JEPPIAAR INSTITUTE OF TECHNOLOGY
"Self-Belief | Self Discipline | Self Respect"

QUESTION BANK

Regulation : 2013

Year/Semester : IV

Semester : 08

Batch : 2016-2020

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Vision of the Institution

Jeppiaar Institute of Technology aspires to provide technical education in futuristic technologies with the perspective of innovative, industrial and social application for the betterment of humanity

Mission of the Institution

M1: To produce competent and disciplined high-quality professionals with the practical skills necessary to excel as innovative professionals and entrepreneurs for the benefit of the society.

M2: To improve the quality of education through excellence in teaching and learning, research, leadership and by promoting the principles of scientific analysis, and creative thinking.

M3: To provide excellent infrastructure, serene and stimulating environment that is most conducive to learning.

M4: To strive for productive partnership between the Industry and the Institute for research and development in the emerging fields and creating opportunities for employability.

M5: To serve the global community by instilling ethics, values and life skills among the students needed to enrich their lives.

DEPARTMENT VISION

To produce Engineers with visionary knowledge in the field of Computer Science and Engineering through scientific and practical education in stance of inventive, modern and communal purpose for the improvement of society.

DEPARTMENT MISSION

M1: Devise students for technical and operational excellence, upgrade them as competent engineers and entrepreneurs for country's development.

M2: Develop the standard for higher studies and perpetual learning through creative and critical thinking for the effective use of emerging technologies with a supportive infrastructure.

M3: Involve in a constructive, team-oriented environment and transfer knowledge to balance the industry-institute interaction.

M4: Enrich students with professional integrity and ethical standards that will make them deal social challenges successfully in their life.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: To support students with substantial knowledge for developing and resolving mathematical, scientific and engineering problems.

PEO 2: To provide students with adequate training and opportunities to work as a collaborator with informative and administrative qualities.

PEO 3: To motivate students for extensive learning to prepare them for graduate studies, R&D and competitive exams.

PEO 4: To cater students with industrial exposure in an endeavour to succeed in the emerging cutting edge technologies.

PEO 5: To shape students with principled values and to follow the code of ethics in social and professional life.

PROGRAM SPECIFIC OUTCOMES (PSOS)

PSO 1 : Students are able to analyse, design, implement and test any software with the programming and testing skills they have acquired.

PSO 2: Students are able to design and develop algorithms for real time problems, scientific and business applications through analytical, logical and problems solving skills.

PSO 3: Students are able to provide security solution for network components and data storage and management which will enable them to work efficiently in the industry.

BLOOM'S TAXONOMY

Definition:

- A theory to identify cognitive levels (Levels of thinking)
- Represents the full range of cognitive functions.

Objectives:

- To classify educational learning objectives into levels of complexity and specificity. The classification covers the learning objectives in cognitive, affective and sensory domains.
- To structure curriculum learning objectives, assessments and activities.

Levels in Bloom's Taxonomy:

- **BTL 1** – **Remember** - The learner is able to recall, restate and remember learned information.
- **BTL 2** – **Understand** - The learner grasps the meaning of information by interpreting and translating what has been learned.
- **BTL 3** – **Apply** - The learner makes use of information in a context similar to the one in which it was learned.
- **BTL 4** – **Analyze** - The learner breaks learned information into its parts to best understand that information.
- **BTL 5** – **Evaluate** - The learner makes decisions based on in-depth reflection, criticism and assessment.
- **BTL 6** – **Create** - The learner creates new ideas and information using what has been previously learned.

TABLE OF CONTENT

CS6801 MULTI-CORE ARCHITECTURES AND PROGRAMMING L T P C
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OBJECTIVES:

The student should be made to:

- Understand the challenges in parallel and multi-threaded programming.
- Learn about the various parallel programming paradigms, and solutions.

UNIT I MULTI-CORE PROCESSORS 9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

UNIT II PARALLEL PROGRAM CHALLENGES 9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP 9

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

UNIT V PARALLEL PROGRAM DEVELOPMENT 9

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Program Parallel Processors.
- Develop programs using OpenMP and MPI.
- Compare and contrast programming for serial processors and programming for parallel processors.

TEXT BOOKS:

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011 (unit 2)

REFERENCES:

1. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
2. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

Subject Code: CS 6801 **Year / Sem : IV/ 08**
Subject Name: Multicore Architecture and Programming **Subject Handler: Ms.R.DAYANA**

UNIT I MULTI-CORE PROCESSORS

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

PART * A

Q.No	Questions
1	**What is Multi-core processor. (NOV/ DEC 2017)** BTL 1 A multi-core processor is a single computing component with two or more independent actual processing units (called "cores"), which are units that read and execute program instructions.
2	**State Vector processor. (APR/MAY 2017)** BTL 1 In computing, a vector processor or array processor is a central processing unit (CPU) that implements an instruction set containing instructions that operate on one-dimensional arrays of data called vectors, compared to scalar processors, whose instructions operate on single data items.
3	**Define SIMD Systems. (NOV/DEC 2017)** BTL 1 Single instruction, multiple data (SIMD), is a class of parallel computers in Flynn's taxonomy. It describes computers with multiple processing elements that perform the same operation on multiple data points simultaneously. Thus, such machines exploit data level parallelism, but not concurrency: there are simultaneous (parallel) computations, but only a single process (instruction) at a given moment.
4	**Define MIMD Systems. (NOV/DEC 2017)** BTL 1 MIMD (multiple instruction, multiple data) is a technique employed to achieve parallelism. Machines using MIMD have a number of processors that function asynchronously and independently. At any time, different processors may be executing different instructions on different pieces of data. MIMD architectures may be used in a number of application areas such as computer-aided design/computer-aided manufacturing, simulation, modeling, and as communication switches.
5	**Define Cache Coherence. (APR/MAY 2017)** BTL 1 Cache coherence is the consistency of shared resource data that ends up stored in multiple local caches. When clients in a system maintain caches of a common memory resource, problems may arise with inconsistent data, which is particularly the case with CPUs in a multiprocessing system.
6	**What are the issues available in handling the performance?** BTL 1 • Speedup and Efficiency • Amdahl‘s Law

	• Scalability • Taking Timings
7	**Define Distributed Memory Systems.** BTL 1 In a distributed-memory system, each processor is paired with its own *private* memory, and the processor-memory pairs communicate over an interconnection network. So in distributed-memory systems the processors usually communicate explicitly by sending messages or by using special functions that provide access to the memory of another processor.

8	**Give an Example for Serial Code and Parallel Code.** BTL 2
	Serial Code:
	sum = 0;
	for (i = 0; i < n; i++) {
	x = Compute next value(. . .);
	sum += x; }
	Parallel Code :
	my sum = 0;
	my first i = . . . ; my last i = . . . ;
	for (my i = my first i; my i < my last i;
	my i++) {
	my x = Compute next value(. . .);
	my sum += my x;}

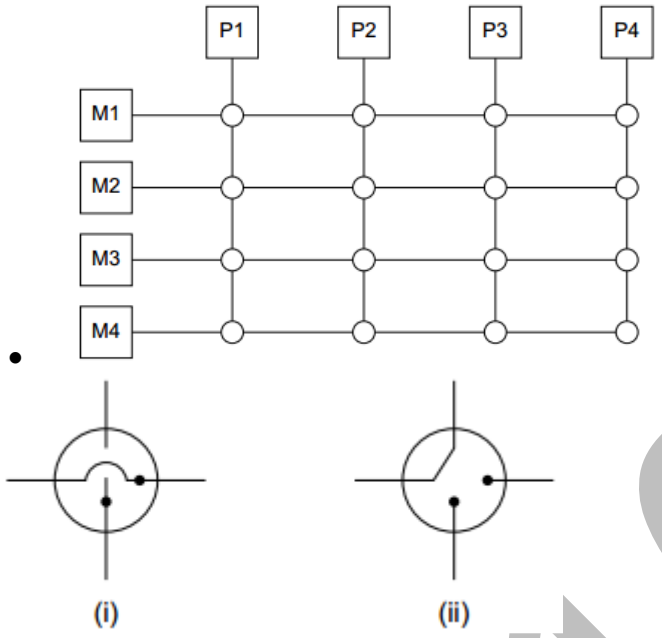
9	**What are UMA and NUMA?** BTL 1 In the first type of system, the time to access all the memory locations will be the same for all the cores, while in the second type a memory location to which a core is directly connected can be accessed more quickly than a memory location that must be accessed through another chip. Thus, the first type of system is called a uniform memory access, or UMA, system, while the second type is called a nonuniform memory access, or NUMA, system.
10	**Define Threads.** BTL 1 Threading provides a mechanism for programmers to divide their programs into more or less independent tasks with the property that when one thread is blocked another thread can be run. Furthermore, in most systems it's possible to switch between threads much faster than it's possible to switch between processes. This is because threads are "lighter weight" than processes.
11	**Define Cache Miss and Cache Hit.** BTL 1 When a cache is checked for information and the information is available, it's called a cache hit orjust a hit. If the information isn't available, it's called a cache miss or a miss. Hit or miss is often modified by the level. For example, when the CPU attempts to access a variable, it might have an L1miss and an L2 hit.
12	**What are Shared Memory Systems?** BTL 1 In a shared-memory system a collection of autonomous processors is connected to a memory system via an interconnection network, and each processor can access each memory location. In a sharedmemory system, the processors usually communicate implicitly by accessing shared data structures.
13	**Define ILP.** BTL 1 Instruction-level parallelism, or ILP, attempts to improve processor performance by having multiple processor components or functional units simultaneously executing instructions. There

	are two main approaches to ILP: pipelining, in which functional units are arranged in stages, and multiple issue, in which multiple instructions can be simultaneously initiated. Both approaches are used in virtually all modern CPUs.
14	**Define TLP.** BTL 1 Thread-level parallelism, or TLP, attempts to provide parallelism through the simultaneous execution of different threads, so it provides a coarser-grained parallelism than ILP, that is, the program units that are being simultaneously executed—threads—are larger or coarser than the finer grained units— individual instructions.
15	**What is Fine grained multithreading?** BTL 1 In fine-grained multithreading, the processor switches between threads after each instruction, skipping threads that are stalled. While this approach has the potential to avoid wasted machine time due to stalls, it has the drawback that a thread that's ready to execute a long sequence of instructions may have to wait to execute every instruction.
16	**Define Coarse grained multithreading.** Coarse-grained multithreading attempts to avoid this problem by only switching threads that are stalled waiting for a time-consuming operation to complete (e.g., a load from main memory).
17	**Define SISD and SIMD.** BTL 1 A single instruction stream, single data stream, or SISD system, since it executes a single instruction at a time and it can fetch or store one item of data at a time. Single instruction, multiple data, or SIMD, systems are parallel systems. As the name suggests, SIMD systems operate on multiple data streams by applying the same instruction to multiple data items, so an abstract SIMD system can be thought of as having a single control unit and multiple ALUs. An instruction is broadcast from the control unit to the ALUs, and each ALU either applies the instruction to the current data item, or it is idle.
18	**List the characteristics of vector processors.** BTL 2 • Vector registers • Vectorized and pipelined functional units. • Vector instructions • Interleaved memory • Strided memory access • Hardware Scatter/Gather
19	**Define Strided memory access.** BTL 1 In strided memory access, the program accesses elements of a vector located at fixed intervals. For example, accessing the first element, the fifth element, the ninth element, and so on, would be strided access with a stride of four.
20	**Is Vector Processors Scalable?** BTL 1 Vector systems have very high memory bandwidth, and every data item that's loaded is actually used,unlike cache-based systems that may not make use of every item in a cache line. On the other hand,they don't handle irregular data structures as well as other parallel architectures, and there seems to be a very finite limit to their scalability, that is, their ability to handle ever larger problems.
21	**What are graphical processing Units?** BTL 1 Real-time graphics application programming interfaces, or APIs, use points, lines,and triangles to internally represent the surface of an object. They use a graphics processing pipeline to convert the internal representation into an array of pixels that can be sent to a computer screen.
22	**Define Latency and Bandwidth with Example.** BTL 1

	The latency is the time that elapses between the source's beginning to transmit the data and the destination's starting to receive the first byte. The bandwidth is the rate at which the destination receives data after it has started to receive the first byte. So if the latency of an interconnect is *l* seconds and the bandwidth is *b* bytes per second, then the time it takes to transmit a message of *n* bytes is message transmission time = l + n/b
23	**Define Block.** BTL 1 A block of code that can only be executed by one thread at a time is called a critical section, and it'susually our job as programmers to insure mutually exclusive access to the critical section. In otherwords, we need to insure that if one thread is executing the code in the critical section, then the other threads are excluded
24	**What is Semaphores?** BTL 1 Semaphores are similar to mutexes, although the details of their behavior are slightly different, andthere are some types of thread synchronization that are easier to implement with semaphores than mutexes.
25	**Define speed-up linear speed-up.** BTL 1 If we define the speedup of a parallel program to be S = Tserial / Tparallel. then linear speedup has S= p, which is unusual. Furthermore, as p increases, we expect S to become a smaller and smaller fraction of the ideal, linear speedup p. Another way of saying this is that S=p will probably get smaller and smaller as p.
26	**State amdahl's law.** BTL 1 In computer architecture, Amdahl's law (or Amdahl's argument) gives the theoretical speedup in latency of the execution of a task *at fixed workload* that can be expected of a system whose resources are improved.
	PART * B

1	**Explain briefly about SIMD systems with implementation. (13M) (NOV/DEC 2017)** BTL 2
	Answer: **Page: 29-35 - Peter S. Pacheco**
	
	Definition (2M)
	Flynn's taxonomy is frequently used to classify computer architectures. It classifies a system according to the number of instruction streams and the number of data streams it can simultaneously manage.
	Coding (3M)
	Single instruction, multiple data, or **SIMD**, systems are parallel systems
	we have two arrays x and y, each with n elements, and we want to add the elements of y to the elements of x:
	for (i = 0; i < n; i++)
	x[i] += y[i];
	suppose we only want to carry out the addition if y[i] is positive:
	for (i = 0; i < n; i++)
	if (y[i] > 0.0) x[i] += y[i];
	Explanation (8M)
	• Vector processors

