deadlock.

PART-C

16(a) FCFS - The table corresponding to FCFS is given below.

Process	Burst time (milliseconds)
P_1	10
P_2	1
P_3	2
P_4	1
P_5	5

Grant chart for the above table is

0 – 10	10 – 11	11 – 13	13 – 14	14 – 19
P_1	P_2	P_3	P_4	P_5
10ms	1ms	2ms	1ms	5ms

waiting time for process P1 = 0 millisecond
waiting time for process P2 = 10 millisecond
waiting time for process P3 = 11 millisecond
waiting time for process P4 = 13 millisecond
waiting time for process P5 = 14 millisecond.

Average waiting time = $\frac{0+10+11+13+14}{5}$ millisecond

$= \frac{48}{5}$ millisecond

$= 9.6$ millisecond.

Turn around time for process P1 = 10 ms
Turn around time for process P2 = 11 ms
Turn around time for process P3 = 13 ms
Turn around time for process P4 = 14 ms
Turn ... process P5 = 19 ms

Average waiting time $= \frac{10+11+13+14+19}{5}$ ms

$= \frac{67}{5}$

$= 13.4$ ms

SJF - The table corresponding to SJF is given below.

Process	Burst time (milliseconds)
P2	1
P4	1
P3	2
P5	5
P1	10

Grant chart for the above table is

0 – 1	1 – 2	2 – 4	4 – 9	9 – 19
P2	P4	P3	P5	P1
1ms	1ms	2ms	5ms	10ms

waiting time for process P2 = 0 millisecond
waiting time for process P4 = 1 millisecond
waiting time for process P3 = 2 milliseconds
waiting time for process P5 = 4 milliseconds
waiting time for process P1 = 9 milliseconds.

The average waiting time $= \frac{0+1+2+4+9}{5}$ ms

$= \frac{16}{5}$

$= 3.2$ ms

Turn around time for process P2 = 1 ms

Turn around time for process P4 = 2 ms

Turn around time for process P3 = 4 ms

Turn around time for process P5 = 9 ms

Turn around time for process P1 = 19 ms

Average turn around time $= \frac{1+2+4+9+19}{5}$

$= \frac{35}{5}$ ms

$= 7$ ms

(ii)

Scheduling type	Average waiting time (millisecond)	Average turn around time
First come, first served	9.6	13.4
Shortest job first	3.2	7.0
Priority	8.2	12.0
Round robin	5.4	9.2

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Continuous Internal Assessment	I						Unit Test					
Register Number	4	2	2	1	1	8	1	0	5	0	1	7
Department	EEE							Semester	VII			
Subject Code	EE-8703		Subject Title	Renewable Energy Systems								
Date & Session	07.10.2021 & FN							No. of Pages used	9			

B. MARY AMALA JENNI	
Name of the Hall Superintendent	Signature of the Hall Superintendent

Instruction to the Candidate: Put a tick mark (✓) for the questions attended in the tick mark column against each question in Valuation Box

PART - A Q.No.	✓	Marks	PART - B &C Q.No.		i ✓	i Marks T	i Marks D	ii ✓	ii Marks T	ii Marks D	iii ✓	iii Marks T	iii Marks D	Total Marks
1	✓	✓	11	a	✓	8								8
2	✓	✓		b										
3	✓	✓	12	a	✓	11								11
4	✓	✓		b										
5	✓	✓	13	a	✓	10								10
6				b										
7			14	a										
8				b										
9			15	a										
10				b										
Total		10	16	a										
				b										
											Total			29
Grand Total			Grand Total (in words)											
Name of the Examiner					Signature of the Examiner									

39/50

78%

A. Prasanna

PART-A

1. Sustainable Development:

* Sustainable energy is produce the process to "meets the needs of present contribution and the future by its own.

* These development is know as the sustainable development.

2. Conventional Energy sources:

* Coal
* Oil
* Petrolium (or) Natural gas
* Thermal Power Plant
* Nuclear Power Plant

3. Maximum Power:

$$P_o = \frac{1}{2} \rho A V^2 C_p$$

$$C_p = \frac{\left(1+\frac{V_o}{V}\right)\left(1-\left(\frac{V_o}{V}\right)^2\right)}{2}$$

P -> Mechanic power in the moving air

ρ -> Air density

A -> Area shept by the rotor blade

V -> Velocity in the air

4. Main Components of Wind Power Plant:

* Tower
* Rotor
* Generator
* Nacelle
* Foundation (or) Base

5. Yaw Control:

* Yaw is placed on the drive to change the direction, based on wind direction.

* Mechanism of Yaw Control to the rotating speed based and wind.

PART-B

6. a)

Fossil Fuel:

* The Most of Environmental problems are caused by the fossil fuels.

* The problems are harmed gas, defused chemical, oil and Coal.

* The major Component of causes the earth surface is Carbon-dioxide.

* Fossil fuels mostly used in risk free places.

* The harmed gas is known as the Unwanted and waste gas in earth surface.

* The Defused Chemical Components from factory affects the surface.

* The oil wastes are the most significant problem in the fossil fuel.

* The Coal based problems are mostly affects the air surface.

* Fossil fuels are the large process for energy source.

* Fossil fuels are the best of the renewable energy source.

* Fossil fuel components are used for the environmental problems.

* It is used in the air surface of earth.

* It is also used in the closed surface.

7. a)

Types of Wind Power Plant:

* Wind is classified either by the scale, the kind of force which causes them, or geographical region of which they exist.

* Prevailling wind.
* Seasonal wind.
* Synoptic scale wind.
* Mesoscale wind.
* Microscale wind.

Wind Resources:

* Surface components does not affect the the wind speed and WPP.

* The wind resoures may be the type soure absorbed by the Wind Power Plant.

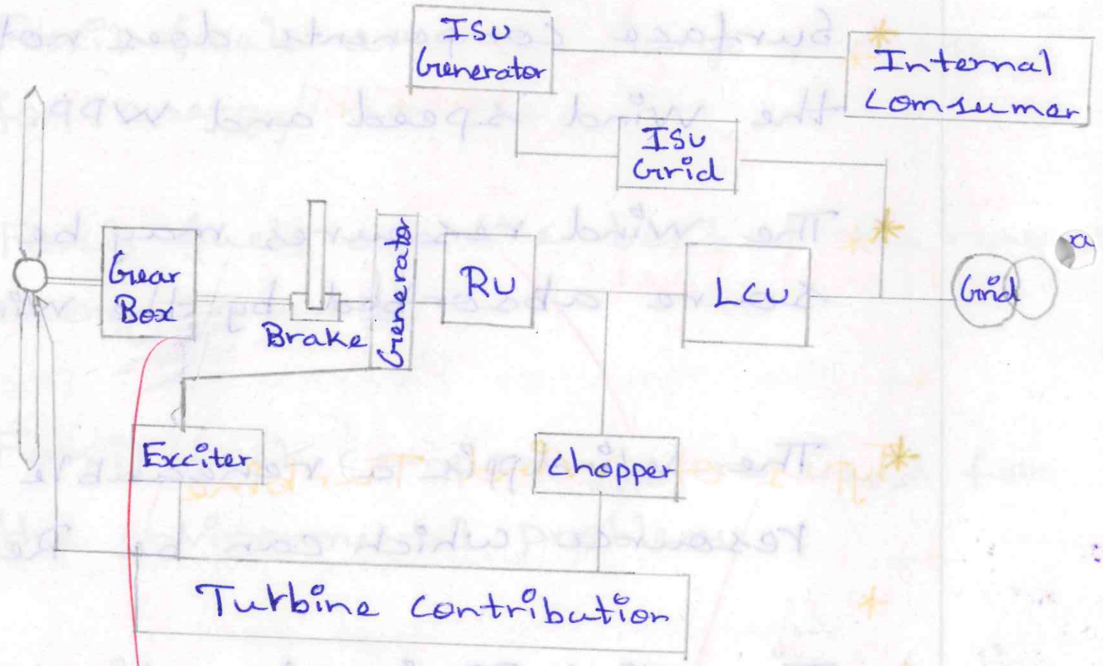
* The Windppis a renewable energy resource which can be Renewabled.