	• Vector registers • Vectorized and pipelined functional units • Vector instructions • Interleaved memory • Strided memory access and hardware scatter/gather • Graphics processing units
2	**Explain briefly about MIMD systems with a neat sketch. (13M)** **(NOV/DEC 2017)** BTL 2 **Answer**: **Page: 35-43 - Peter S. Pacheco** **Definition (2M)** Multiple instruction, multiple data, or MIMD, systems support multiple simultaneous instruction streams operating on multiple data streams.MIMD systems typically consist of a collection of fully independent processing units or cores, each of which has its own control unit and its own ALU. **Explanation (8M)** **Shared-memory systems** A multi core processor has multiple CPUs or cores on a single chip. **Distributed-memory systems** Composed of a collection of commodity systems—for example, PCs—connected by a commodity interconnection network—for example, Ethernet. **Diagram(3M)**
3	**Explain in briefly about Interconnection networks. (13M) (APR/MAY 2017)** BTL 2 **Answer**: **Page: 35-38 - Peter S. Pacheco** **Definition(2M)** The processors and memory have virtually unlimited performance, a slow interconnect will seriously degrade the overall performance of all but the simplest parallel program. **Explanation (6M)** **Shared-memory interconnects** Buses have the virtue of low cost and flexibility; multiple devices can be connected to a bus with little additional cost • Distributed-memory interconnects • Latency and bandwidth in interconnection networks ***Message transmission time = l+ n / b*** **Diagram (5M)**

	 • (i) (ii)

4	**Explain in detail about cache coherence in parallel hardware systems. (13M) (NOV/DEC 2017)** BTL 1
	Answer: **Page: 43-46 - Peter S. Pacheco**
	Definition(2M)
	Cache coherence
	Cache coherence is the discipline that ensures that changes in the values of shared operands are propagated throughout the system in a timely fashion**.**There are two main approaches to insuring cache coherence: snooping cache coherence and directory-based cache coherence.
	Explanation (6M)
	• Snooping cache coherence
	• Directory-based cache coherence
	• False sharing
	Coding (5M)
	int i, j, m, n;
	double y[m];
	/* Assign y = 0 */
	. . .
	for (i = 0; i < m; i++)
	for (j = 0; j < n; j++)
	y[i] += f(i,j);

5	**Discuss in detail about various performance issues of multi core processors. (13M)** BTL 2

Answer: **Page: 46-47 - Peter S. Pacheco**

Explanation (10M)

Speedup and efficiency

The serial run-time Tserial and our parallel run-time T parallel , then the best we can hope for is **Tparallel = Tserial/p**.

$$S = \frac{T_{\text{serial}}}{T_{\text{parallel}}}, \qquad E = \frac{S}{p} = \frac{\left(\frac{T_{\text{serial}}}{T_{\text{parallel}}}\right)}{p} = \frac{T_{\text{serial}}}{p \cdot T_{\text{parallel}}}.$$

Amdahl's law

overall parallel run-time

$$T_{\text{parallel}} = 0.9 \times T_{\text{serial}}/p + 0.1 \times T_{\text{serial}} = 18/p + 2,$$

$$S = \frac{T_{\text{serial}}}{0.9 \times T_{\text{serial}}/p + 0.1 \times T_{\text{serial}}} = \frac{20}{18/p + 2}.$$

Scalability

$$E = \frac{n}{p(n/p+1)} = \frac{n}{n+p}.$$

The number of processes/threads

$$E = \frac{n}{n+p} = \frac{xn}{xn+kp}.$$

Diagram (3M)

6 **Write short notes on parallel program design with a neat diagram. (13M)**
(APR/MAY 2017) BTL 2

Answer: **Page: 65-66 - Peter S. Pacheco**

Definition (2M)

Designing and developing parallel programs has characteristically been a very manual process. The programmer is typically responsible for both identifying and actually implementing parallelism.

Explanation (8M)

- The compiler analyzes source code and identifies opportunities for parallelism.
- The analysis includes identifying inhibitors to parallelism and possibly a cost weighting on whether or not the parallelism would actually improve performance.

- Loops are most frequent target for automatic parallelization.
- Partitioning
- Domain Decomposition
- Functional Decomposition

Diagram (3M)

PART * C

1 **State and Explain Amdahl's law in detail. (15M) (APR/MAY 2018)** BTL 3

Answer: **Page: 61-62- Peter S. Pacheco**

Explanation (10M)

Amdahl's law:

Overall parallel run-time

$$T_{\text{parallel}} = 0.9 \times T_{\text{serial}}/p + 0.1 \times T_{\text{serial}} = 18/p + 2,$$

$$S = \frac{T_{\text{serial}}}{0.9 \times T_{\text{serial}}/p + 0.1 \times T_{\text{serial}}} = \frac{20}{18/p + 2}.$$

Scalability

$$E = \frac{n}{p(n/p+1)} = \frac{n}{n+p}.$$

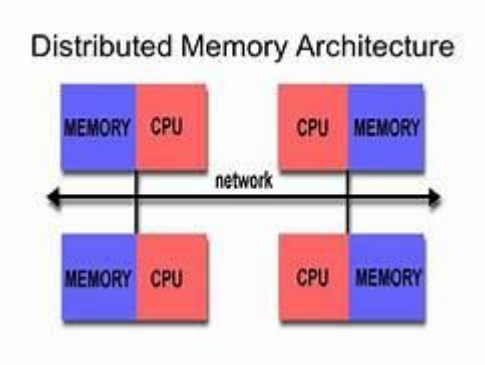
The number of processes/threads

$$E = \frac{n}{n+p} = \frac{xn}{xn+kp}.$$

Talking timings

Coding (5M)

```
private double start, finish;
. . .
start = Get_current_time();
/* Code that we want to time */
. . .
finish = Get_current_time();
printf("The elapsed time = %e seconds\n", finish-start);
```

2	**Explain in detail, the distributed memory architecture with a neat diagram. (15M) (APR/MAY 2018)** BTL 2 **Answer**: **Page:32-35 - Peter S. Pacheco** **Diagram(5M)**  **Explanation (10M)** • Variables are shared directly • Cost of communication is invisible • Processes could cause error by altering data • Executing the processes may happen with non-overlapping lifetimes
3	**Write short notes on single core and multicore processor. Illustrate the advantages and disadvantages. (15M) (APR/MAY 2017)** BTL 3 **Answer**: **Page: 29-35- Peter S. Pacheco** **Definition (2M)** A multi-core processor is a single computing component with two or more independent processing units called cores, which read and execute program instructions **Explanation (10M)** **Advantages** The proximity of multiple CPU cores on the same die allows the cache coherency circuitry to operate at a much higher clock rate than what is possible if the signals have to travel off-chip **Disadvantages** Maximizing the usage of the computing resources provided by multi-core processors requires adjustments both to the operating system **Diagram (3M)**

Subject Code: CS 6801 **Year / Sem : IV/ 8**
Subject Name: Multicore Architecture and Programming **Subject Handler: Ms. Suganya M**

UNIT II PARALLEL PROGRAM CHALLENGES

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

PART * A

Q.No	Questions
1	**What is a data race?** BTL 1 Data races are the most common programming error found in parallel code. A data race occurs when multiple threads use the same data item and one or more of those threads are updating it.
2	**In a parallel programming, what a data race occurs?** BTL 1 • Two or more threads in a single process access the same memory location concurrently, and • At least one of the accesses is for writing, and • The threads are not using any exclusive locks to control their accesses to that memory.
3	**Define Mutex.** BTL 1 In computer programming, a mutex is a program object that allows multiple program threads to share the same resource, such as file access, but not simultaneously. When a program is started, a mutex is created with a unique name. After this stage, any thread that needs the resource must lock the mutex from other threads while it is using the resource.
4	**Define Semaphore.** BTL 1 Semaphore is a variable or abstract data type that is used to control access to a common resource by multiple processes in a concurrent system such as a multiprogramming operating system. A trivial semaphore is a plain variable that is changed (for example, incremented or decremented, or toggled) depending on programmer-defined conditions
5	**State Deadlock. (APR/MAY 2017)** BTL 1 In concurrent computing, a deadlock is a state in which each member of a group of actions, is waiting for some other member to release a lock. Deadlock is a common problem in multiprocessing systems, parallel computing, and distributed where software and hardware locks are used to handle shared resources and implement process synchronization.
6	**What is condition variable?** BTL 1 A condition variable is basically a container of threads that are waiting for a certain condition. Monitors provide a mechanism for threads to temporarily give up exclusive access in order to wait for some condition to be met, before regaining exclusive access and resuming their task.
7	**What is meant by message queue?** BTL 1 A message queue is a queue of messages sent between applications. It includes a sequence of work objects that are waiting to be processed. A message is the data transported between the sender and and the receiver application, it's essentially a byte array with some headers on top.
8	**Define cache conflict miss.** BTL 1 A conflict cache miss is where one thread has caused data needed by another thread to be evicted

	from the cache. The worst example of this is thrashing where multiple threads each require an item of data and that item of data maps to the same cache line for all the threads.
9	**What are synchronization primitives?** BTL 1 • Mutexes • Locks • Semaphores • Barriers.
10	**Define Semaphores.** BTL 1 Semaphores are counters that can be either incremented or decremented. They can be used in situations where there is a finite limit to a resource and a mechanism is needed to impose that limit. An example might be a buffer that has a fixed size. Every time an element is added to a buffer, the number of available positions is decreased
11	**What is reader- writer lock?** BTL 1 However, sometimes data that is typically read-only needs to be updated. A *readers writer lock* (or multiple reader lock) allows many threads to read the shared data but can then lock the readers threads out to allow one thread to acquire a writer lock to modify the data
12	**Define Barriers.** BTL 1 There are situations where a number of threads have to all complete their work before any of the thread scan start on the next task. In these situations, it is useful to have a barrier where the threads will wait until all are present. One common example of using a barrier arises when there is dependence between different sections of code.
13	**Give an example for deadlock.** BTL 2 Suppose two threads need to acquire mutex locks A and B to complete some task. If thread 1 has already acquired lock A and thread 2 has already acquired lock B, then A cannot make forward progress because it is waiting for lock B, and thread 2 cannot make progress because it is waiting for lock A. The two threads are deadlocked.
14	**Define Livelock. (APR/MAY 2017)** BTL 1 A livelock traps threads in an unending loop releasing and acquiring locks. Livelocks can be caused by code toback out of deadlocks. In Listing below, the programmer has tried to implement a mechanism that avoids deadlocks. If the thread cannot obtain the second lock it requires, it releases the lock that it already holds.
15	**List the mechanisms for communication.** BTL 2 • Memory –Direct Communication • Shared Memory communication • Memory Mapped Communication • Communication using condition variables • Communication by signals • Event Communication • Message Queues • Named Pipes • Communication through Network stacks
16	**What are signals? What system calls use signals in unix?** BTL 1 sighandler_t signal(intsignum, sighandler_thandler); Description: The behavior of signal() varies across UNIX versions, and has also varied historically across different versions of linux.

17	**Define – Signal.** BTL 1 Signals are a UNIX mechanism where one process can send a signal to another proceed and have a handler in the receiving process perform some task upon the receipt of the message
18	**What is the use of pipe?** BTL 1 The symbol | is the Unix pipe symbol that is used on the command line. What it means is that the standard output of the command to the left of the pipe gets sent as standard input of the command to the right of the pipe.
19	**Define Deadlock.** BTL 1 First is the deadlock, where two or more threads cannot make progress because the resources that they need are held by the other threads.
20	**Define Atomic Operation.** BTL 1 An atomic operation is one that will either successfully complete or fail; it is not possible for the operation to either result in a "bad" value or allow other threads on the system to observe a transient value.An example of this would be an atomic increment, which would mean that the calling thread would replace a variable that currently holds the value N with the value N+1.
21	**What is the advantage of Atomic Operation?** BTL 1 Using synchronization primitives can add a high overhead cost. This is particularly true if they are implemented as calls into the operating system rather than calls into a supporting library. These over heads lower the performance of the parallel application and can limit scalability. In some cases, either *atomic operations* or *lock-free code* can produce functionally equivalent code without introducing the same amount of overhead.
22	**Define Critical Region.** BTL 1 The region of code between the acquisition and release of a mutex lock is called a *critical section*, or *critical region*. Code in this region will be executed by only one thread at a time.
23	**How to avoid data races?** BTL 1 It can be hard to identify data races, avoiding them can be very simple: Make sure that only one thread can update the variable at a time. The easiest way to do this is to place a synchronization lock around all accesses to that variable and ensure that before referencing the variable, the thread must acquire the lock.
24	**Define Contended Mutex.** BTL 1 If multiple threads are attempting to acquire the same mutex at the same time, then only one thread will succeed, and the other threads will have to wait. This situation is known as a contended mutex.
25	**What are the tools used for detecting data races?** BTL 1 • Helgrind • Sun Studio Thread Analyzer
PART * B	
Q.No	**Questions**
1	**Discuss briefly about the performance metrics of the parallel programming.(13M)** BTL 2 **Answer**: **Page:47-49 - Peter S. Pacheco** **Definition (2M)** The amount of time that the system is unavailable, typically called downtime or availability. The metrics that are used to specify and measure performance have many ramifications in the

	design of a system to meet those metrics **Explanation (8M)** **Common metrics for performance:** **Items per unit time:** This might be transactions per second, jobs per hour, or some other combination of completed tasks and units of time. **Time per item:** This is a measure of the time to complete a single task. It is basically a measure of latency or response time. Number of transactions of latency greater than some threshold **Diagram (3M)**

2	**Explain in detail about data races with implementation details. (13M) (NOV/DEC 2017)** BTL 2
	Answer: **Page: 56-58 - Peter S. Pacheco**
	Definition (2M)
	Data races are the most common programming error found in parallel code. A data race occurs when multiple threads use the same data item and one or more of those threads are updating it**)**
	Coding (8M)
	Avoiding data races
	Fig 2.1: Updating the Value at an Address
	`void update(int * a)`
	`{`
	`  *a = *a + 4;`
	`}`
	Use tools to detect data races
	Fig 2.4: Code Containing Data Race
	`#include <pthread.h>`
	
	`int counter = 0;`
	
	`void * func(void * params)`
	`{`
	`  counter++;`
	`}`
	
	`void main()`
	`{`
	`  pthread_t thread1, thread2;`
	`  pthread_create( &thread1, 0, func, 0);`
	`  pthread_create( &thread2, 0, func, 0);`
	`  pthread_join( thread1, 0 );`
	`  pthread_join( thread2, 0 );`
	`}`
	Diagram (3M)

3 **What are synchronization primitives? Describe in detail about the following synchronization primitives: (13M) (MAY/JUNE 2016)** BTL 3

Answer: **Page: 66-70 - Peter S. Pacheco**

Explanation (8M)

- Mutexes and critical regions
- Spin locks
- Semaphores
- Readers-Writer locks
- Barriers

Coding (5M)

Fig 2.10: Placing Mutex Locks Around Accesses to Variables

```
int counter;

mutex_lock mutex;

void Increment()
{
   acquire( &mutex );
   counter++;
   release( &mutex );
}

void Decrement()
{
   acquire( &mutex );
   counter--;
   release( &mutex );
}
```

4 **Write a short note on :**

a) Deadlocks (8M)

b) Livelocks (5M) (NOV /DEC 2017) BTL 2

Answer: **Page:75-76 - Peter S. Pacheco**

Deadlocks (4M)

- Deadlock is a situation where two or more threads cannot make progress because the resources that they need are held by the other threads.
- It is easiest to explain this with an example. Suppose two threads need to acquire mutex locks A and B to complete some task.
- If thread 1 has already acquired lock A and thread 2 has already acquired lock B, then A cannot make forward progress because it is waiting for lock B, and thread 2 cannot make progress because it is waiting for lock A.

- The two threads are deadlocked.

Coding (4M)

Fig 2.22: Two Threads in a Deadlock

Thread 1

```
void update1()
{
   acquire(A);
   acquire(B); <<< Thread 1
                   waits here
   variable1++;
   release(B);
   release(A);
}
```

Thread 2

```
void update2()
{
   acquire(B);
   acquire(A); <<< Thread 2
                   waits here
   variable1++;
   release(B);
   release(A);
}
```

Livelocks (2M)

- A livelock traps threads in an unending loop releasing and acquiring locks.
- Livelocks can be caused by code to back out of deadlocks.
- The programmer has tried to implement a mechanism that avoids deadlocks.
- If the thread cannot obtain the second lock it requires, it releases the lock that it already holds.

Coding (3M)

Fig 2.23: Two Threads in a Livelock

Thread 1

```
void update1()
{
   int done=0;
   while (!done)
   {
     acquire(A);
     if ( canAcquire(B) )
     {
       variable1++;
       release(B);
       release(A);
       done=1;
     }
     else
     {
       release(A);
     }
   }
}
```

Thread 2

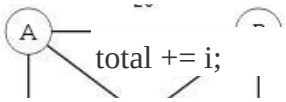
```
void update2()
{
   int done=0;
   while (!done)
   {
     acquire(B);
     if ( canAcquire(A) )
     {
       variable2++;
       release(A);
       release(B);
       done=1;
     }
     else
     {
       release(B);
     }
   }
}
```

5	**Explain how communication between threads is achieved by condition variables, signals, message queues and pipes? (13M)** BTL 2
	Answer: **Page: 56-57 - Peter S. Pacheco**
	Explanation (8M)
	• Condition variables
	• Signals
	• Message queues
	• Pipes
	Coding (5M)
	Fig 2.15: Producer Thread Adding an Item to the Queue
	`Acquire Mutex();`
	`Add Item to Queue();`
	`If ( Only One Item on Queue )`
	`{`
	`Signal Conditions Met();`
	`}`
	`Release Mutex();`

6	**Explain in detail, the tools used for detecting data races. (13M) (APR/MAY 2017)** BTL 2
	Answer: **Page: 56-58 - Peter S. Pacheco**
	Explanation (5M)
	• Helgrind
	• Sun Studio Thread Analyzer
	• Code Containing Data Race
	Coding (5M)
	`#include <pthread.h>`
	`int counter = 0;`
	`void * func(void * params)`
	`{`
	`counter++;`
	`}`

	void main()
	{
	pthread_t thread1, thread2; pthread_create(&thread1, 0, func, 0); pthread_create(&thread2, 0, func, 0); pthread_join(thread1, 0); pthread_join(thread2, 0);
	}
	Diagram (3M)

	PART * C
1	**Discuss in detail about synchronization with a neat sketch. (15M)** BTL 2 **Answer**: **Page: 47-49- Peter S. Pacheco** **Definition (2M)** Synchronization is the coordination of events to operate a system in unison. The conductor of an orchestra keeps the orchestra synchronized or in time. Systems that operate with all parts in synchrony are said to be synchronous or in sync—and those that are not are asynchronous. **Explanation (8M)** **synchronization primitives** • Mutexes and critical regions • Spin locks • Semaphores • Readers-Writer locks • Barriers **Diagram (5M)**
2	**Explain in detail, the importance of algorithmic complexity with a program. (13M)** BTL 2 **Answer**: **Page:83-84 - Peter S. Pacheco** **Definition (2M)** Algorithmic complexity is a measure of how much computation a program will perform when using a particular algorithm. **Algorithm (3M)** • It is a measure of its efficiency and estimate of operation count. • It is not a measure of the complexity of the code necessary to implement a particular algorithm. • An algorithm with low algorithmic complexity is likely to be more difficult to implement than an algorithm with higher algorithmic complexity. **Coding (10M)** Sum of the First N Numbers void sum(int N)

	{
	int total=0;
	for (int i=1; i<=N; i++)
	{
	 
	total += i;
	}
	printf("Sum of first %i integers is %i\n", N, total);
	}

3	**Write short notes on signals, events, message queues and named pipes (15M) (NOV /DEC 2017)** BTL 2 **Answer**: **Page: 88-89 - Peter S. Pacheco** **Explanation (10M)** **Signals** Signals are a UNIX mechanism where one process can send a signal to another process and have a handler in the receiving process perform some task upon the receipt of the message **Events** Signals and events are really optimized for sending limited or no data along with the signal, and as such they are probably not the best mechanism for communication when compared to other options **Message Queues** A message queue is a structure that can be shared between multiple processes. Messages can be placed into the queue and will be removed in the same order in which they were added. **Named pipes** UNIX uses pipes to pass data from one process to another. For example, the output from the command ls, which lists all the files in a directory, could be piped into the wc command, which counts the number of lines, words, and characters in the input. **Diagram (5M)**

Subject Code: CS 6801 **Year / Sem : IV/ 8**
Subject Name: Multicore Architecture and Programming **Subject Handler: Ms. Suganya M**

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP

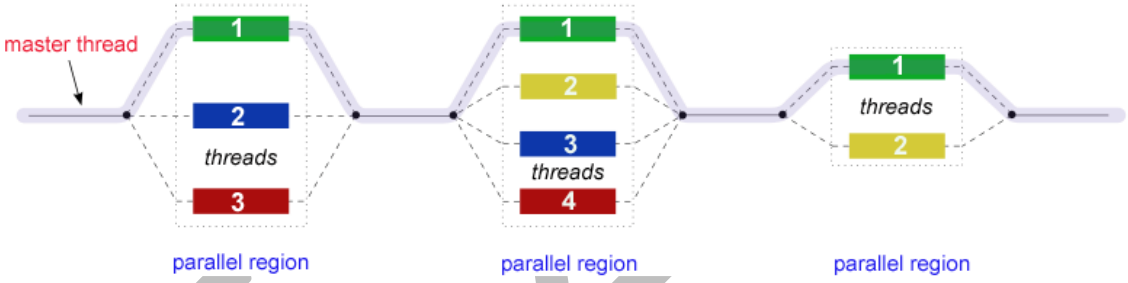
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

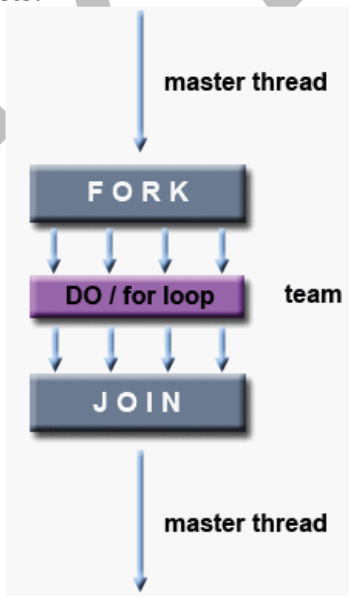
PART * A

Q.No	Questions
1	**Define the term thread private memory.** BTL 1 The temporary view of memory allows the thread to cache variables and thereby to avoid going to memory for every reference to a variable. Each thread also has access to another type of memory that must not be accessed by other threads, called thread private memory.
2	**List the effect of cancel construct.** BTL 2 The cancel construct depends on its construct-type clause. If a task encounters a cancel construct with a task group construct-type clause, then the task activates cancellation and continues execution at the end of its task region, which implies completion of that task.
3	**Write short notes on private variable.** BTL 2 A private variable in a task region that eventually generates an inner nested parallel region is permitted to be made shared by implicit tasks in the inner parallel region. A private variable in a task region can be shared by an explicit task region generated during its execution.
4	**Define the term shared variable in execution context.** BTL 1 A shared variable has the same address in the execution context of every thread. All threads have access to shared variables.
5	**What is the need of Open MP flush operation?** BTL 1 Open MP flush operation enforces consistency between the temporary view and memory. The flush operation is applied to a set of variables called the flush-set. The flush operation is applied to a set of variables called the flush set. The flush operation restricts reordering of memory applications that an implementation might otherwise do.
6	**List the restrictions to work sharing contructs.** BTL 2 Each work sharing region must be encountered by all threads in a team or by none at all, unless cancellation has been requested for the innermost enclosing parallel region. The sequence of work sharing regions and barrier regions encountered must be the same for every thread in a team.
7	**What are the restrictions to sections constructs.** BTL 1 □ Orphaned section directives are prohibited. That is, the section directives must appear within the sections construct and must not be encountered elsewhere in the sections region. □ The code enclosed in a sections construct must be a structured block. □ Only a single no wait clause can appear on a sections directive.
8	**Define Simple lock routines.** BTL 1

	The type omp_lock_t is a data type capable of representing a simple lock. For the following routines, a simple lock variable must be of omp_lock_type. All simple lock routines reqire an argument that is a pointer to a variable of type omp_lock_t. The simple lock routines are as follows: • The omp_init_lock routine initializes a simple lock. • The omp_destroy_lock routine uninitializes a simple lock. • The omp_set_lock routine waits until a simple lock is available, and then sets it. • The omp_unset_lock routine unsets a simple lock. • The omp_test_lock routine tests a simple lock, and sets it if it is available.
9	**State pragma.** BTL 1 A compiler directive in C or C++ is called a pragma. The word pragma is short for ―pragmatic information.‖ A pragma is a way to communicate information to the compiler. The information is nonessential in the sense that the compiler may ignore the information and still produce a correct object program. However, the information provided by the pragma can help the compiler optimize the program. Like other lines that provide information to the preprocessor, a pragma begins with the # character. A pragma in C or C++ has this syntax: #pragma omp <rest of pragma>
10	**What is termed as initial task region? NOV/DEC 2017** BTL 1 An initial thread executes sequentially, as if enclosed in an implicit task region, called an initial task region, that is defined by the implicit parallel region surrounding the whole program.
11	**How to Compile and run OpenMP programs? MAY /JUNE 2017** BTL 2 To compile this with gcc we need to include the -fopenmp option: $ gcc -g -Wall -fopenmp -o omp hello omp hello.c To run the program, we specify the number of threads on the command line. For example, we might run the program with four threads and type $ ./omp hello 4
12	**Define Team, Master, slave.** BTL 1 In OpenMP parlance, the collection of threads executing the parallel block—the original thread and the new threads—is called **a team**, the original thread is called the **master**, and the additional threads are called **slaves.**
13	**What is trap function in parallel directive?** BTL 1 The parallel directive specifies that the Trap function should be executed by thread count threads. Afterreturning from the call to Trap, any new threads that were started by the parallel directive are terminated,and the program resumes execution with only one thread. The one thread prints the result and terminates. Inthe Trap function, each thread gets its rank and the total number of threads in the team started by the paralleldirective.
14	**Define Scope of a variable? APR/MAY 2018** BTL 1 In serial programming, the scope of a variable consists of those parts of a program in which the variablecan be used. For example, a variable declared at the beginning of a C function has "function-wide" scope,that is, it can only be accessed in the body of the function. On the other hand, a variable declared at thebeginning of a .c file but outside any function has "file-wide" scope. The default scope of a variable canchange with other directives, and that OpenMP provides clauses to modify the default scope.
15	**List the Parallel directives.** BTL 2 • Trap function

	• Scope of variable • Reduction clause • For Directive • Caveats • Data dependences • Loop carried dependences • Estimating
16	**List the types of sorting in loops.** BTL 2 • Bubble sort • Transposition sort • Odd-Even sort
17	**What are the different types of schedules in schedule clause?** BTL 1 • Static • Dynamic or guided • Auto • Runtime
18	**List the different producers and consumers.** BTL 2 • Queues • Message Passing • Sending Messages • Receiving Messages • Termination Detection • StartUp
19	**List the type of directives.** BTL 2 • Parallel Directive • Atomic Directive • Critical Directive
20	**Define Cache Memory.** BTL 1 If a processor must read data from main memory for each operation, it will spend most of its time simplywaiting for the data from memory to arrive. Also recall that in order to address this problem, chip designershave added blocks of relatively fast memory to processors. This faster memory is called cache memory.
21	**Define Cache Block.** BTL 1 If a processor needs to access main memory location to/from main memory, a block of memory containing *x* block of memory is called a cache line or cache block.
22	**Give the formula for efficiency.** BTL 2 *x*, rather than transferring only the contents of *x* is transferred from/to the processor's cache. Such a If *T*serial is the run-time of the serial program and *T*parallel is the run-time of the parallel program, recall that the *efficiency E* of the parallel program is the speedup *S* divided by the number of threads, *t*: Since *S _t*, *E _* 1.
23	**When a loop carried dependency does occurs?** BTL 1 A loop-carried dependence occurs when a memory location is read or written in one iteration and written in iteration. OpenMP won't detect loop-carried dependences; it's up to us, the programmers, to detect them and eliminate them. It may, however, be impossible to eliminate them, in which case,

	the loop isn't a candidate for parallelization.
24	**Define Block Partitioning.** BTL 1 Most systems use a block partitioning of the iterations in a parallelized **for** loop. If there are *n* iterations,this means that roughly the first *n*=thread count are assigned to thread 0, the next *n*=thread count are assigned to thread 1, and so on.
25	**Define Thread safety.** BTL 1 A block of code is thread-safe if it can be simultaneously executed by multiple threads without causing problems.
	PART * B
1	**Explain briefly about the OpenMP Execution Model. (13M) APR/MAY 2018** BTL 2 **Answer**: **Page: 116-119 - Peter S. Pacheco** **Diagram (3M)**  **Definition (2M)** OpenMP uses the fork-join model of parallel execution. When a thread encounters a parallel construct, the thread creates a team composed of itself and some additional (possibly zero) number of threads.The encountering thread becomes the master of the new team. The other threads of the team are called **slave threads** of the team. **Explanation (8M)** **Control of Nested Parallelism** **OMP_NESTED** Nested parallelism can be enabled or disabled by setting the **OMP_NESTED** environment variable or calling **omp_set_nested()**. **OMP_THREAD_LIMIT** The OpenMP runtime library maintains a pool of threads that can be used as slave threads in parallel regions. **OMP_MAX_ACTIVE_LEVELS** The setting of the **OMP_THREAD_LIMIT** environment variable controls the number of threads in the pool.