* The Wind PP is placed on wind direction and risk free places.

Wind Turbine Resources:

* The main component for the wind Power plant is its turbine.
* The Turbine output is the mechanical energy source.
* The Turbine is connected with the wind blades
* Some Wind turbine have the Gearbox and brake system in it.

Working of Wind Turbine:



ISU - Internal System unit
RU - Rectifier unit
LCU - Local Control unit

* When the wind hits the ~~rotor~~ blade, the rotor will rotating.

* The rotor is Connected with the gearbox for increasing the speed.

* The Gearbox have the brake system to Control during wind direction changes.

* Then the Generator connected with the turbine system.

* The Generator is Converted the mechanical energy to electrical energy.

* The Recitifier unit used to control recitifier system.

* The Grid is Connected with the Internal system unit.

Types of Wind Turbine:

* Horizontal Wind Tubine
* Vertical wind Turbine

PART-C

8. a)

Working of Wind Energy Conversion Systems

* The rotor will rotates when the wind is hits rotor blades.

* The rotor is connected with the Gearbox System to increase speed.

* The gearbox have a brake to control during charges in wind direction.

* The Generator is connected with the turbine system.

* The Generator converts the mechanical energy into electrical energy.

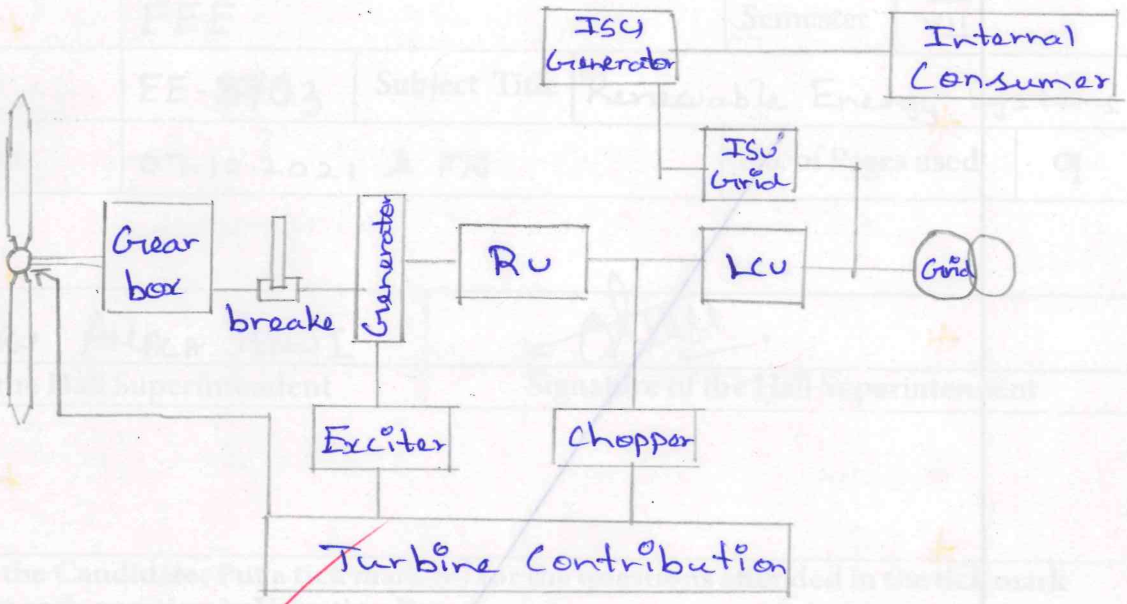
* The Recifier unit and Local Control Unit interconnect with the Chopper.

* The Exciter connected with the Generator for excitation process

* The Grid is connected with the Internal system unit.

Types of Wind Turbine:

* Horizontal Wind Turbine
* Vertical Wind Turbine



For 1/4 Marks. not sufficient ?

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Continuous Internal Assessment	III	Unit Test	

Register Number	4	2	2	1	1	8	1	0	6	0	2	1

Department	ECE	Semester	
Subject Code	EC8702	Subject Title	AD HOC Wireless Sensor Networks
Date & Session	23.11.21.	No. of Pages used	

S. Durai Raj	S. Durai
Name of the Hall Superintendent	Signature of the Hall Superintendent

Instruction to the Candidate: Put a tick mark (✓) for the questions attended in the tick mark column against each question in Valuation Box

PART - A

Q.No.	✓	Marks
1	✓	2
2	✓	2
3	✓	2
4	✓	2
5	✓	2
6	✓	2
7	✓	2
8	✓	2
9	✓	2
10		
Total		20

PART - B & C

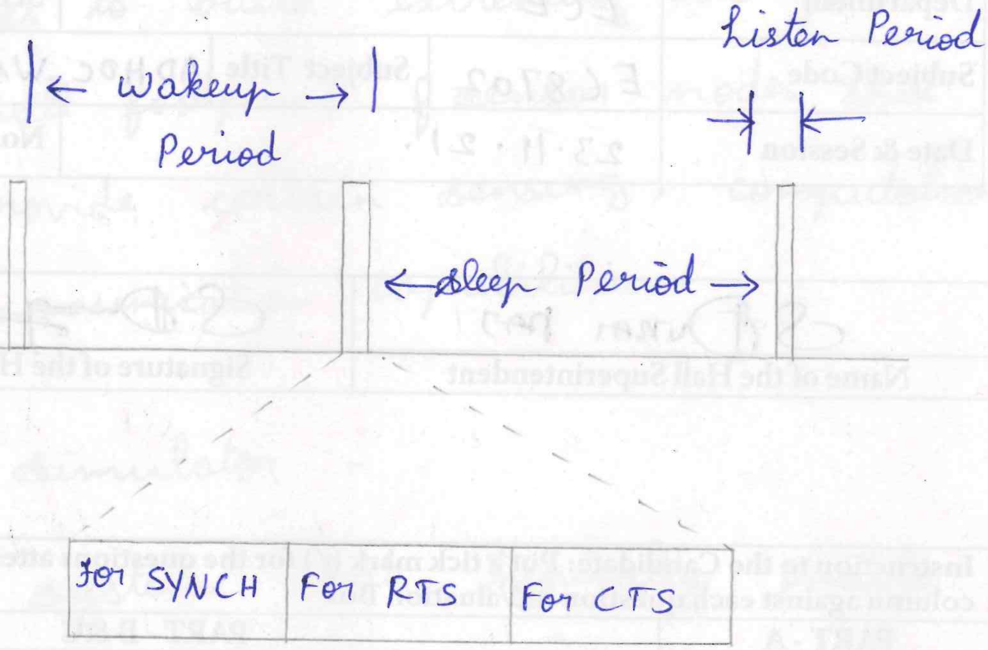
Q.No.		i ✓	i Marks T	i Marks D	ii ✓	ii Marks T	ii Marks D	iii ✓	iii Marks T	iii Marks D	Total Marks
11	a	✓	13								13
	b										
12	a										
	b	✓	13								13
13	a	✓	13								13
	b										
14	a										
	b	✓	13								13
15	a	✓	13								13
	b										
16	a										
	b	✓	14								14
										Total	79

Grand Total	99	Grand Total (in words)	
Name of the Examiner	D. UMAMAHESWARI	Signature of the Examiner	D. Umamaheswari

99/100

PART - B.

11.)
a.) S-MAC Protocol in WSN.



1) First Phase

* In the first phase (SYNCH), node x accepts SYNCH packets from its neighbors.

* In these packets, the neighbors describe their own schedule and x stores their schedule in a table (the schedule table).

PART - B

11.) a.) Explain about S-MAC Protocol in WSN.

* The S-MAC (Senor-MAC) Protocol Provides mechanisms to circumvent idle listning collisions, and overhearing.

* S-MAC adopts a periodic wakeup scheme, that is, each mode alternates between a fixed length listen Period and a fixed-length sleep Period according to its schedule.

* The listen period of S-MAC can be used to receiver and transmit Packets.

* S-MAC attempts to coordinate the schedules of neighboring nodes such that their listen Periods start at the same time.

* Node x's SYNCH phase is subdivided into time slots and x's neighbors contend according to a CSMA scheme with additional backoff.

2.) Second Phase.

* In the second phase (RTS Phase) x listens for RTS packets from neighboring nodes.

* In S-MAC, the RTS/CTS handshake is used to reduce collisions of data Packet due to hidden-terminal situations.

* Again, intersted neighbors contend in this phase according to a CSMA scheme with additional backoff.

3·) Third Phase.

* In the third Phase (CTS Phase), node x transmits a CTS Packets if an RTS Packet was received in the previous Phase. After this, the packet exchange continues, extending into x's nominal sleep time.

Working of S·MAC Protocol.

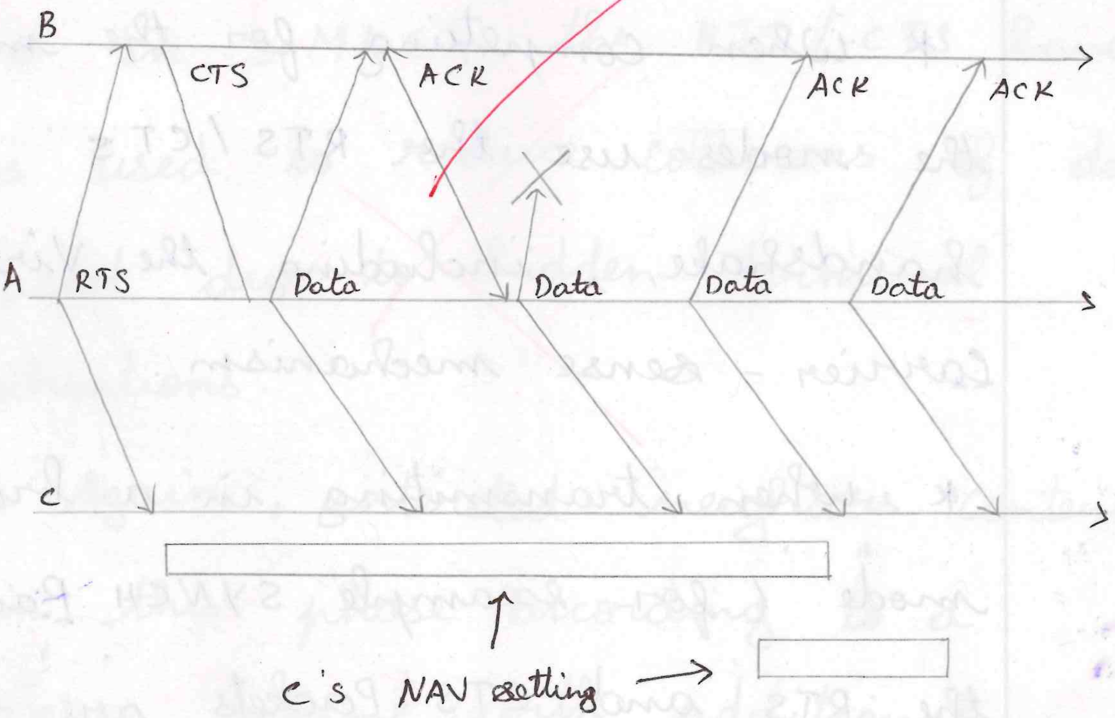
* When competing for the medium, the nodes use the RTS / CTS handshake, including the Virtual carrier - sense mechanism.

* when transmiting in a broadcast mode (for example SYNCH Packet), the RTS and CTS Packets are dropped and the nodes use CSMA with backoff.

* If we can arrange that the schedules of node x and its neighbors are synchronized, node x and all its neighbors wake up at the same time and x can reach all of them with a single SYNCH Packet.

* The S-MAC Protocol allows neighboring nodes to agree on the same schedule and to create <u>virtual clusters</u>.

*



S-MAC includes a fragmentation scheme.

* A series of fragments is transmitted with only one RTS / CTS exchange between the transmitting node A and receiving node B.

* After each fragment, B has to answer with an acknowledgment Packet.

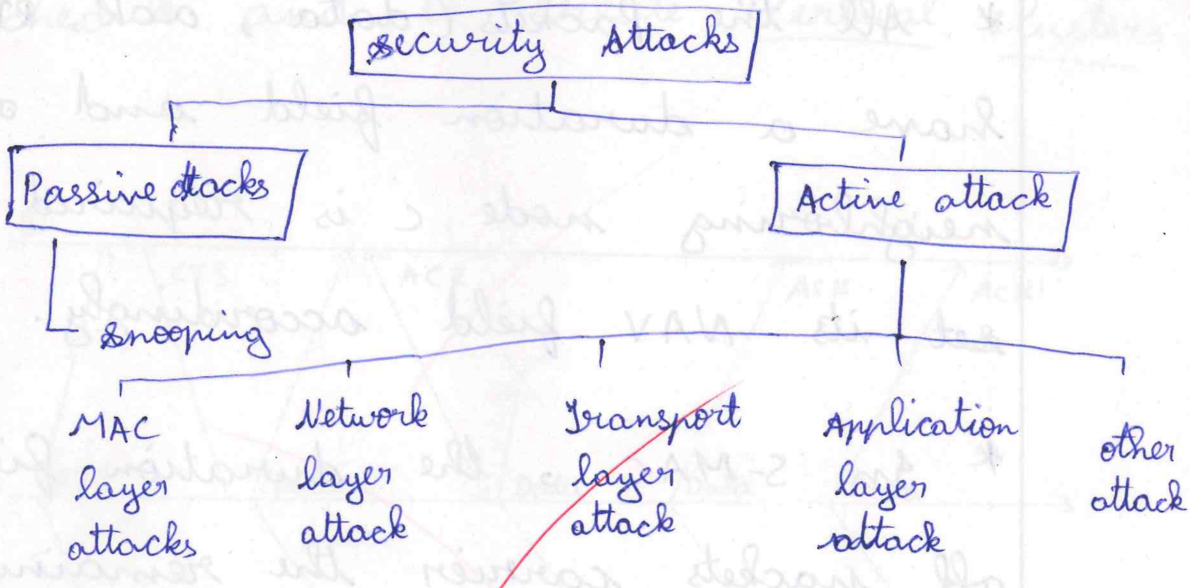
* All the Packets (data, ack, RTS, CTS) have a duration field and a neighboring node c is required to set its NAV field accordingly.

* In S-MAC, the duration field to all packets carries the remaining length of the whole transaction, including all fragments and their acknowledgments. Therfore, the whole message shall be Passed at once.

Drawbacks :-

* It is hard to adapt the length of the wakeup period to changing load situations, since this length is essentially fixed, as is the length of the listen period.

12.) b.) Various network and application.



Attacks on adhoc wireless networks can be classified into 2 broad categories, namely

1.) Passive attack.

* It does not disrupt the operations of the network, the adversary snoops the data echanged in the network without altering it.

* one way to overcome such problems is to use powerful encryption mechanisms to encrypt the data being transmitted.

2.) Active attack.

* An active attack attempts to alter or destroy the data being exchanged in the network, thereby disrupting the normal functioning of the network.

* They can be further classified into 2 categories.

i.) External attack, which are carried out by nodes that do not belong to the network can be prevented using standard encryption techniques and firewalls.

ii.) Internal attacks are from compromised nodes that are actually part of the network.

Network layer Attacks.

There are many types of attacks pertaining to the network layer in network protocol stack. Some of their are as follows.

i) Wormhole attack.

* In this attack, an attacker receives packets at one location in the network & tunnels them (possible selectively) to another location in the network, where the packets are

resent into the network. This tunnel between 2 colliding attackers is referred to as a wormhole.

* If proper mechniasm are not employed to defend the network may fail to find valid routes.

2.) Blackhole attack.

* In this attack, a malicious node falsely advertises good paths to destination node during path packets being sent to the destination node.