2	**Discuss briefly about OpenMP Directives with a neat sketch. (13M)** BTL 2 **Answer**: **Page: 116-120 - Peter S. Pacheco** **Definition (2M)** **Directives** An OpenMP executable directive applies to the succeeding structured block or an OpenMP Construct. **Explanation (8M)** A structured block is a single statement or a compound statement with a single entry at the top and a single exit at the bottom **Diagram (3M)**
3	**Explain in detail about various OpenMP work-sharing constructs. (13M)** BTL 2 **Answer**: **Page: 106-109 - Peter S. Pacheco** **Explanation (10M)** **Work-Sharing Constructs** • A work-sharing construct divides the execution of the enclosed code region among the members of the team that encounter it. • Work-sharing constructs do not launch new threads • There is no implied barrier upon entry to a work-sharing construct, however there is an implied barrier at the end of a work sharing construct. **Types of Work-Sharing Constructs:**  **Restrictions:** • A work-sharing construct must be enclosed dynamically within a parallel region in order for the directive to execute in parallel. • Work-sharing constructs must be encountered by all members of a team or none at all • Successive work-sharing constructs must be encountered in the same order by all members of a team

	DO / for Directive **SECTIONS Directive** **Diagram (3M)**
4	**Explain about the OpenMP Library functions and routine uses in API. (13M)** BTL 1 **Answer**: **Page:88-89 - Peter S. Pacheco** **Definition (2M)** The OpenMP API includes an ever-growing number of run-time library routines. **Explanation (8M)** **Diagram(3M)** **Routine** — **Purpose** OMP_SET_NUM_THREADS — Sets the number of threads that will be used in the next parallel region OMP_GET_NUM_THREADS — Returns the number of threads that are currently in the team executing the parallel region from which it is called OMP_GET_MAX_THREADS — Returns the maximum value that can be returned by a call to the OMP_GET_NUM_THREADS OMP_GET_THREAD_NUM — Returns the thread number of the thread, within the team, making this call. OMP_GET_THREAD_LIMIT — Returns the maximum number of OpenMP threads available to a program OMP_GET_NUM_PROCS — Returns the number of processors that are available to the program
5	**Explain briefly about how to handle loops in OpenMP with program implementation (13M) (APR/MAY 2017)** BTL 2 **Answer**: **Page: 90-92 - Peter S. Pacheco** **Program(5M)** Virtually all useful programs have some sort of loop in the code, **Parallel for loops** for**(**int x=0**;** x < width**;** x++**)** **{** for**(**int y=0**;** y < height**;** y++**)** **{** finalImage**[**x**][**y**]** = RenderPixel**(**x,y**, &**sceneData**);** **}** **}** **Explanation (5M)** Forgetting to declare a variable as private - most common bugs associated with writing OpenMP applications

	Wrapping up quickly and easily modify your program - multiple processors with OpenMP. Using OpenMP to parallelize loops - extremely scalable. **Diagram (3M)**
6	**State memory model. Explain in detail how threads interact through memory? (13M)** BTL 3 **Answer**: **Page:210-212 - Peter S. Pacheco** **Definition (2M)** A formal specification of how the memory system will appear to the programmer, eliminating the gap between the behavior expected by the programmer and the actual behavior supported by a system." **Explanation (8M)** Memory model specifies: How threads interact through memory } What value a read can return } When does a value update become visible to other threads} What assumptions are allowed to make about memory when} writing a program or applying some program optimization Memory model affects: Programmability} Performance} Portability} The Single Thread Model Memory access executes one-at-a-time in program order Read returns value of last write} For hardware} & compiler reordering Optimization must respect data/control dependences} Memory operations must follow the order the program is} written Easy to program and optimize} **Diagram (3M)**
	PART * C
1	**Explain the Data Handling in detail with a sample program. (15M)** BTL 2 **Answer**: **Page: 110-112 - Peter S. Pacheco** **Definition (2M)** Data handling is the process of ensuring that research data is stored, archived or disposed off in a safe and secure manner during and after the conclusion of a research project. This includes the development of policies and procedures to manage data handled electronically as well as through non-electronic means . **Coding (10M)** for**(**int x=0**;** x < width**;** x++**)** **{** for**(**int y=0**;** y < height**;** y++**)**

	{ finalImage**[**x**][**y**]** = RenderPixel**(**x**,**y**, &**sceneData**);** **}** **}** **Diagram (3M)**
2	**Define loop handling. Illustrate the importance of Open MP in loop handling. (15M) (APR/MAY 2018)** BTL 3 **Answer**: **Page:109-111 - Peter S. Pacheco** **Definition (2M)** Virtually all useful programs have some sort of loop in the code, whether it is a for, do, or while loop. **Explanation (5M)** OpenMP effectively exploits these common program characteristics, so it is extremely easy to allow an OpenMP program to use multiple processors simply by adding a few lines of compiler directives into your source code • A word about shared variables • Wrapping up **Coding (5M)** **Parallel for loops** #pragma omp parallel for for**(**int x=0**;** x < width**;** x++**)** **{** for**(**int y=0**;** y < height**;** y++**)** **{** finalImage**[**x**][**y**]** = RenderPixel**(**x**,**y**, &**sceneData**);** **}** **}** **Diagram(3M)**
3	**What is data Parallelism. Describe in detail the processing of data with a parallel program design (15M) (NOV/DEC 2017)** BTL 3 **Answer**: **Page:126-127 - Peter S. Pacheco** **Definiton (2M)** Data parallelism is parallelization across multiple processors in parallel computing environments. It focuses on distributing the data across different nodes, which operate on the data in parallel. **Explanation (8M)** For addition of arrays in a data parallel implementation, let's assume a more modest system

	with two central processing units (CPU) A and B, CPU A could add all elements from the top half of the arrays, while CPU B could add all elements from the bottom half of the arrays. Since the two processors work in parallel, the job of performing array addition would take one half the time of performing the same operation in serial using one CPU alone. **Coding (5M)** if CPU = "a" 20lower_limit := 1 upper_limit := round(d.length/2) else if CPU = "b" lower_limit := round(d.length/2) + 1 upper_limit := d.length for i from lower_limit to upper_limit by 1 foo(d[i])

Subject Code: CS 6801 **Year / Sem : IV/ 8**
Subject Name: Multicore Architecture and Programming **Subject Handler: Ms. Suganya M**

UNIT IV MEMORY PROGRAMMING WITH MPI MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation	
PART * A	
1	Define **MIMD.** BTL 1 Multiple data, or MIMD, computers is, for the most part,divided into distributed-memory and shared-memory systems. From a programmer's point of view, adistributed-memory system consists of a collection of core-memory pairs connected by a network, and thememory associated with a core is directly accessible only to that core.
2	**What does the distributed memory consist of in MIMD? (NOV/DEC 2018)** BTL 1 In the world of parallel multiple instruction, multiple data, or MIMD, computers is, for the most part,divided into distributed-memory and shared-memory systems. From a programmer's point of view, a distributed-memory system consists of a collection of core-memory pairs connected by a network, and the memory associated with a core is directly accessible only to that core.
3	**What does the shared memory consist of in MIMD?** BTL 1 In the world of parallel multiple instruction, multiple data, or MIMD, computers is, for the most part, divided into distributed-memory and shared-memory systems. From a programmer's point of view, a shared-memory system consists of a collection of cores connected to a globally accessible memory, in which each core can have access to any memory location.
4	**State MPI? Write a brief note on it.** BTL 2 In message-passing programs, a program running on one core-memory pair is usually called a process, and two processes can communicate by calling functions: one process calls a send function and the other calls a receive function. The implementation of message-passing that we'll be using is called MPI, which is an abbreviation of Message-Passing Interface. MPI is not a new programming language. It defines a library of functions that can be called from C, C++, and Fortran programs.
5	**What are Collective Communication functions?** BTL 1 Some "global" communication functions that can involve more than two processes. These functions are called collective communications.

6	**Write a program "hello, world" that makes some use of MPI. (NOV/DEC 2017)** BTL 6
	#include <stdio.h>
	int main(void) {
	printf("hello, world\n");
	return 0; }

7	**How to compile and execute MPI programs?** BTL 2 The details of compiling and running the program depend on your system, so you may need to check with alocal expert. We are using a text editor to write the program source and command line to compile and run. Many systems use a command called mpicc for compilation:

	$ mpicc -g -Wall -o mpi_hello mpi hello.c
	Many systems also support program startup with mpiexec:
	$ mpiexec -n <number of processes> ./mpi hello

8	**What is wrapper? (APR/MAY 2017)** BTL 1 Typically, mpicc is a script that's a wrapper for the C compiler. A wrapper script is a script whose main purpose is to run some program. In this case, the program is the C compiler. However, the wrapper simplifies the running of the compiler by telling it where to find the necessary header files and which libraries to link with the object file.
9	**What is MPI_Init?** BTL 1 The call to MPI Init tells the MPI system to do all of the necessary setup. For example, it might allocate storage for message buffers, and it might decide which process gets which rank. As a rule of thumb, no other MPI functions should be called before the program calls MPI Init. Its syntax is int MPI Init(int* argc p /* in/out*_/, char*** argv p /* in/out */);
10	**Define MPI_Finalize.** BTL 1 The call to MPI Finalize tells the MPI system that we're done using MPI, and that any resources allocated for MPI can be freed. The syntax is quite simple: int MPI Finalize(void); In general, no MPI functions should be called after the call to MPI Finalize.
11	**Give the List of MPI Functions.** BTL 2 • MPI_Init • MPI_Finalize • MPI_Comm_Size • MPI_Comm_Rank • MPI_Send • MPI_Recv • MPI_Datatype • MPI_Status • MPI_Source • MPI_Tag • MPI_Error • MPI_Get_Count
12	**Define SPMD.** BTL 1 A single program is written so that different processes carry out different actions, and this is achieved by simply having the processes branch on the basis of their process rank. Recall that this approach to parallel programming is called single program, multiple data, or SPMD.
13	**Write About MPI Communicator.** BTL 2 In MPI a communicator is a collection of processes that can send messages to eachother. One of the purposes of MPI Init is to define a communicator that consists of all of the processes started by the user when she started the program. This communicator is called MPI COMM WORLD. The function calls in Lines are getting information about MPI COMM WORLD.
14	**Define Collective communication and Point-to-Point Communication.** BTL 1 A "global-sum function" will obviously require communication. However, unlike the MPI Send-

	MPI Recv pair, the global-sum function may involve more than two processes. In fact, in our trapezoidal rule program it will involve all the processes in MPI COMM WORLD. In MPI parlance, communication functions that involve all the processes in a communicator are called collective communications. To distinguish between collective communications and functions such as MPI Send and MPI Recv, MPI Send and MPI Recv are often called point-to-point communications. In fact, global sum is just a special case of an entire class of collective communications.
15	**State Butterfly.** BTL 1 In this situation, we encounter some of the same problems we encountered with our original global sum. For example, if we use a tree to compute a global sum, we might "reverse" the branches to distribute the global sum. Alternatively, we might have the processes *exchange* partial results instead of using one-way communications. Such a communication pattern is sometimes called a butterfly.
16	**Define Broadcast in MPI.** BTL 1 Collective communication in which data belonging to a single process is sent to all of the processes in the communicator is called a broadcast.
17	**What are the different partitions available in MPI?** BTL 1 Block partitioning Cyclic Partitioning Block-Cyclic Partitioning
18	**Define MPI Derived Data Types.** BTL 1 In MPI, a derived data type can be used to represent any collection of data items in memory by storing both the types of the items and their relative locations in memory. The idea here is that if a function that sends data knows the types and the relative locations in memory of a collection of data items, it can collect the items from memory before they are sent. Similarly, a function that receives data can distribute the items into their correct destinations in memory when they're received.
19	**Define Speedup and Linear Speedup.** BTL 1 Recall that the most widely used measure of the relation between the serial and the parallel run-times is the speedup. It's just the ratio of the serial run-time to the parallel run-time: .The ideal value for *S.n,p/* is *p*. If *S.n,p/* D *p*, then our parallel program with comm sz D *p* processes is running *p* times faster than the serial program. In practice, this speedup, sometimes called linear speedup, is rarely achieved. S(n,p) = T serial(n)/T Parallel(n,p)
20	**List the functions of group assessors.** BTL 2 MPI_GROUP_SIZE(group, size) MPI_GROUP_RANK(group,rank) MPI_GROUP_TRANSLATE_RANKS(group1,n,ranks1,group2,ranks2) MPI_GROUP_COMPARE(group1,group2,result)
21	**Brief about strongly and weakly scalable.** BTL 2 Programs that can maintain a constant efficiency without increasing the problem size are sometimes said to be strongly scalable. Programs that can maintain a constant efficiency if the problem size increases at the same rate as the number of processes are sometimes said to be weakly scalable.
22	**What is the use of MPI derived datatype?** BTL 1 In MPI, a derived datatype can be used to represent any collection of data items in memory by

	storing both the types of the items and their relative locations in memory. The idea here is that if a function that sends data knows the types and the relative locations in memory of a collection of data items, it can collect the items from memory before they are sent.
23	**What are the different datatype constructors?** BTL 1 MPI_TYPE_CONTIGUOUS MPI_TYPE_VECTOR MPI_TYPE_CREATE_HVECTOR MPI_TYPE_INDEXED MPI_TYPE_CREATE_HINDEXED MPI_TYPE_HINDEXED_BLOCK MPI_TYPE_INDXED_BLOCK MPI_TYPE_STRUCT
24	**Define MPI_Wtime.** BTL 1 MPI provides a function, MPI Wtime, that returns the number of seconds that have elapsed since some timein the past: double MPI Wtime(void);
25	**How the messages can be matched?** BTL 2 If recv type = send type and recv buf sz _ send buf sz, then the message sent by *q* can be successfully received by *r*. Of course, it can happen that one process is receiving messages from multiple processes, *and* the receiving process doesn't know the order in which the other processes will send the messages.
	PART * B
Q.No	**Questions**
1	**Explain in detail about the execution of MPI programs. (13M) (NOV/DEC 2016)** BTL 6 **Answer**: **Page: 288-289- Peter S. Pacheco** **Explanation (5M)** In parallel programming, it's common (one might say standard) for the processes to be identified by nonnegative integer ranks. So if there are p processes, the processes will have ranks 0,1,2, : : : , p 1. For our parallel ―hello, world,‖ let's make process 0 the designated process, and the other processes will send it messages. **Coding (8M)**

```c
#include <stdio.h>
#include <string.h>  /* For strlen             */
#include <mpi.h>     /* For MPI functions, etc */

const int MAX_STRING = 100;

int main(void) {
   char       greeting[MAX_STRING];
   int        comm_sz;  /* Number of processes */
   int        my_rank;  /* My process rank     */

   MPI_Init(NULL, NULL);
   MPI_Comm_size(MPI_COMM_WORLD, &comm_sz);
   MPI_Comm_rank(MPI_COMM_WORLD, &my_rank);

   if (my_rank != 0) {
      sprintf(greeting, "Greetings from process %d of %d!",
            my_rank, comm_sz);
      MPI_Send(greeting, strlen(greeting)+1, MPI_CHAR, 0, 0,
            MPI_COMM_WORLD);
   } else {
      printf("Greetings from process %d of %d!\n", my_rank,
          comm_sz);
      for (int q = 1; q < comm_sz; q++) {
         MPI_Recv(greeting, MAX_STRING, MPI_CHAR, q,
            0, MPI_COMM_WORLD, MPI_STATUS_IGNORE);
         printf("%s\n", greeting);
      }
   }

   MPI_Finalize();
   return 0;
}  /* main */
```