3.) Byzantine attack.

Here, a compromised intermediate note or a set of compromised intermediate node work in collision & carries out attack such as creating routing loops, routing packets on non-optimal Paths & selectively dropping Packets.

4.) Information disclosure.

A compromised node may leak confidential or important information to unauthorized node in the network.

5.) Resource consumption attack.

In this attacks, a malicious node tries to consume/waste resource of other nodes present in the network.

6.) Routing attacks:

There are several types of attacks mounted on routing protocol & they are as follows.

i) Routing table overflow:

ii) Routing table Poisoning

iii) Packet replication.

iv) Route cache poisoning.

v) Rushing attack.

Transport layer attack

1.) Session hijacking.

Here, an adversary takes control over a session between 2 node.

Application layer attack.

1.) Repudiation:

It refers to the denial or attempted denial by a node involved in a communication of having participated in all or Part of the communication.

other attacks :-

It discusses security attacks that cannot strictly be associated with

Multi - layer attacks :

1.) Denial of Service.

2.) Impersonation.

3.) Device tampering.

13.)

a.) Key Management approaches and Asymmetric algorithms.

* Inorder to overcome the attacks. Various techniques are employed.

* CRYPTOGRAPHY is one of the most common & reliable means to ensure security & can be applied to any communication network.

Symmetric Key Algorithms.

* Symmetric key algorithms rely on the presence of shared key at both the sender & receiver. which has been exchanged by some previous

* They are 2 kinds of symmetric key algorithms,

i) one involving block ciphers &

ii) The stream ciphers.

Asymmetric key algorithm.

* Asymmetric key (or public key) algorithm use different keys at the sender & receiver ends for encryption & decryption, respectively.

* Let the encryption Process be respresented by a function F & decryption by D.

RSA algorithm

* RSA algorithm is the best example of public key cryptography.

* Digital signatures schemes are also based on Public key encryption.

* This is usually a governmental or business organisation.

Key managment appraches.

* The Primary goal of key managem is to share (some information) among a specified set of Participants

* The main appraaches to key management are key predistribution key transport, key arbitration and key agrement.

1.) Key predistribution

Key predistribution, as the name suggests, involves distributing key to all interested parties before the start of communication.

2.) Key transport.

In key transport systems, one of the communicating entities generates keys & transports them to the other members.

* 3.) Key arbitration :-

Key arbitration schemes use a central arbitractor to create & distribute keys among all participates.

4.) Key agrement.

Key agrement protocols are used to establish a secure contesct over which a session can be run, starting with many parties who wish to communicate & an insecure channel.

13

14.)
b.) Node level Software Platforms for sensor networks.

operating system : Tiny OS.

* Tiny OS aims at supporting sensor network applications on

resource - constrained hardware platforms, such as the Berkeley motes.

* To ensure that an application code has an extremely small footprint.

* Tiny OS chooses to have no file system, supports only static memory allocation, implements a simple task model, and provides minimal device and networking abstractions.

* An application, typically developed in the nesC language covered in the next section, wires these components together with other applications - specific components.

* A diagram of the field Monitor applications is shown in above figure, where blocks represent tiny OS components and arrows represent function calls among them.

Timer component of the field Monitor application.

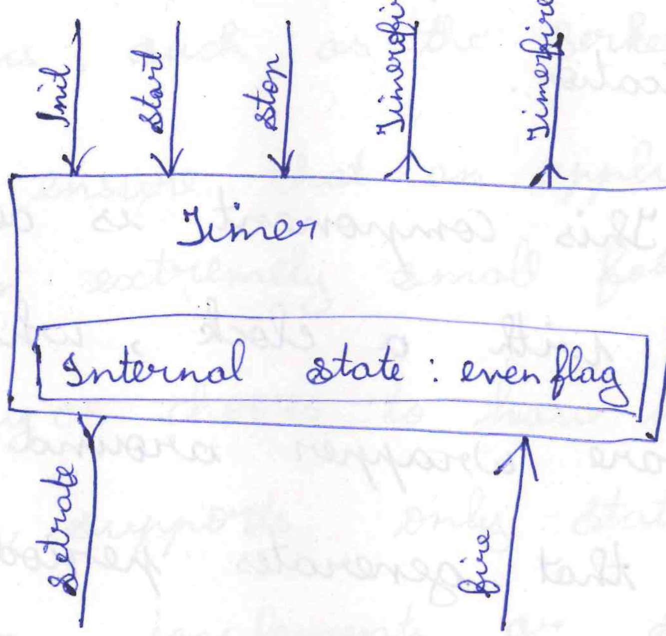
* This component is designed to work with a clock, which is a software wrapper around a hardware clock that generates periodic interrupts

* The method calls of the Timer component is are shown in the figure as arrowheads.

* An arrowhead pointing into the component is a method of the component that other components can call.

* The absolute directions of the arrows up or down, illustrate this component's relatiponshi with other layers.

* For exampl, the timer depends on a lower layer HWC lock component.



* A Program executed in tinyOS has two contexts, tasks and events, which provide two source of concurrency.

* Tasks are create (also called Posted) by components to a task scheduler.

13

* The scheduler invokes a new task from the task queue only when the current task has completed.

* when no tasks are available in the task queue, the scheduler puts the CPU into the sleep mode to save energy.

15.) Components of node level simulators.

a.)

Node - level design methodologies are usually associated with simulators that simulate the behavior of a sensor network on a per- node basis.

* Sensor node model.

* A node in a simulator acts as a software execution platform, a sensor host, as well as a communication terminal.

* In order for designers to focus of the application - level code, a node model typically provides or simulates a communication Protocol stack, sensor behaviors and operating nodes needs to be modeled.

Communication model:

Depending on the details of modeling, communication may be captured at different layers.

* Altermately, the communication may be simulated at the MAC layer or network layer, using e.g, stochastic processes to represent low-level-behaviors

Physical environment model:

* A key element of the environment within which a sensor network operation is the Physical phenomenon of interest.

Statistics and Visualization.

* The simulation results need to be collected for analysis.

* Depending on how the time is advanced in the simulation, there are two types of exection models: cycle-driven (CD) simulation and discrete-event (DE) simulation.

cycle-driven (CD) simulation & discrete-event (DE) simulation.

* A CD simulation discretizes the continuous notion of real time into (typically regularly spaced) ticks and simulates the system behavior at these ticks

* Synchronous languages, which are typically used in control system design rather than sensor network designs, do allow cyclic dependencies.

* They use a fixed point semantics to define the behavior of a system at each tick.

13

* Another class of simulators is on network modeling, protocols stacks, and simulation performance.

PART - C

16.)

b.) i) Cooja simulator.

* Cooja is an emulator

* According to different sources, an emulator is :

* a hardware or software system that enables one computer system.

* Cooja is not a simulator.

* Cooja is a contiki network emulator

* The code to be executed by the node is the exact same firmware you may upload to Physical nodes.

* Allows large and small networks of motes to be simulated & Motes can be emulated at the hardware level.

* Cooja a highly useful tool for contiki development.

* It allows developers to test their code and systems long before running it hardware.

ii) Simulator - TOSSIM used for WSN.

* TOSSIM is a dedicated Simulator for Tinyos applications running on one or more Berkeley motes.

* The key design decisions on building TOSSIM were to make it Scalable to a network of Poteniaully thousands of nodes, and to be able to use the actual software code in the Simulation.

* The event - driven execution model of TinyOS greatly Simplifies the design of TOSSIM.

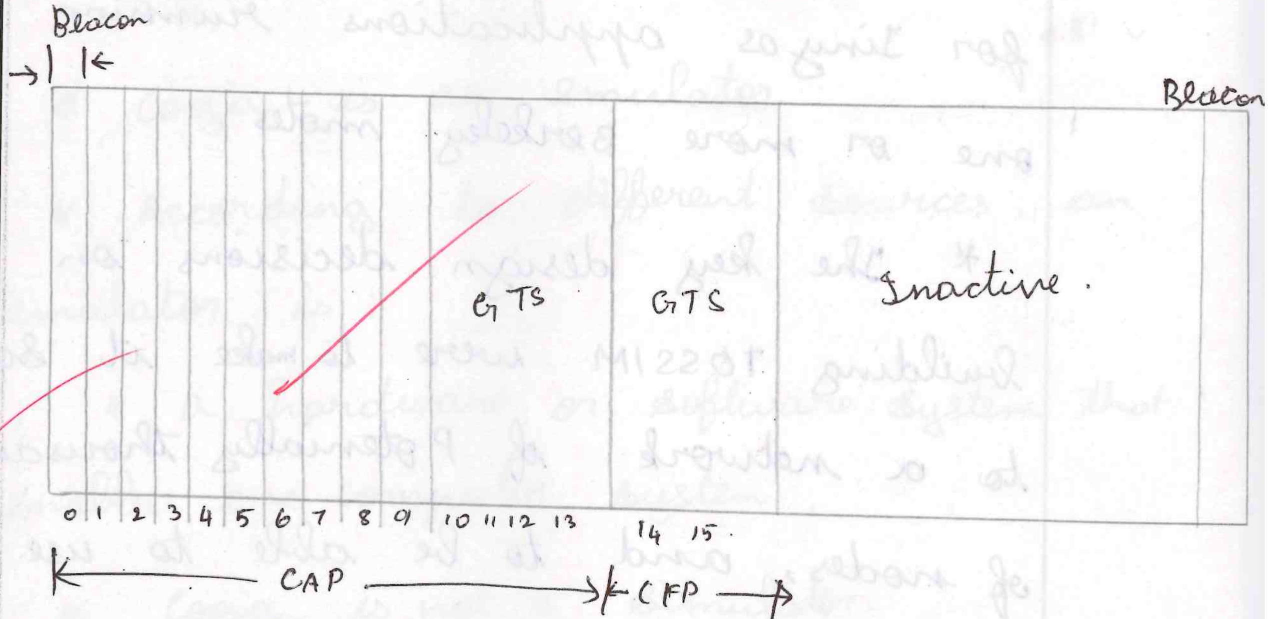
14

* Tiny Viz also provides mechanisms to control a running simulation by. eg. modifying ADC readings, changing channel properties, and injecting Packets.

* Beside the default Visual interfaces, users can add application - specific onces easily.

PART - A.

1.) IEEE 802.15.4.



2.) Computer systems organization dependable and fault tolerant system and network.

* General and reference Cross compeling node and technolow

* Mathematics of compeling.

3.) Session hijacking :-

Session hijacking is a technique used by hackers to gain access to a target computer or online accounts.

4.) denial of service attacks.

A denial - of - service attack is a cyber attack in which perpefrator seeks to make a machine or network resource unavailable to its intended users by temporarity or idenfinitely disropting services of a host connected to anetwork.

5.) structure of LEACH.

W	5	7	2	13	12	6	8	10
X	1	3	11	14	1	3	11	14
Y	4	2	9	4	2	9	4	2
Z	18	20	18	20	18	20	18	20

6.)

Wormhole attacks	Blackhole attacks.
* An attacker receives Packet at one location in the network tunnels them to another location in the network.	A malicious nodes falsely adverties good Paths to the destination node during the Path finding Process.

7.) Features of SOC nodes :-

The goal is to find new ways of integrating CMOS, MEMS, and RF technologies to build extremely low power and small footprint of sensor nodes that still provide certain sensing, computation and communication capabilities.

8.) Cooja simulator :-

A system that typically enables the host system to run software or use peripheral devices designed for the guest system : eg. Cooja enabling your laptop to run the RPL protocol. LIBP and / or other IoT protocols of interest.

9.) Features of MICA mode :

* The MICA motes have a two-CPU design.

* The main microcontroller (MCU), an Atmel ATmega103L, takes care of regular

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Continuous Internal Assessment	III	Unit Test	-
Register Number	4 2 2 1 1 8 1 1 4 3 0 2		
Department	MECHANICAL	Semester	VII
Subject Code	ME8793	Subject Title	process planning and cost estimation
Date & Session	25.11.2021 - FN	No. of Pages used	17.

M. SAHINIPPRIYA	[signature]
Name of the Hall Superintendent	Signature of the Hall Superintendent

Instruction to the Candidate: Put a tick mark (✓) for the questions attended in the tick mark column against each question in Valuation Box

PART - A

Q.No.	✓	Marks
1	✓	2
2	✓	2
3	✓	2
4	✓	2
5	✓	2
6	✓	2
7	✓	2
8	✓	2
9	✓	2
10	✓	2
Total		20

PART - B & C

Q.No.		i ✓	i Marks T	i Marks D	ii ✓	ii Marks T	ii Marks D	iii ✓	iii Marks T	iii Marks D	Total Marks
11	a	✓	12								12
	b										
12	a	✓	12								12
	b										
13	a										
	b	✓	12								12
14	a	✓	12								12
	b										
15	a										
	b	✓	12								12
16	a	✓	13								13
	b										
									Total		73

Grand Total	93	Grand Total (in words)	Nine Three
Name of the Examiner	P. Murugan	Signature of the Examiner	[signature]

PART - A

1) * The overhead cost is, Indirect labour cost, Indirect material cost, and other expence including service. Which can be conventionly changed in to specific of unit.

It can be followed as,

* production expence
* factory expence
* Administrative expence
* Selling expence
* Distribution expence

2. * Relaxiation allowance

(i) fatigue allowance

(ii) personal allowance

* process allowance
* Interference allowance
* contincy allowance
* special allowance

3. * Roll forging it is used for draw the bar stock. i.e. reducing the cross-section and increase the length. Special roll forging machine is decrease the cross-section in use of roll forging.

4. Material cost,

Material cost = Gross weight x price/kg

Gross weight = Net weight + losses of the metal

Net weight = Volume of the metal + density of roll forging.

5. Cost accounting,

In this cost the system account in which the systematically and accurately a device every expenditure in order to determine the cost of product in which after knowing the different expenditure incurring various department.

6.	Cost estimating — Cost accounting.
	* It gives an expected cost The product based on the calculation and standard formula. certain establised rule. — It gives an Annual cost The product based on the data collected and different expenditure is accurately done.
7.	* depreciation due to physical condition
	* wear and tear physical decay accident
	* poor maintance of equipment
	* depreciation due to functional condition.
	* condency obsolence
8.	* Scale loss
	* flash loss
	* toungs hold loss
	* sprue loss
	* Shear loss.

9. Machining time,

* In This machining time, The work complete The component. ie, The time is The tool touch of The workpiece and The tool leaves on The component after completion operation The machining time depends upon The material machining speed, feed, depth of cut, and different cut material.

10. Machining time calculation,

* calculation on The length (L)

* Calculation on The feed (f) and depth of cut.

* calculation on The speed (S) and RPM (N)

1000 S/ π D.

* using The machining time formula.

PART - B

13. b. Solution :-

Direct material Cost = Cost of raw material in stock 1-04-2003 + Raw material purchased - Cost of raw material in stock 31-03-2004.

= 10,000 + 25,000 - 15,000

= 50,000

prime cost = Direct material Cost + Direct labour Cost + Direct expence

= 50,000 + 14,000 + 1000

= 65,000

factory cost = prime cost + factory expence

= 65,000 + 9750

= 74750

production Cost = factory cost + Administrative expenditure

= 74,750 + 6500

= 81250

total cost = production cost + Selling expence

= 81250 + 3250

= 84500

Selling price = 84500 + 10 percent of 84500

= 92950.

prime cost / Item = 65000 / 650 = 100

factory cost / Item = 74750 / 650 = 115

production cost / Item = 81250 / 650 = 125

total cost / Item = 84500 / 650 = 130

Selling price / Item = 92950 / 650 = 143

14 a) Given data,

unit on belt = 100 per hour

material cost = 375

Labour Cost = 245 office on cost = 30%

direct expence = 80

Sales price = 11.20

factory expense = labour cost x1.5

= 245 x1.5

= 367.5

prime cost = 375 + 245 +80

= 700

factory cost = prime cost + factory expence

= 700 + 367.5

= 1067.5

office on cost = 0.3x 1067.5

= 320.25

Total Cost = 1067.5 + 320.25

= 1387.75

A factoy product 100 bolt and neut

$= \frac{1387.}{100} = 13.87$

Sales price = 11.30

= 13.87 − 11.30

= 2.57

The company lossy 2.57 l.