Program 4.1: MPI program that prints greetings from the processes

Compilation and Execution:

$ mpicc g Wall o mpi hello mpi hello.c

MPI_Init and MPI_Finalize

```c
int MPI_Finalize(void);
```

Communicators-MPI_Comm_size and MPI_Comm_rank

2	**Describe in detail about MPI_Send and MPI_Receive. (13M)** BTL 2 **Answer**: **Page:88-90 - Peter S. Pacheco** **Explanation** **MPI_Send (7M)**

```
int MPI_Send(
      void*         msg_buf_p     /* in */,
      int           msg_size      /* in */,
      MPI_Datatype  msg_type      /* in */,
      int           dest          /* in */,
      int           tag           /* in */,
      MPI_Comm      communicator  /* in */);
```

MPI datatype	C datatype
MPI_CHAR	signed char
MPI_SHORT	signed short int
MPI_INT	signed int
MPI_LONG	signed long int
MPI_LONG_LONG	signed long long int
MPI_UNSIGNED_CHAR	unsigned char
MPI_UNSIGNED_SHORT	unsigned short int
MPI_UNSIGNED	unsigned int
MPI_UNSIGNED_LONG	unsigned long int
MPI_FLOAT	float
MPI_DOUBLE	double
MPI_LONG_DOUBLE	long double
MPI_BYTE	
MPI_PACKED	

MPI_Recv (6M)

```
int MPI_Recv(
      void*         msg_buf_p     /* out */,
      int           buf_size      /* in  */,
      MPI_Datatype  buf_type      /* in  */,
      int           source        /* in  */,
      int           tag           /* in  */,
      MPI_Comm      communicator  /* in  */,
      MPI_Status*   status_p      /* out */);
```

3 **Explain in detail about the following collective communication mechanisms.(13M) (MAY/JUNE 2018)** BTL 1

Answer: **Page: 90-92- Peter S. Pacheco**

a) Tree-structured communication (7M)
b) Broadcast (6M)
Explanation (7M)
Tree-structures communication (4M)
a. Processes 2 and 6 send their new values to processes 0 and 4, respectively.
b. Processes 0 and 4 add the received values into their new values.
2. a. Process 4 sends its newest value to process 0.
b. Process 0 adds the received value to its newest value.
Diagram (3M)

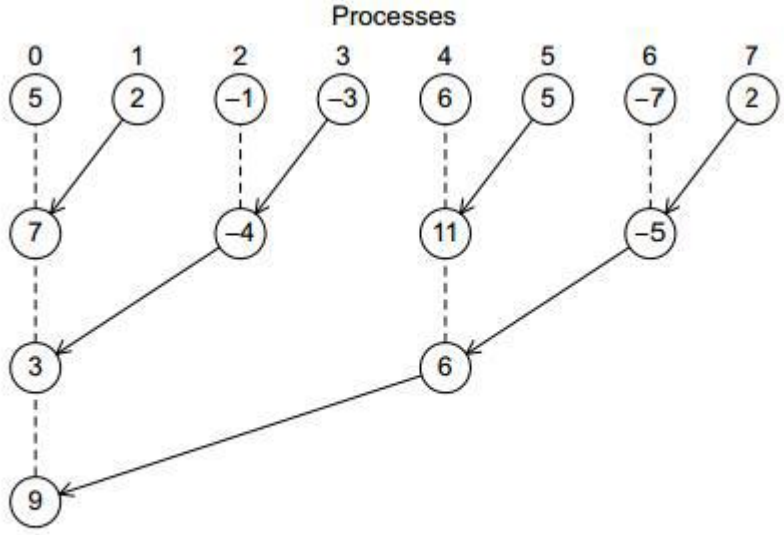


Fig 4.2:

A tree-structured global sum

Broadcast (6M)

```
int MPI_Bcast(
         void*         data_p          /* in/out */,
         int           count           /* in     */,
         MPI_Datatype  datatype        /* in     */,
         int           source_proc     /* in     */,
         MPI_Comm      comm            /* in     */);
```

4 **Discuss elaborately about the differences of collective and point-to-point communications. (13M) (NOV/DEC 2017)** BTL 4

Answer: **Page: 105-106 - Peter S. Pacheco**

Explanation (10M)

All the processes in the communicator must call the same collective function.
For example, a program that attempts to match a call to MPI_Reduce on one process with a call to MPI_Recv on another process is erroneous, and, in all likelihood, the program will hang or crash.
2. The arguments passed by each process to an MPI collective communication must be ―compatible.‖ For example, if one process passes in 0 as the dest_process and another passes in 1, then the outcome of a call to MPI_Reduce is erroneous, and, once again, the program is likely to hang or crash.
3. The output_data_p argument is only used on dest_process. However, all of the processes still need to pass in an actual argument corresponding to output_data_p, even if it‘s just NULL.
4. Point-to-point communications are matched on the basis of tags and communicators. Collective communications don‘t use tags, so they‘re matched solely on the basis of the communicator and the order in which they‘re called

Diagram(3M)

Time	Process 0	Process 1	Process 2
0	a = 1; c = 2	a = 1; c = 2	a = 1; c = 2
1	MPI_Reduce(&a, &b, ...)	MPI_Reduce(&c, &d, ...)	MPI_Reduce(&a, &b, ...)
2	MPI_Reduce(&c, &d, ...)	MPI_Reduce(&a, &b, ...)	MPI_Reduce(&c, &d, ...)

5 **Explain in detail about various MPI Derived Datatypes with program implemeentation (13M)** BTL 2

Answer: **Page:116-119 - Peter S. Pacheco**

Explanation (8M)

In virtually all distributed-memory systems, communication can be much more expensive than local computation.

For example, sending a double from one node to another will take far longer than adding two doubles stored in the local memory of a node.

Program (5M)

```
double x[1000];
. . .
if (my_rank == 0)
   for (i = 0; i < 1000; i++)
      MPI_Send(&x[i], 1, MPI_DOUBLE, 1, 0, comm);
else /* my_rank == 1 */
   for (i = 0; i < 1000; i++)
      MPI_Recv(&x[i], 1, MPI_DOUBLE, 0, 0, comm, &status);

if (my_rank == 0)
   MPI_Send(x, 1000, MPI_DOUBLE, 1, 0, comm);
else  /* my_rank == 1 */
   MPI_Recv(x, 1000, MPI_DOUBLE, 0, 0, comm, &status);
```

6 **Describe on MPI performance evaluation with a suitable example. (13M) (APR/MAY 2017)** BTL 2

Answer: **Page:119 - Peter S. Pacheco**

Explanation(8M)

The current trend to multicore architectures underscores the need of parallelism.

- MPI performance against Unified Parallel C (UPC)
- OpenMP on multicore architectures.

OpenMP usually lacks efficient data locality support and is restricted to shared memory systems, which limits its scalability.

MPI UPC OpenMP Multicore Architectures Performance Evaluation NAS Parallel Benchmarks

Diagram(5M)

	PART * C
1	**Define MPI Libraries. Illustrate MPI libraries with a suitable example. (15m)** BTL 5 **Answer**: **Page: 151-153 - Peter S. Pacheco** **Explanation(10m)** MPI libraries for parallel applications The Message Passing Interface (MPI) is the typical way to parallelize applications on clusters, so that they can run on many compute nodes simultaneously. **OpenMPI** • Detailed configuration on installation is found by ompi_info command, including the information on processor affinity. • Processor binding at OpenMPI are manually handled by using the extra argument at runtime. Unfortunately, the exact way to do this varies depending on the exact version of OpenMPI. mpprun --pass="--bind-to-core --bycore" $(EXE) Intel MPI • To use 8 byte integer, you shall add -ilp64 as a compilation flag or as a global option at runtime. It may accompany the 8-byte integer compilation flag from the compiler. mpprun --pass="-genv I_MPI_DEBUG 5" $(EXE) **Diagram (5m)**
2	**Write a short note on Collective communication and Point-to-Point Communication. (15m) (NOV/DEC 2017)** BTL 3 **Answer**: **Page:105-106 - Peter S. Pacheco** **Explanation (10m)** **Collective communication and Point-to-Point Communication** • A "global-sum function" will obviously require communication. • MPI Send-MPI Recv pair, the global-sum function may involve more than two processes. • In fact, in our trapezoidal rule program it will involve all the processes in MPI COMM WORLD. In MPI parlance, communication functions that involve all the processes in a communicator are called collective communications. • To distinguish between collective communications and functions such as MPI Send and MPI Recv, MPI Send and MPI Recv are often called point-to-point communications.

	• In fact, global sum is just a special case of an entire class of • collective communications. **Diagram (5m)**
3	**Explain in detail, the MPI constructs of distributed memory. (15m) (NOV/DEC 2016)** BTL 5 **Answer**: **Page: 289-290 - Peter S. Pacheco** **Explanation (10m)** Process – program running on 1 core memory pair ● Communicate by calling functions – Send function – Receive function ● Message-Passing Interface (MPI) – Library of functions – Can be called from Fortran, C, or C++ Identifying MPI processes Common practice to identify processes by nonnegative integer ranks. p processes are numbered 0, 1, 2, .. p-1 Compilation Execution **Coding(5m)**

Subject Code: CS 6801 **Year / Sem : IV/ 8**
Subject Name: Multicore Architecture and Programming **Subject Handler: Ms. Suganya M**

UNIT V PARALLEL PROGRAM DEVELOPMENT Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison	
PART A	
1	**What does the n-body problem do?** BTL 1 In an *n*-body problem, we need to find the positions and velocities of a collection of interacting particles over a period of time. For example, an astrophysicist might want to know the positions and velocities of a collection of stars, while a chemist might want to know the positions and velocities of a collection of molecules or atoms. An *n*-body solver is a program that finds the solution to an *n*-body problem by simulating the behavior of the particles.
2	**What are the input and output parameters of n-body problem?** BTL 1 The input to the problem is the mass, position, and velocity of each particle at the start of the simulation, and the output is typically the position and velocity of each particle at a sequence of user-specified times, or simply the position and velocity of each particle at the end of a user-specified time period.
3	**State the Euler's method.** BTL 1 There are many possible choices for numerical methods, but we'll use the simplest one: Euler's method, which is named after the famous Swiss mathematician Leonhard Euler (1707–1783). In Euler's method, weuse the tangent line to approximate a function. The basic idea is that if we know the value of a function g(t0) at time t0 and we also know its derivative g(t0) at time t0, then we can approximate its value at time t0 +Δt by using the tangent line to the graph of g(t0). Now if we know a point (t0,g(t0)) on a line, and we know the slope of the line g0'(t0),
4	**What is the function of Pthread's Loop_schedule in parallel processing?** BTL 1 Loop schedule determines • the initial value of the loop variable, • the final value of the loop variable, and • the increment for the loop variable.
5	**What are the modes of message passing interfaces for send and its functions?** BTL 1 MPI provides four modes for sends: • standard(MPI_Send) • synchronous(MPI_Ssend) • ready(MPI_Rsend) • buffered(MPI_Bsend)

6	**What are the global variables for recursive depth first search?** BTL 1 n: the total number of cities in the problem digraph: a data structure representing the input digraph
7	**Write about Fulfill_request functions.** BTL 1 If a process has enough work so that it can usefully split its stack, it calls Fulfill request. Fulfill request uses MPI Iprobe to check for a request for work from another process. If there is a request, it receives it, splits its stack, and sends work to the requesting process.
8	**What are the two phases for computation of forces?** BTL 1 First phase, each thread carries out exacltly the same calculations it carried out in the erroneous parallelization. Second phase, the thread that has been assigned particle q will add the contributions that have been computed by the different threads.
9	**Define graph.** BTL 1 A graph is a pictorial representation of a set of objects where some pairs of objects are connected by links. The interconnected objects are represented by points termed as vertices, and the links that connect the vertices are called edges.
10	**How to parallelize the n-body solver by MPI? (APR/MAY 2017)**BTL 2 The only communication among the tasks occurs when we're computing the forces, and, in order to compute the forces, each task/particle needs the position and mass of every other particle. MPI All gather is expressly designed for this situation, since it collects on each process the same information from every other process.
11	**Discuss the performance of MPI Solvers.** BTL 2 The run-times of the serial solvers differed from the single-process MPI solvers by less than 1%, so we haven't included them. Clearly, the performance of the reduced solver is much superior to the performance of the basic solver, although the basic solver achieves higher efficiencies.
12	**How to parallelize tree search?** BTL 3 We need to keep in mind that the best tour data structure requires additional communication that is not explicit in the tree edges. Thus, it's convenient to add an additional task that corresponds to the best tour. It"sends" data to every tree node task, and receives data from some of the leaves. This latter view is convenient for shared-memory, but not so convenient for distributed-memory
13	**What is the problem with depth first search? (MAY/JUNE 2018)** BTL 1 The problem with depth-first search is that we expect a sub tree whose root is deeper in the tree to requireless work than a subtree whose root is higher up in the tree, so we would probably get better load balance ifwe used something like **breadth-first search** to identify the subtrees.
14	**Define Dynamic Mapping Scheme**. BTL 1 In a dynamic scheme, if one thread/process runs out of useful work, it can obtain additional work fromanother thread/process. In our final implementation of serial depth-first search, each stack record contains apartial tour. With this data structure a thread or process can give additional work to another thread/processby dividing the contents of its stack
15	**What are the details to be checked for thread termination?** BTL 1 There are several details that we should look at more closely. Notice that the code executed by a thread before it splits its stack is fairly complicated. In Lines 1–2 the thread • checks that it has at least two tours in its stack, • checks that there are threads waiting, and • checks whether the new stack variable is NULL