11

---

15 b) Given data,

drill holes = 4,

depth of holes = 2 cm = 20 mm

diameter of hole = 2 cm = 20 mm

cutting speed = 21.9 m/min

feed = 0.02 cm/rev

Solution,

Depth of hole = L + 0.3(d)

= 2 + 0.3(2)

= 2.6

$$\text{Rpm } N = \frac{1000 V}{\pi D} = \frac{1000 \times 21.9}{3.14 \times 20}$$

= 350 rpm

$$T_m = \frac{\text{depth of hole}}{(\text{feed} \times \text{rpm})}$$

$$= \frac{2.6}{(0.02 \times 350)} = 0.3714.$$

T_m = Time required = 4 × 0.3714

= 1.485

11 objectives of cost estimation,

a) * The product making selling price.

* To ascertain weather proposed on the material machining, marketing, profitability

* The establish how much of invested in the product testing.

* Too establish the material assemblies the cheaply fabricated (or) marketed (make or by decision)

* To the most economical cost is the material making the product

* To establish standard performance of the new project

* To study the project and process plan.

* to estimate The finincial planning

* To prepare The product budget

* The product on tender enquiries.

* To Ready The project and Make on design.

* The prepare on standard Cost. a material. labour, other expence, over head.

* The project is Cost Reduction in The Economical a new Raw material purchased. and a lower Scraches is only available The process is under standing and continuosly.

* to anual Cost is to control The given steps objectives and estimation.

PART-C

16 a) Data requirement of Cost estimation,

* Man hour Cost - The man hour Cost is skilled labour, semi skilled labour, un skilled labour.

* Machine hour Cost, The various method machine is available.

* Matrial Cost The diffrent matrial is Involved.

* The matrial Cost is weigh in per kg/. and diffrent matrial ferrous metal, Non ferrous metal, and diffrent velocity and diffrent thickness.

* Scrap value The diffent Scrap value are available

* welding Cost, The Cost is electrode Cost, ~~fallix~~ flux Cost, gas Cost, power Supply Cost in welding material Cost.

* Set-up time diffent type of the processes.

* allowance The Company allowance is Relaxiatio allowance, fatigue allowance, personal allowance, process allowance, interface allowance, contig allowance, Special allowance.

* standard time is diffrent process.

* % of over head The over head is Indirect labour Cost in per/hr. extra time of machining

* In life time year permitted in the material machininging are available in Cost recovery and

* data base of Cost, The Company is collected in the data base.

* Cost of data, The material and machine of cost is data collected in Company.

* To prepare the production Estimate the budget.

* Journal and sheet metal to considering higher given in Estimate and Cost preparation.

12 a) ~~Losses to be considered~~

Estimation of arc welding of cost of Job.

four type,

* Direct material Cost
* Direct Labour Cost
* Direct expence
* over head Cost.

* direct material cost:—

* direct material of welding cost is arc, gas cost, flux cost, electrode cost in available.

* The material cost is Raw material purchased.

Material cost = Gross Weight + price /kg

Gross weight = Net Weight + losses of metal

Net Weight = Volume of metal + density.

* direct labour cost:—

* The labour cost is machining time of labour per hour.

* machining The welding, Jointing, arc welding, gas welding.

* The tool touch The work piece and tool Remove The Component after Completion

Page No.........................

* labour cost per hour in skilled labour semi skilled labour and un skilled labour.

* Direct expence :-

* The expence is of welding Job is extra time,

* production expence, factory expence, Administrative expence.

The expence of welding operation

$$= \frac{V \times A}{1000} \times \frac{t}{60} \times \frac{1}{E} \times \frac{1}{r} \times C$$

V – voltage of machine

A – Amphere

t – time of operation

E – Efficiency of Job

r – Ratio of equipment

C – Cost of estimation

* over head Cost :-

* The Cost is Indirect labour Cost Working of Welding Job.

* machining per hour calculated in overhead Cost.

* A Arc Welding in flux gas using a operation in per hour in over head cost

* The over head cost is Indirect material Cost, Indirect labour Cost It can be convention by Changed in to specific emit.

i) production expence

ii) factory expence

iii) Administrative expence.

—X—X—

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Continuous Internal Assessment	3	Unit Test	
Register Number	4 2 2 1 1 7 1 0 4 0 1 7		
Department	CSE	Semester	I
Subject Code	PH8151	Subject Title	ENGINEERING PHYSICS
Date & Session	12.12.17	No. of Pages used	19

Name of the Hall Superintendent	Signature of the Hall Superintendent

Instruction to the Candidate: Put a tick mark (✓) for the questions attended in the tick mark column against each question in Valuation Box

PART - A

Q.No.	✓	Marks
1	✓	2
2	✓	2
3	✓	2
4	✓	2
5	✓	2
6	✓	2
7	✓	2
8	✓	2
9	✓	2
10	✓	2
Total	20	

PART - B & C

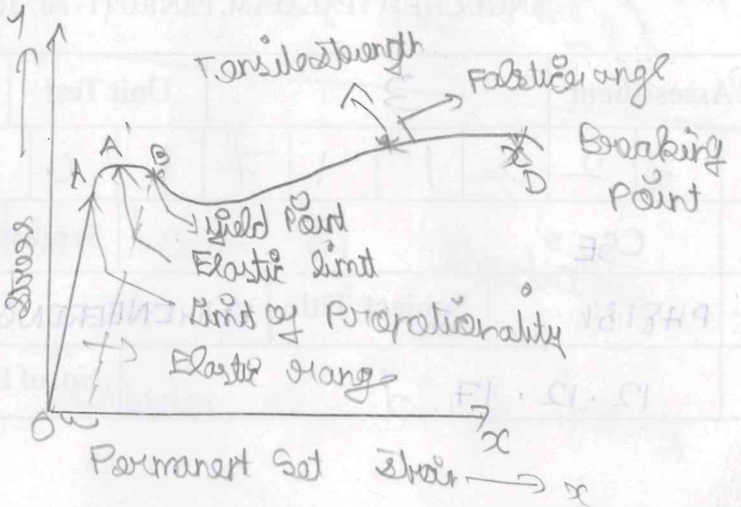
Q.No.		i ✓	i Marks T	i Marks D	ii ✓	ii Marks T	ii Marks D	iii ✓	iii Marks T	iii Marks D	Total Marks
11	a										
	b	✓									16
12	a	✓									15
	b										
13	a										
	b	✓									16
14	a	✓									16
	b										
15	a										
	b										
16	a										
	b										
									Total		63

Grand Total	83	Grand Total (in words)	Eight Three
Name of the Examiner	A. John Pertin	Signature of the Examiner	A. J [signature]

[signature]

PART -A

1.



2. *) Effect of stress.
*) Effect of change in temperature.
*) Effect of impurities
*) Effect of hammering, rolling and annealing.
*) Effect of Crystalline nature.

3. Most of the oscillation in air or in any medium are damped. when an oscillation occurs, some kind of damping force may arise due to friction of air resistance offered by the medium.

i) The oscillation of a Pendulum
ii) Electromagnetic damping in galvanometer

4. Progressive wave originating from a point source and propagating through an isotropic medium travel with equal velocity in all directions

6. A refrigerator works by passing a cool refrigerant gas around food items. which absorbs heat from them and then loses that heat to the relatively cooler surroundings on the outside.