16	**How to detect Distributed Termination?** BTL 2 The functions Out of work and No work left (Lines 11 and 15) implement the termination detection algorithm. As we noted earlier, an algorithm that's modeled on the termination detection algorithm we used in the shared-memory programs will have problems.
17	**How to detect Termination?** BTL 2 The functions Out of work and No work left (Lines 11 and 15) implement the termination detectionalgorithm. As we noted earlier, an algorithm that's modeled on the termination detection algorithm we usedin the shared-memory programs will have problems.
18	**Brief about pthread_mutex_trylock.** BTL 3 Pthreads provides a nonblocking alternative to pthread_mutex_lock called pthread_mutex_trylock:
19	**Brief about My_avail_tour_count functions.** BTL 2 The function My avail tour count can simply return the size of the process' stack. It can also make use of a ―cutoff length.‖ When a partial tour has already visited most of the cities, there will be very little work associated with the subtree rooted at the partial tour.
20	**How can we decide which API, MPI, Pthreads, or OpenMP is best for our application?** BTL 3 As a first step, decide whether to use distributed-memory, or shared-memory. In order to do this, first consider the amount of memory the application will need. In general, distributed-memory systems can provide considerably more main memory than shared-memory systems, so if the memory requirements are very large, you may need to write the application using MPI.
21	**Define n-body problem. (NOV/DEC 2017)**BTL 1 *n*-body problem, we need to find the positions and velocities of a collection of interacting particlesover a period of time. For example, an astrophysicist might want to know the positions and velocities of acollection of stars, while a chemist might want to know the positions and velocities of a collection ofmolecules or atoms. An *n*-body solver is a program that finds the solution to an *n*-body problem bysimulating the behavior of the particles.
22	**Define graph.** BTL 1 A graph is a pictorial representation of a set of objects where some pairs of objects are connected by links. The interconnected objects are represented by points termed as vertices, and the links that connect the vertices are called edges.
23	**How to partition the tree?** BTL 2 Using MPI ScatterV function.
24	**Discuss the performance of MPI Solvers.** BTL 2 The run-times of the serial solvers differed from the single-process MPI solvers by less than 1%, so we haven't included them. Clearly, the performance of the reduced solver is much superior to the performance of the basic solver, although the basic solver achieves higher efficiencies.
25	**Distinguish between MPI_Pack and MPI_Unpack.** BTL 2 • MPI_Pack Packing data into a buffer of contiguous memory • MPI_UnpacK Unpacking data from a buffer of contiguous memory
	PART * B
1	**Explain in detail about how to parallelize the solvers using Pthreads and MPI? (13M)** **(NOV/DEC 2017)** BTL 2 **Answer**: **Page: 289-290 - Peter S. Pacheco** **Explanation(8M)**

Parallelizing the solvers using pthreads:

Parallelizing the two n-body solvers using Pthreads is very similar to parallelizing them using OpenMP.

By default local variables in Pthreads are private, so all shared variables are global in the Pthreads version

the initial value of the loop variable,

o the final value of the loop variable, and

o the increment for the loop variable.

The input to the function is

o the calling thread‘s rank,

o the number of threads,

o the total number of iterations, and

o an argument indicating whether the partitioning should be block or cyclic.

Coding (5M)

Parallelizing the basic solver using MPI

```
Process 0:  pos[0], pos[1], . . . , pos[loc_n-1]
Process 1:  pos[loc_n], pos[loc_n+1], . . . , pos[loc_n + loc_n-1]
   . . .
Process q:  pos[q*loc_n], pos[q*loc_n+1], . . . , pos[q*loc_n +
    loc_n-1]
   . . .
```

2 **Explain in detail about performance of the MPI Solvers. (13M)** BTL 1

Answer: **Page: 290-292 - Peter S. Pacheco**

Explanation(8M)

Table 5.1: Performance of the MPI *n*-Body Solvers (times in seconds)

Processes	Basic	Reduced
1	17.30	8.68
2	8.65	4.45
4	4.35	2.30
8	2.20	1.26
16	1.13	0.78

Formulae (3M)

For example, the efficiency of the basic solver on 16 nodes is about 0.95, while the efficiency of the reduced solver on 16 nodes is only about 0.70.

n+4n/p

Diagram (2M)

3 **Explain the following tree search mechanisms:**

	a) Recursive depth-first search (7M) **b) Non-recursive depth-first search (6M) (NOV/DEC 2016)** BTL 2 **Answer**: **Page: 302-304 - Peter S. Pacheco** **Explanation(7M)** **a) Recursive depth-first search:** The algorithm makes use of several global variables: • n: the total number of cities in the problem digraph: a data structure representing the input digraph • hometown: a data structure representing vertex or city 0, the salesperson's hometown • best_tour: a data structure representing the best tour so far **Non-recursive depth-first search (3M)** Pseudocode for an implementation of a depth-first solution to TSP that doesn't use recursion **Diagram(3M)**

4	**Discuss briefly about the data structures and performance of the serial implementations. (13M) (APR/MAY 2017)** BTL 2
	Answer: **Page: 305-306 - Peter S. Pacheco**
	
	Explanation (8M)
	Data structures for the serial implementations:
	data structures are the tour, the digraph, and, in the iterative implementations, the stack
	`/* Find the ith city on the partial tour */`
	`int Tour_city(tour_t tour, int i) {`
	`  return tour->cities[i];`
	`} /* Tour_city */`
	Performance of the serial implementations
	Diagram(5M)

5	**Explain briefly about the implementation of tree search using MPI and static partitioning. (13M) (APR/MAY 2017)** BTL 2 **Answer**: **Page: 319-320 - Peter S. Pacheco** **Definition(2M)** The vast majority of the code used in the static parallelizations of tree search using Pthreads and OpenMP is taken straight from the second implementation of serial, iterative tree search. In fact, the only differences are in starting the threads, the initial partitioning of the tree, and the Update_best_tour function. **Explanation (8M)** The principal differences lie in • partitioning the tree, • checking and updating the best tour, and

	• after the search has terminated, making sure that process 0 has a copy of the best tour for output. **Partitioning the tree** MPI code to check for new best tour costs If msg_avail is true, then we can receive the new cost with a call to MPI_Recv: **Printing the best tour** *If process 0 already has the best tour, we simply return. *Otherwise, the process owning the best tour sends it to process 0. **Diagram (3M)**
	PART * C
1	**Explain n-Body solvers in detail with a suitable requirements for n-body solver. (15M) (NOV/DEC 2017)** BTL1 **Answer**: **Page: 271-272- Peter S. Pacheco** **Explanation (8M)** In an *n*-body problem, we need to find the positions and velocities of a collection of interacting particlesover a period of time. **For example**, an astrophysicist might want to know the positions and velocities of a collection of stars, while a chemist might want to know the positions and velocities of a collection of molecules or atoms. An *n*-body solver is a program that finds the solution to an *n*-body problem bysimulating the behaviour of the particles. **Coding (4M)** **Diagram (3M)**
2	**Differentiate Recursive depth-first searchand Non-recursive depth-first search. (15M) (APR/MAY 2017)** BTL 3 **Answer**: **Page:302-203 - Peter S. Pacheco** **Explanation (5M)** The algorithm makes use of several global variables: n: the total number of cities in the problem digraph: a data structure representing the input digraph hometown: a data structure representing vertex or city 0, the salesperson‘s hometown best_tour: a data structure representing the best tour so far **Coding (6M)**

```
1  void Depth_first_search(tour_t tour) {
2     city_t city;
3
4     if (City_count(tour) == n) {
5        if (Best_tour(tour))
6           Update_best_tour(tour);
7     } else {
8        for each neighboring city
9           if (Feasible(tour, city)) {
10             Add_city(tour, city);
11             Depth_first_search(tour);
12             Remove_last_city(tour, city);
13          }
14    }
15 }  /* Depth_first_search */
```

Non-recursive depth-first search (4M)

```
1  for (city = n-1; city >= 1; city--)
2     Push(stack, city);
3  while (!Empty(stack)) {
4     city = Pop(stack);
5     if (city == NO_CITY) // End of child list, back up
6        Remove_last_city(curr_tour);
7     else {
8        Add_city(curr_tour, city);
9        if (City_count(curr_tour) == n) {
10          if (Best_tour(curr_tour))
11             Update_best_tour(curr_tour);
12          Remove_last_city(curr_tour);
13       } else {
14          Push(stack, NO_CITY);
15          for (nbr = n-1; nbr >= 1; nbr--)
16             if (Feasible(curr_tour, nbr))
17                Push(stack, nbr);
18       }
19    }  /* if Feasible */
20 }  /* while !Empty */
```

3 **Describe OpenMP and MPI implementations with a suitable example. (15M) (MAY/JUNE 2018)** BTL 2

Answer: **Page:288-290 - Peter S. Pacheco**

Definition (2M)

The vast majority of the code used in the static parallelizations of tree search using Pthreads and OpenMP is taken straight from the second implementation of serial, iterative tree search. In fact, the only differences are in starting the threads, the initial partitioning of the tree, and

	the Update_best_tour function. **Explanation (8M)** The principal differences lie in • partitioning the tree, • checking and updating the best tour, and • after the search has terminated, making sure that process 0 has a copy of the best tour for output. **Partitioning the tree** MPI code to check for new best tour costs If msg_avail is true, then we can receive the new cost with a call to MPI_Recv: **Printing the best tour** *If process 0 already has the best tour, we simply return. *Otherwise, the process owning the best tour sends it to process 0. **Coding(5M)**

CS6008 HUMAN COMPUTER INTERACTION L T P C

3 0 0 3

OBJECTIVES:

The student should be made to:

- **Learn the foundations of Human Computer Interaction.**
- **Be familiar with the design technologies for individuals and persons with disabilities.**
- **Be aware of mobile HCI.**
- **Learn the guidelines for user interface.**

UNITI FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNITII DESIGN & SOFTWARE PROCESS 9

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNITIII MODELS AND THEORIES 9

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNITIV MOBILE HCI 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNITV WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. L: 45, T: 0,

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

1. **Design effective dialog for HCI.**
2. **Design effective HCI for individuals and persons with disabilities.**

3. **Assess the importance of user feedback.**
4. **Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.**
5. **Develop meaningful user interface.**

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III).

2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009 (UNIT –IV).

3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.(UNIT-V).

Subject Code: CS6008 **Year/Semester: IV/08**
Subject Name: HUMAN COMPUTER INTERACTION **Subject Handler: N.GLADISS MERLIN**

UNIT I FOUNDATIONS OF HCI	
The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	
PART * A	
Q.No.	Questions
1.	**Define HCI.**BTL1 It is the study, planning and design of how people and computer work together so that a person needs are satisfied in the most effective way.
2	**What are the basic requirements of Successful Interactive System?**BTL1 The following 3 words must be true for a product to be successful Useful : 1. Accomplish what is required Usable 2. Do it easily & naturally without danger of error 3. Make people want to use it(Be attractive)
3	**What is STM & LTM?**BTL1 STM:Short term memory-act as a scratch pad for temporary recall of information. Information can only be held there temporarily In order of 200ms- has limited capacity LTM: Long term memory –stores factual information, experiential knowledge an srules.-stores information in a semantic network form
4	**List out the types of reasoning methods.**BTL2 Reasoning: Inferring new information from what is already known- is a process by which we use the knowledge to draw some conclusion for a problem. Types: Deductive Inductive Abductive
5	**What are the types of text entry devices?**BTL1 Keyboard, Chord Keyboard, Phone Pad, Handwriting recognition & Speech recognition
6	**What is Execution Evaluation cycle?**BTL1 In Norman's Model, User formulates a plan, Executed at the computer interface. When plan has been executed, user observes the computer interface to evaluate the result of the executed plan and determine future action. This cycle has two phases, Execution & Evaluation phase.
7	**Define Ergonomics**BTL1 Ergonomics are human factors –is a study of the physical characteristics of the interaction. That is, how the controls are designed, In which physical environment the interaction takes place, layout & physical qualities of the screen. The main focus is on User performance
8	**Define Interaction. what are the styles used for Interaction?** BTL1 Interaction is a dialog between the computer and user.The no. of styles are, 1. Command Line Interface 2. ZSZS4Z 3. Menus 4. Natural Language

	5. Question / Answer and Query Dialog
9	**What is paradigm?** BTL1 A successful Interactive system can serve as paradigms for the development of future products Concerns 1. How can an interactive system be developed to ensure its usability? 2. How can the usability of an interactive system be demonstrated or measured? 3. History of interactive system design provides paradigms for usable designs
10	**List the elements of WIMP.**BTL3 WIMP elements are, 1. Windows 2. Icons 3. Menu 4. Pointers
11	**State the Categories of Devices.**BTL3 1. Text entry devices 2. Positioning & Printing Devices 3. Display devices 4. Devices for Virtual reality & 3D Interaction
12	**What are the basic levels of skills identified by Anderson's ACT model?** BTL1 There are 3 levels , 1. Learner uses general purpose rules which interpret facts about a problem. 2. Learner develop rules specific to the task 3. The rules are tuned to speed up performance
13	**Define usability.** BTL1 It describes the effectiveness of human performance. It can be defined as the capability to be used by humans easily and effectively.
14	**Identify human characteristics in design.**BTL5 The important human characteristics in design are perception, memory, visual and peripheral vision, sensory Storage, information processing & skill and individual differences.
15	**What is problem solving?**BTL1 It is a process of finding a solution to an unfamiliar task, using the knowledge we have No. of views are Gestalt view- Productive problem solving, Reproductive problem solving Newell & Simon's View: Problem space
16	**Define Mental model.**BTL1 It is an internal representation of a person's current conceptualization and understands of something. Mental model are gradually developed in order to understand, explain and do something.
17	**Define Sensors & Effectors.**BTL1 Input in the human occurs mainly through the sensors and the output through the motor control of the effectors Five major senses: Sight, Hearing, Touch, Taste, Smell Five major Effectors: Limbs, Fingers,