5. Solar energy is any type of energy generated by the sun. Solar energy can be harnessed directly or indirectly for human use. These solar panels, mounted on a rooftop in germany, harvest solar energy and convert it to electricity

7. Matter waves do not have electromagnetic properties the electron microscope would be constructed on de-Broglie waves the like hood of locating a particle in spacetime is represented by a matter wave, the charge of the material component has no effect on matter waves

8.

$$\Delta\lambda = \lambda' - \lambda = \frac{h}{m_0 c}(1-\cos\theta)$$

or $\lambda' = \lambda + \frac{h}{m_0 c}(1-\cos\theta)$

$$\lambda' = 3\times10^{-10} + \frac{6.623\times10^{-34}}{9.1\times10^{-31}\times3\times10^{8}}(1-\cos 60^{\circ})$$

$$= 3\times10^{-10} + \frac{6.623\times10^{-34}}{2.730\times10^{-22}}(1-0.5)$$

$$= 3\times10^{-10} + 2.427\times10^{-12}\times0.5$$

$$= 3\times10^{-10} + 1.2132\times10^{-12}$$

$$\lambda' = 3.012\times10^{-10}\ m$$

$$\boxed{\lambda' = 3.012\ \mathring{A}}$$

9) Determine the intercept of the face along the crystallographic axes, in terms of unit cell dimensions.

Take the reciprocals of the coefficients of the intercept. Clear fractions

Reduce the lowest integer

$\frac{1}{2}, \frac{1}{2}, \frac{1}{3}$

$6 \Rightarrow \frac{1}{2} \times 6, \frac{1}{2} \times 6, \frac{1}{3} \times 6$

3, 3, 2

10) $r = 0.123$ Å

The lattice constant for BCC $= 4r/\sqrt{3}$

the lattice constant $= 0.2840$ Å

Part - B

11) b)

Definition

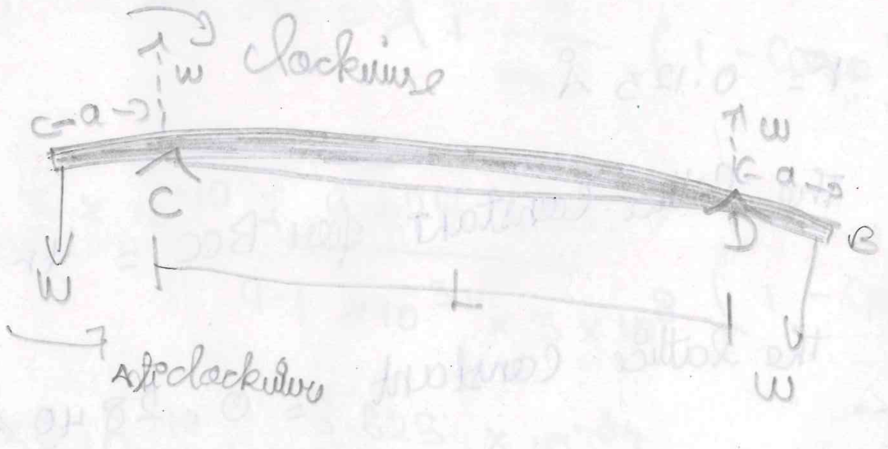
If the beam is loaded with equal weights on the both ends ...

of the beam forms an arc of a circle. The elevation is produced in the beam. This type of bending is known as uniform bending.

Theory of uniform bending

Expression for young's modulus of the beam

Consider a beam AB arranged horizontally on two knife edges C and D. symmetrically so that $AC = BD = x$.



The beam is loaded with equal weights W at each ends A and B. The reactions on the knife edges at C and D are equal to w and they are acting vertically upward.

$= W \times AF - W \times CF = W(AF - CF)$

$= W \times AC = W \times x = Wx \longrightarrow (1)$

Internal bending moment $= \frac{YI}{R}$

External bending moment = Internal bending moment

$$Wx = \frac{YI}{R}$$

Then, $CD = l$ and y is the elevation of the midpoint E of the beam so that $y = EF$

Then, from the property of a circle

$$EF \times EG = CE \times ED$$

$$EF(2R - EF) = (CE)^2$$

$(\because CE = ED$ and $FG = 2R - EF)$

$$y(2R - y) = \left(\frac{l}{2}\right)^2$$

$$2yR - y^2 = \frac{l^2}{2^2} = \frac{l^2}{4}$$

$$y^2 R = \frac{l^2}{4}$$

$$y = \frac{L^2}{8R}$$

$$\frac{8y}{L^2} = \frac{1}{R}$$

$$\frac{1}{R} = \frac{8y}{L^2}$$

$$W\alpha = \frac{8y}{L^2} Y I$$

$$Y = \frac{W\alpha L^2}{8 I y}$$

$$Y = \frac{W\alpha L^2}{8 I y}$$

$$\boxed{Y = \frac{W\alpha L^2}{8 I y}}$$

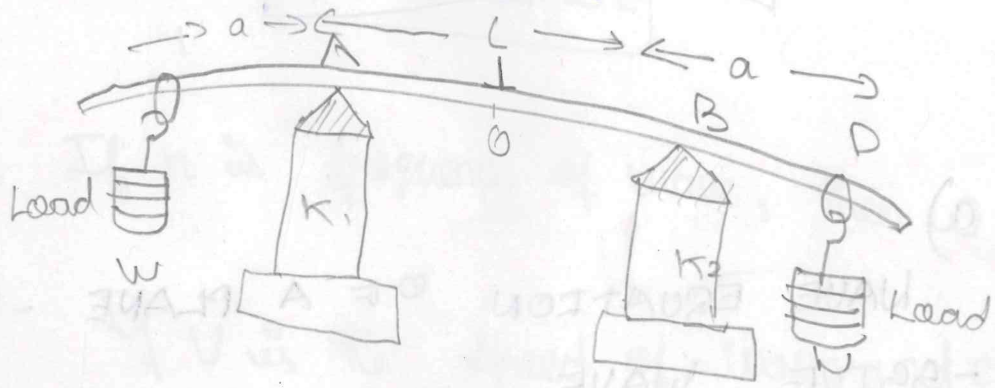
If the beam is of rectangular cross section, then $I = \frac{bd^3}{12}$, where b is breath and d is thickness of beam.

If M is the mass, the corresponding weight W = Mg.

$$\boxed{Y = \frac{3}{2}\frac{Mg\,\alpha L^2}{b d^3 y}}$$

Experiment to determine young's modulus of a beam pin and microscope method

A rectangular beam AB of uniform section is supported horizontally on two knife edges A and B



Initial reading in the microscope on the vertical scale is noted. Equal weights are added to both hangers stimulated and the reading in the microscope in the vertical scale is noted.

The experiment is repeated for decrea-sing order of the equal masses.

The observation are tabulated and mean elevation (y) at the mid point of the bar

The breadth (b) and thickness (d) of the bad are measured by using Vernier Callipers and screw gauge

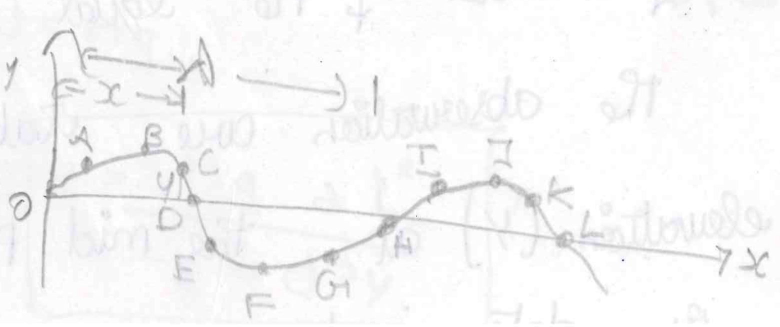
$$\boxed{Y = \frac{3}{2} \frac{Mg}{b} \frac{a l^2}{d^3 y}} \; Nm^{-2}$$

12) a)

WAVE EQUATION OF A PLANE - PROGRE-SSIVE WAVE

On Propagation of wave in a medium the Particles of medium execute simple harmonic motion.