	Eyes, Head, Vocal System,
18	**What are the two things you need in order for prototyping methods to work?** BTL1 1. To understand what is wrong and how to improve. 2. A good start point.
19	**What are the advantages and disadvantages of Prototyping Model?**BTL1 Advantages: • It produces the products quickly and thus saves the time and solves the waiting problem in waterfall model. • It minimizes the cost and product failure. • It is possible for the developers and client to check the function of preliminary implementations of system models before committing to a final system. • It obtains feedback from clients and changes in system concept. Disadvantages: • It ignores quality, reliability maintainability and safety requirements. Customer satisfaction is not achieved
	PART * B
1	**Describe briefly about I/O channels with neat diagram.(13M)** BTL3 **Answer: Page 1.2 – 1.8 – Dr. Latha jothi** Vision(3M) Hearing(2M) Touch(2M) Movement (2M) Reasoning(2M) System(2M)
2	**Discuss briefly about vision and hearing. (13M)** BTL3 **Answer: Page 1.9 – 1.10 – Dr. Latha jothi** Perceiving size and depth(3M) Visual angle (2M) Perceiving brightness (3M) Perceiving color (2M) The human ear (3M)
3	**Explain the concept of human memory**. (13M) BTL3 **Answer: Page 1.8 – 1.12 – Dr. Latha jothi** Sensor memory(3M) Short-term memory(3M) Long term memory(3M) Sensory receptor(2M) Movement (2M)
	PART C

1	**Discuss about thinking methodology.(15M)** BTL3 **Answer: Page 1.17 – 1.19 – Dr. Latha jothi** Reasoning (1M) Inductive reasoning(3M) Deductive reasoning (3M) Abductive reasoning (3M) Problem solving (2M) Gestalt Theory (3M)
2	**Explain display devices.(15M)** BTL3 **Answer: Page 2.11– 2.16 – Dr. Latha jothi** The alphanumeric keyboard (3M) Dvorak keyboard (3M) Phone pad and T9 entry (3M) Handwriting recognition (3M) Digital Paper (3M)
3	**Discuss positioning, pointing and drawing. (15M)** BTL4 **Answer: Page 2.11– 2.16 – Dr. Latha jothi** The mouse (3M) The touchpad (3M) Trackball and thumbwheel (3M) Joystick and keyboard nipple (3M) Touch sensitive screens (3M)

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UNITII DESIGN & SOFTWARE PROCESS	
Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	
PART * A	
Q.No.	Questions
1	**What are the goals of design? BTL1** The main goal of an interactive system design is Maximize the usability. Design means "Achieving the goals within the constraints". The goals are determine the purpose of the design, identify the users & why do they want?
2	**State the Golden rule of Design. BTL5** The golden rule of design is "Understand Your Materials". For Human computer Interaction the obvious materials are the human and the computer. Understand the computer: Limitations,Capacities,Tools & PlatformsUnderstand People : Psychological,Social aspects, Human Error
4	**Write down the process of Design Requirements.BTL4** What is there and what is wanted …, Analysis: ordering and Understanding, Design: what to do and how to decide Iteration and Prototyping: getting it right … and finding what is really needed! implementation and deployment :making it and getting it out there
5	**How the complexity of interactive system design will be reduced by the interaction & prototyping? BTL3** Due to complexity, the first design will not be perfect (human situations are complex). For this reason, all interaction design includes some form of iterations of ideas.
6	**Define Internalization of a System. Why it is necessary? BTL1** Process of making a software suitable for different languages & culture is called Internationalization. Internationalization (sometimes shortened to "I1N, meaning "I - eighteen letters -N") is the process of planning and implementing products and services so that they can easily be adapted to specific local languages and cultures, a process called localization. The internationalization process is sometimes called translation or localization enablement.
7	**List out the activities in software life cycle BTL4** Software life cycle is an attempt to identify the activities that occur in software development. The various activities are, 1. Requirement Specification 2. Architectural Design 3. Detailed Design

	4. Coding & Testing 5. Integration & Testing 6. Operation & Maintenance
8	**List the prototyping approaches used. BTL1** Iterative design overcomes inherent problems of incomplete requirements Prototypes simulate or animate some features of intended system different types of prototypes 1. throw-away 2. Incremental 3. Evolutionary
9	**Define Design Rationale BTL1** Design rationale is information that explains the structural/Architectural description, Functional/Behavioral description of a system. It relates to an activity of both reflection & documentation Benefits of design rationale 1. Communication throughout life cycle 2. Reuse of design knowledge across products 3. Enforces design discipline 4. Presents arguments for design trade-offs 5. Organizes potentially large design space 6. Capturing contextual information
10	**State the Principles that support Usability. BTL1** Usability describes the effectiveness of human performance. It can be defined as the capability to be used by humans easily and effectively. The principles that supports usability are, 1. abstract design rules 2. low authority 3. high generality The Abstract Design Rule are divided into 3 main categories (by DIX) 1. Learnability: ease with new user 2. Flexibility : Multiple ways in which user, system exchange information 3. Robustness : Level of support provided to the user
11	**List out the categories of Smith & Mosier guidelines. BTL1** Guidelines are Lower-level, more specific than principles.The basic categories of smith & Mosier guidelines are, 1. Data entry 2. Data Display 3. Sequence control 4. User guidance 5. Data Transmission 6. Data Protection
12	**What is Evaluation? BTL1** List out the techniques Tests the usability, functionality and acceptability of interactive system. It occurs throughout the design Life cycle and the results of evaluation feedback into modifications to the design. The various evaluation techniques are, 1. Evaluation through Expert Analysis

	2. Evaluation through User participation 3. Evaluation through Observation Techniques 4. Evaluation through Monitoring physiological Response
13	**Define Heuristic Evaluation. BTL1** Heuristic is a guideline \rule\Thumb to critique a system. It is useful for evaluating early design. It is flexible & cheap. It evaluates independently critique a system come up with potential problem
14	**What are the factors need to be considered to select an Evaluation Method? BTL1** 1. Stage in the cycle at which the evaluation is carried out 2. Style of Evaluation 3. Level of Subjectivity\Objectivity of the technique 4. Types of Measures provided 5. Information Provided 6. Immediate of the response Level of Interference implied
15	**Why Universal Design is important? BTL1** Universal design makes thing more accessible, safer and convenient for everyone. It also called Design for all or Inclusive Design. It is a philosophy that can be applied to policy, design and other practices to make products, environments and systems. It functions better for a wide range of people.
16	**Differentiate Multimedia & Multimodal Systems. BTL1** • Multi-modal systems use more than one sense (or mode) of interaction, Multimodal systems process two or more combined user input modes – such as speech, pen, touch, manual gestures, gaze, and head and body movements – in a coordinated manner with multimedia system output. e.g. visual and aural senses: a text processor may speak the words as well as echoing them to the screen • Multi-media systems use a number of different media to communicate information e.g. a computer-based teaching system:may use video, animation, text and still images: different media all using the visual mode of interaction; may also use sounds, both speech and non-speech: two more media, now using a different mode
17	**What are the three main goals of Evaluation? BTL1** 1. To assess the extent and accessibility of the system's functionality. 2. To assess users' experience of the interaction 3. To identify any specific problems with the system.
18	**Define Design rationale. BTL1** Design rationale is the information that explains why a computer system is the way it is, including its structural or architectural description and its functional or behavioral description.
19	**What is the beneficial to have access to the design rationale? BTL1** 1. Design rationale provides a communication mechanism among the members of a design team so that during later stages of design and/or maintenance it is possible to understand what critical decisions were made, what alternatives were investigated. 2. Accumulated knowledge in the form of design rationales for a set of products can be reused to transfer what has worked in one situation to another situation which has similar needs..
20	**What is key to an effective design space analysis? BTL1**

	The key to an effective design space analysis using the QOC(Questions,Options and Criteria) notation is deciding the right questions to use to structure the space and the correct criteria to judge the options.
21	**Define HCI Patterns. BTL1** A pattern is an invariant solution to a recurrent problem within a specific context. Patterns address the problems that designers face by providing a 'solution statement'. Patterns are an approach to capturing and reusing this knowledge – of abstracting the essential details of successful design so that these can be applied again and again in new situations.
22	**Define Universal Design principles.BTL1** It is the process of designing products so that they can be used by as many people as possible in as many situations as possible.
23	**What are the Criteria by which measuring method can be determined? BTL1** 1. Time to complete a task 2. Per cent of task completed 3. Per cent of task completed per unit time 4. Ratio of successes to failures 5. Time spent in errors 6. Per cent or number of errors 7. Per cent or number of competitors better than it
24	**What are the possible ways to set measurement levels in a usability specification? BTL1** Existing system or previous version 1. Competitive systems 2. Carrying out the task without use of a computer system 3. An absolute scale 4. Your own prototype 5. User's own earlier performance 6. Each component of a system separately 7. Successive split of the difference between best and worst values observed in user tests
	PART -B
1	**Explain models of interaction.(13M)** BTL4 **Answer: Page 3.1–3.9 – Dr. Latha jothi** Terms of interaction(2M) The Norman's Execution Evaluation cycle(3M) Evaluation Execution Loop(3M) The interaction framework(3M) Ergonomics(2M)

2	**Explain interaction Styles.(13M)**BTL4 **Answer: Page 3.10–3.16 – Dr. Latha jothi** Command line interface (2M) Menus (1M) Natural language (2M) Form-fills and spreadsheets (2M) The wimp interface (2M) Point – And – Click interface (2M) Three dimensional interface (2M)
3	**Discuss Navigation Design and screen design layout.(13M)**BTL5 **Answer: Page 4.5–4.10 – Dr. Latha jothi** Local structure (3M) Global structure- Hierarchical organization (2M) Global structure – Dialog(2M) Tools for layout(2M) User action and control(2M) Appropriate appearance(2M)
4	**Draw software life cycle and explain in detail.(13M)**BTL5 **Answer: Page 5.1–5.4 – Dr. Latha jothi** Diagram(3M) Activities in the life cycle(3M) Validation and verification(2M) Management and contractual issues(2M) Interactive systems and the software life cycle(3M)
5	**Explain the principle to support usability.(13M)**BTL5 **Answer: Page 6.1–6.9 – Dr. Latha jothi** Learnability(2M) Flexibility(2M) Robustness(3M) Standards(2M) Guidelines(1M) Golden rules and heuristics(3M)
	PART C
1	**How implementation supports the user interface management system?(15M)**BTL5 **Answer: Page 7.1–7.11 – Dr. Latha jothi** Elements of widowing system (3M) Programming the application(3M) Using tool kits(3M) UIMS as a conceptual architecture(3M) Implementation consideration(3M)
2	**Explain the evaluation technique.(15M)**BTL5

	Answer: Page 7.1–7.11 – Dr. Latha jothi Evaluation through expert analysis(1M) Cognitive walkthrough(3M) Heuristic evaluation(3M) Model based evaluation(3M) Style of evaluation(3M) Query technique (2M)

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UNITIII MODELS AND THEORIES	
Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	
PART * A	
Q.No.	Questions
1	**What is a Cognitive model? BTL1** A Cognitive model is the designer's intended mental model for the user of the system: a set of ideas about how it is organized and operates.
2	**What is models and theories? BTL1** "Analyze and design user interfaces and new user-interface technologies", "created software tools and development environment to facilitate the construction of graphical user interfaces", "pioneered the user of voice and video in user interfaces, hypertext links, interactive tutorials and context-sensitive help systems."
4	**Define Cognition psychology**. **BTL1** Cognitive psychology is the study of mental processes such as "attention, language use, memory, perception, problem solving, creativity, and thinking
5	**Define user modeling.BTL1** User modeling is the subdivision of human–computer interaction which describes the process of building up and modifying a conceptual understanding of the user. The main goal of user modeling is customization and adaptation of systems to the user's specific needs. The system needs to "say the 'right' thing at the 'right' time in the 'right' way".
6	**What do we do when there are several ways of solving a problem, or if the solutions to two sub goals interact? BTL1** Users will often have more than one way to achieve a goal and there must be some way of representing how they select between competing solutions.
7	**What are issues for goal hierarchies? BTL1** 1. Granularity, 2. Routine learned behavior, not problem solving, 3. Conflict, 4. Error
8	**What is GOMS?BTL1** GOMS is a specialized human information processor model for human-computer interaction observation that describes a user's cognitive structure on four components. a set of Goals, a set of Operators, a set of Methods for achieving the goals, and a set of Selections rules for choosing among competing methods for

	goals.
9	**Define Goals and Operators. BTL1** Goals are symbolic structures that define a state of affairs to be achieved and determinate a set of possible methods by which it may be accomplished Operators are elementary perceptual, motor or cognitive acts, whose execution is necessary to change any aspect of the user's mental state or to affect the task environment
10	**Define Methods and Selections. BTL1** Methods describe a procedure for accomplishing a goal Control Structure: Selection Rules are needed when a goal is attempted, there may be more than one method available to the user to accomplish it.
11	**Give an example for GOMS GOAL. BTL1** CLOSE-WINDOW. [Select GOAL: USE-MENU-METHOD . MOVE-MOUSE-TO-FILE-MENU. PULL-DOWN-FILE-MENU. CLICK-OVER-CLOSE-OPTION GOAL: USE GOAL: USE-CTRL-W-METHOD. PRESS-CONTROL-W-KEYS] For a particular user: Rule 1: Select USE-MENU-METHOD unless another rule applies Rule 2: If the application is GAME, select CTRL-W-METHOD
12	**Describe Cognitive complexity theory. BTL1** Cognitive complexity theory, begins with the basic premises of goal decomposition from GOMS and enriches the model to provide more predictive power. CCT has two parallel descriptions: one of the user's goals and the other of the computer system (called the device in CCT).
13	**Describe various problem with CCT. BTL1** There are various problems with CCT. As with many 'rich' description methods, the size of description for even a part of an interface can be enormous. Furthermore, there may be several ways of representing the same user behavior and interface behavior, yielding different measures of dissonance.
14	**How to Representative of the linguistic approach?BTL1** Representative of the linguistic approach is Reiner's use of Backus–Nauru Form (BNF) rules to describe the dialog grammar. This views the dialog at a purely syntactic level, ignoring the semantics of the language. BNF has been used widely to specify the syntax of computer programming languages, and many system dialogs can be described easily using BNF rules.
15	**What is Task Action Grammar? BTL1** Measures based upon BNF have been criticized as not 'cognitive' enough. They ignore the advantages of consistency both in the language's structure and in its use of command names and letters. Task–action grammar (TAG) [284] attempts to deal with some of these problems by including elements such as parametrized grammar rules to emphasize consistency and encoding the user's world knowledge
16	**Define Keystroke Level Model. (KLM). BTL1** KLM (Keystroke-Level Model) uses this understanding as a basis for detailed predictions about user performance. It is aimed at unit tasks within interaction – the execution of simple command sequences, typically taking no more than 20 seconds.
17	**Define three-state model. BTL1** The three-state model, which captures some of these crucial distinctions. He begins by looking at a mouse.