Suppose a plane progessive wave is propagating in a medium along positive x - axis



Let the particle begin to vibrate from origin O at time $t = 0$, If y is the displacement of the particle at time t, then equation of particle executing simple harmonic motion about O is

$$\boxed{y = A \sin \omega t}$$

If n is frequency of wave, then $\omega = 2\pi n$.

If V is the speed of wave and c is a particle at a distance x from O, then the time taken by wave to reach point c is $\frac{x}{V}$ seconds after at particle at O.

which was of particle O at time $\left[t - \frac{x}{V}\right]$

The displacement of particle O at time $\left[t - \frac{x}{V}\right]$ can be obtained by substituting $\left[t - \frac{x}{V}\right]$ in place of t in equation.

$$\boxed{Y = A \sin \omega\left(t - \frac{x}{v}\right)}$$

If T is time period and λ the wavelength of wave, then

$$\omega = \frac{2\pi}{T}$$

$$Y = A \sin \frac{2\pi}{T}\left[t - \frac{x}{v}\right]$$

$$= A \sin 2\pi\left[\frac{t}{T} - \frac{x}{vT}\right]$$

But $vT = \lambda$

$$\boxed{Y = A \sin 2\pi\left[\frac{t}{T} - \frac{x}{\lambda}\right]}$$

This equation is expressed as

$$Y = A \sin \frac{2\pi}{\lambda}\left[\frac{t\lambda}{T} - x\right]$$

$$Y = A \sin \frac{2\pi}{\lambda}(vt - x)$$

$$Y = \sin\left[\frac{2\pi vt}{\lambda} - \frac{2\pi x}{\lambda}\right]$$

$$Y = \sin\left[\frac{2\pi nvt}{V} - \frac{2\pi n x}{\lambda V}\right]$$

The eqn. (2) is also expressed as

$$Y = A \sin\left[\omega t - \frac{\omega}{V} x\right]$$

But $\frac{\omega}{V} = \frac{2\pi}{\lambda} = K$ = propagation constant

$$Y = A \sin(\omega t - Kx)$$

If the wave is propagating along negative x-axis.

$$Y = A \sin(\omega t + Kx)$$

If ϕ is the phase difference between this wave travelling positive x-axis

$$Y = A \sin\left[(\omega t - Kx) + \phi\right]$$

This wave most general eqn of a plane progressive wave travelling along positive direction of x-axis

Differential equation of wave motion

$$y = A \sin \frac{2\pi}{\lambda}(vt - x)$$

$$\frac{dy}{dt} = \frac{2\pi v A}{\lambda} \cos \frac{2\pi}{\lambda}(vt - x)$$

$$\frac{dy}{dx} = \frac{-2\pi A}{\lambda} \cos \frac{2\pi}{\lambda}(vt - x)$$

$\therefore$ Particle Velocity

$$\frac{dy}{dt} = -v \frac{dy}{dx}$$

$$\frac{d^2y}{dx^2} = -A\left[\frac{2\pi}{\lambda}\right]^2 \sin \frac{2\pi}{\lambda}(vt - x)$$

$$\frac{d^2y}{dt^2} = -A\left[\frac{2\pi}{\lambda}\right]^2 v^2 \sin \frac{2\pi}{\lambda}(vt - x)$$

This is the Particle acceleration

$$\boxed{\frac{d^2y}{dt^2} = \frac{1}{v^2}\frac{d^2y}{dx^2}}$$

This is the differential equation of wave motion.

then $y' = a \sin \frac{2\pi}{\lambda} \left[v(t + \delta t) - (x + v\delta t) \right]$

$$y' = a \sin \frac{2\pi}{\lambda} \left[vt + v\delta t - x - v\delta t \right]$$

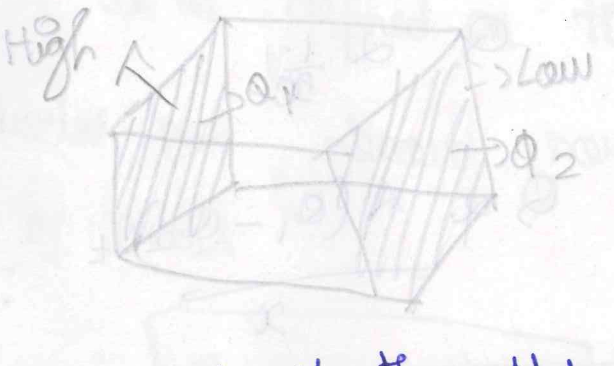
$$= a \sin \frac{2\pi}{\lambda} (vt - x) = y$$

Thus in a time δt, the wave advance through $v\delta t$, Hence v is the velocity of the wave.

13 b)

Expression of Thermal Conductivity

Consider a slab of material of length x metre (thickness) and area of cross section A as shown



One end of the slab is maintained at a higher temperature θ_1 (hot end) and the other end at a lower temperature (cold end). Now, heat flows from hot end to cold end.

It is found that amount of heat (Q) conducted from one end to the other end is

*) directly proportional to area of cross section (A).

*) directly proportional to temperature difference between the ends $(\theta_1 - \theta_2)$.

*) directly proportional to time of conduction (t).

$$Q \propto A$$

$$Q \propto (\theta_1 - \theta_2)$$

$$Q \propto t$$

$$Q \propto \frac{1}{x}$$

$$Q \propto \frac{A(\theta_1 - \theta_2)t}{x}$$

$$\boxed{Q = \frac{KA(\theta_1 - \theta_2)t}{x}}$$

where K is a Proportionality constant. It is known as Coefficient of thermal conductivity or simply thermal conductivity

$$K = \frac{Qx}{A(\theta_1 - \theta_2)t}$$

If $A = 1\,m^2$ $\theta_1 - \theta_2 = 1$ kelvin

$x = 1$ metre $t = 1$ second

$$K = Q$$

This condition defines the coefficient of thermal conductivity.

Definition

It is defined as the amount of heat conducted per second normally across unit area of cross

$$Q = -KA\frac{d\theta}{dx}t$$

unit

we know that $k = \dfrac{Qx}{A(\theta_1 - \theta_2)t}$

$= \dfrac{\text{Joule} \times \text{metre}}{\text{metre}^2 \times \text{kelvin} \times \text{second}}$

$= \dfrac{\text{Joule}}{\text{second} \times \text{metre} \times \text{kelvin}}$

$= \dfrac{\text{watt}}{\text{metre} \times \text{kelvin}} = \dfrac{W}{mK}$

$= W m^{-1} K^{-1}$

Therefore, the unit of thermal conductivity is $W M^{-1} K^{-1}$

14) a)

Plancks quantum theory of black body radiation

The revolutionary 'Planck hypothesis' of black body radiation was introduced

Planck's theory

*) A black body is not only filled up with the radiation but also with a large number of tiny oscillators. They are of atomic oscillators or Planck's oscillators.

$$\varepsilon \propto \nu$$

$$\boxed{\varepsilon = h\nu}$$

It is known as Planck's Constant ($h = 6.625 \times 10^{-34}$ J.s)

It is given by

$$\boxed{\varepsilon_n = nh\nu = n\varepsilon}$$

where n is a positive integer 1, 2, 3

Plancks law of Radiation

Satement

The energy density of heat radiation emitted from a black body at Temperature T in the wavelength range from λ to $\lambda + d\lambda$

$$E_\lambda \, d\lambda = \frac{8\pi hc}{\lambda^3 (e^{h\nu/KT} - 1)} d\lambda$$

Planck's Law of Radiation

Consider a black body with a large number of atomic oscillators

Average energy $\vec{E}$ per oscillator

$$\vec{E} = \frac{E}{N}$$

Number of atomic oscillators in ground state $= N_0$

$$N_n = N_0 e^{-E_n/KT}$$

If N is total number of oscillators and N_0, N_1, N_2 are the number of oscillator with energies $\varepsilon_0, \varepsilon_1, \varepsilon_2$

$$N = N_0 + N_1 + N_2 + \ldots$$

$$N = N_0 e^{-\varepsilon_0/KT} + N_0 e^{-\varepsilon_1/KT} + N_0 e^{-\varepsilon_2/KT}$$