	If you move it with no buttons pushed, it normally moves the mouse cursor about. This tracking behavior is termed state
18	**Define term computer-supported cooperative work'. (CSCW). BTL1** The term 'computer-supported cooperative work' (CSCW) seems to assume that groups will be acting in a cooperative manner. This is obviously true to some extent; even opposing football teams cooperate to the extent that they keep (largely) within the rules of the game, but their cooperation only goes so far. People in organizations and groups have conflicting goals, and systems that ignore this are likely to fail spectacularly
19	**What is use of storekeeper? BTL1** The storekeeper always used to understate stock levels slightly in order to keep an emergency supply, or sometimes inflate the quoted levels when a delivery was due from a reliable supplier. Also, requests for stock information allowed the storekeeper to keep track of future demands and hence plan future orders.
20	**What is Free rider problem? BTL1** A few free riders in a conference system are often not a problem, as the danger is more likely from too much activity. In addition, in electronic conferences the patterns of activity and silence may reflect other factors such as expertise. However, it is easy for the number of free riders gradually to increase and the system slide into disuse.
21	**What is 'Critical Mass'? BTL1** Critical mass is the point at which a growing company becomes self-sustaining, and no longer needs additional investment to remain economically viable.
22	**Who are the stakeholders? BTL1** Understanding stakeholders is key to many of the approaches to requirements capture, since in an organizational setting it is not simply the end-user who is affected by the introduction of new technology
23	**Define CUSTOM methodology. BTL1** CUSTOM is a socio-technical methodology designed to be practical to use in small organizations. It is based on the User Skills and Task Match (USTM) approach, developed to allow design teams to understand and fully document user requirements. CUSTOM focusses on establishing stakeholder requirements: all stakeholders are considered, not just the end-users.
24	**What are the CATWOE approach? BTL1** Primary stakeholders are people who actually use the system – the end-users. Secondary stakeholders are people who do not directly use the system, but receive output from it or provide input to it (for example, someone who receives a report produced by the system). Tertiary stakeholders are people who do not fall into either of the first two categories but who are directly affected by the success or failure of the system (for example, a director whose profits increase or decrease depending on the success of the system). Facilitating stakeholders are people who are involved with the design, development and maintenance of the system.
25	**Define Open System Task Analysis (OSTA) BTL1** OSTA is an alternative socio-technical approach, which attempts to describe what happens when a technical system is introduced into an organizational work environment. Like CUSTOM, OSTA specifies both social and technical aspects of the system. However, whereas in CUSTOM these aspects are framed in terms of stakeholder perspectives, in OSTA they are captured through a focus on tasks..

26	**Define Soft systems methodology. (SSM). BTL1** Soft systems methodology (SSM) arises from the same tradition but takes a view of the organization as a system of which technology and people are components. There is no assumption of a particular solution: the emphasis is rather on understanding the situation fully.
27	**Define ETHICS methodology. BTL1** Effective Technical and Human Implementation of Computer-based Systems (ETHICS) ETHICS considers the process of system development as one of managing change: conflicts will occur and must be negotiated to ensure acceptance and satisfaction with the system. If any party is excluded from the decision-making process then their knowledge and contribution is not utilized and they are more likely to be dissatisfied. However, participation is not always complete.
28	**What is FACE-TO-FACE communication? BTL1** Face-to-face contact is the most primitive form of communication – primitive, that is, in terms of technology. If, on the other hand, we consider the style of communication, the interplay between different channels and productivity, we instead find that face-toface is the most sophisticated communication mechanism available. The first thing to note is that face-to-face communication involves not just speech and hearing, but also the subtle use of body language and eye gaze
29	**What are four types of textual communication in current groupware? BTL1** Discrete – directed message as in email. There is no explicit connection between different messages, except in so far as the text of the message refers to a previous one. Linear – participants' messages are added in (usually temporal) order to the end of a single transcript. Non-linear – when messages are linked to one another in a hypertext fashion. Spatial – where messages are arranged on a two-dimensional surface.
30	**What is use of distributed cognition? BTL1** A school of thinking has recently developed which regards thinking as happening not just within the head, but in the external relationships with things in the world and with other people. This viewpoint is called distributed cognition
31	**What is the advantage of animation? BTL1** 1. Communication Skills 2. Building Bridges 3. Self-expression 4. Technical Skills 5. Presentation Skills
	PART -B
1	**Explain multi model interaction and designing for diversity.(13M)**BTL4 **Answer: Page 9.1–6.9 – Dr. Latha jothi** Touch in the interface (2M) Handwriting recognition (2M) Gesture recognition (2M) Designing the user with disability(2M) Designing for different age groups(2M) Designing for cultural differences(3M)
2	**Write down the challenges of display based systems.(13M)**BTL2

	Answer: Page 10.13–10.22 – Dr. Latha jothi GOMS and cognitive complexity theory (3M) Linguistic models (2M) Keystroke level model(3M) Three state model(3M) The problem space Model (2M)
3	**Explain the organizational issues in SOCIO.(13M)**BTL4 **Answer: Page 11.1–11.17 – Dr. Latha jothi** Changing power structure (2M) The invisible worker(3M) Free rider problem(2M) Capturing requirements (2M) Soft system methodology(2M) ethnographic(2M)
4	**Explain face – to – face communication and conversation in detail .(13M)**BTL4 **Answer: Page 11.1–11.17 – Dr. Latha jothi** Transfer effects and personal space(3M) Eye contact and gaze(2M) Back channel, confirmation and interruption(3M) Break down and repair(2M) Speech act theory(3M)
5	**Discuss static web content and dynamic web content .(13M)**BTL5 **Answer: Page 13.8–13.29 – Dr. Latha jothi** The message and the medium(2M) Text and graphics(2M) Movies and sound(2M) The active web(3M) Automatic generation(2M) Batch generation(2M)
	PART C
1	**Explain the types of mobile applications.(15M)**BTL4 **Answer: Page 15.1–15.3 – Dr. Latha jothi** Mobile application medium types(3M) Mobile application media matrix(3M) Application context(3M) Utility context(3M) Locale context(3M)
2	**Draw the mobile information architecture and explain mobile 2.0.(15M)**BTL5 **Answer: Page 16.2–17.6 – Dr. Latha jothi**

	Diagram representation(3M) Prototype(3M) The mobile web server(3M) JavaScript in next frontier(3M) Mobile widget(3M)

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UNITIV MOBILE HCI	
Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	
PART * A	
Q.No.	Questions
1	**List out the layers of the mobile ecosystem. BTL1** 1.Services, 2.Applications 3.Application Frameworks 4.Operating Systems 5.Platforms 6.Devices 7.Aggregators 8.Networks 9.Operators.
2	**What are the services? BTL1** Services include tasks such as accessing the Internet, sending a text message, or being able to get a location—basically, anything the user is trying to do.
3	**What do you mean by Operators? BTL1** The base layer in the mobile ecosystem is the operator. Operators go by many names, depending on what part of the world you happen to be in or who you are talking to. Operators can be referred to as Mobile Network Operators (MNOs); mobile service providers, wireless carriers, or simply carriers; mobile phone operators; or cellular companies.
4	**What is the use of application layer?BTL1** Application frameworks are used to create applications, such as a game, a web browser, a camera, or media player. Although the frameworks are well standardized, the devices are not. The largest challenge of deploying applications is knowing the specific device attributes and capabilities.
5	**What is the need of Application Framework layer? BTL1** The first layer that you have any control over is the choice of application framework. Application frameworks often run on top of operating systems, sharing core services such as communications, messaging, graphics, location, security, authentication, and many others.
6	**Define garbage collection. BTL1** Garbage may be created also as a side effect of crashes. Periodically, it is necessary to find all the garbage pages and to add them to the list of free pages. This process is called garbage collection.
	What is Mobile platform?BTL1

7	A mobile platform's primary duty is to provide access to the devices. To run software and services on each of these devices, you need a platform, or a core programming language in which all of your software is written.
8	**What are all the types of Mobile Platforms? BTL1** Licensed:- Licensed platforms are sold to device makers for nonexclusive distribution on devices. Eg. Java Micro Edition (Java ME), Binary Runtime Environment for Wireless (BREW), WindowsMobile, Limo Proprietary:- Proprietary platforms are designed and developed by device makers for use on their devices.Eg.Palm,BlackBerry,iPhone Open Source:- Open source platforms are mobile platforms that are freely available for users to download, alter, and edit. Open source mobile platforms are newer and slightly controversial, but they are increasingly gaining traction with device makers and developers. Android is one of these platforms.
9	**What is the use of Mobile Application medium type? BTL1** The mobile medium type is the type of application framework or mobile technology that presents content or information to the user. It is a technical approach regarding which type of medium to use; this decision is determined by the impact it will have on the user experience. The technical capabilities and capacity of the publisher also factor into which approach to take.
10	**What is Web Widget? BTL1** A mobile web widget is a standalone chunk of HTML-based code that is executed by the end user in a particular way.
11	**Write about pros and cons of the Mobile web applications. BTL1** Pros:- • They are easy to create, using basic HTML, CSS, and JavaScript knowledge. • They are simple to deploy across multiple handsets. • They offer a better user experience and a rich design, tapping into device features and offline use. • Content is accessible on any mobile web browser. Cons:- • The optimal experience might not be available on all handsets. • They can be challenging (but not impossible) to support across multiple devices. • They don't always support native application features, like offline mode, location lookup, file system access, camera, and so on.
12	**Give short notes on Immersive Full Screen Applications**. **BTL1** The immersive full-screen applications is like a game, a media player, or possibly even a single-screen utility. These applications are meant to consume the user's focus, often doing so by filling the entire screen, and leaving no trace of the device user interface to distract the user. Again, the majority of mobile engagement occurs when the user has idle periods of time; the immersive context is typical in most entertainment applications, one of the most popular mobile content areas.
13	**What is the use of Productivity Application Context? BTL1** The productivity application context is used for content and services that are heavily task-based and meant to increase the users' sense of efficiency. With these types of applications, we can assume that the users are more committed to accomplishing a particular goal, like managing content such as messages, contacts, or media, but we should still assume that they are doing so during idle periods.

14	**List down the disciplines of mobile Information architecture. BTL1** • Information architecture- The organization of data within an informational space. In other words, how the user will get to information or perform tasks within a website or application. • Interaction design-The design of how the user can participate with the information present, either in a direct or indirect way, meaning how the user will interact with the website of application to create a more meaningful experience and accomplish her goals. • Information design-The visual layout of information or how the user will assess meaning and direction given the information presented to him. • Navigation design-The words used to describe information spaces; the labels or triggers used to tell the users what something is and to establish the expectation of what they will find. • Interface design-The design of the visual paradigms used to create action or understanding.
15	**What is the use of Clickstreams? BTL1** Clickstream is a term used for showing the behavior on websites, displaying the order in which users travel through a site's information architecture, usually based on data gathered from server logs. Clickstreams are usually historical, used to see the flaws in your information architecture, typically using heat-mapping or simple percentages to show where your users are going.
16	**Why Wireframes required? BTL1** Wireframes are a way to lay out information on the page, also referred to as information design. Site maps show how our content is organized in our informational space; wireframes show how the user will directly interact with it. They also serve to separate layout from visual design, defining how the user will interact with the experience.
17	**Write about different types of Mobile Prototyping. BTL1** Paper prototypes-The most basic level we have is paper prototyping: taking our printedout wireframes or even drawings of our interface, and putting them in front of people. Context prototype-Take a higher-end device that enables you to load full-screen images on it. Take your wireframes or sketches and load them onto the device, sized to fill the device screen. HTML prototypes-This is a prototype that you can actually load onto a device and produce the nearest experience to the final product, but with static dummy content and data. It takes a little extra time, but it is worth the effort.
18	**Define Subpixels. BTL1** A subpixel is the division of each pixel into a red, green, and blue (or RGB) unit at a microscopic level, enabling a greater level of antialiasing for each font character or glyph. The addition of these RGB subpixels enables the eye to see greater variations of gray, creating sharper antialiasing and crisp text.
19	**What is Pixel Density? BTL1** The pixel density is determined by dividing the width of the display area in pixels by the width of the display area in inches. As this applies to mobile devices, the higher the density of pixels, the sharper the screen appears to the naked eye. This guideline especially applies to type, meaning that as text is ant aliased on a screen with a high density of tiny pixels, the glyph appears sharper to the eye.
20	**What are all the ways of defining a Color Palette? BTL1**

	Sequential: - In this case, there are primary, secondary, and tertiary colors. Often the primary color is reserved as the "brand" color or the color that most closely resembles the brand's meaning. The secondary and tertiary colors are often complementary colors. Adaptive: - An adaptive palette is one in which you leverage the most common colors present in a supporting graphic or image. Inspired: - This is a design that is created from the great pieces of design you might see online or offline, in which a picture of the design might inspire you. This could be anything from an old poster in an alley, a business card, or some packaging. Like with the adaptive palette, you actually extract the colors from the source image, though you should never ever use the source material in a design.
21	**List out the rules to be followed for Readability in mobile design?BTL1** 1. Use a high-contrast typeface 2. Use the right typeface 3. Provide decent leading (rhymes with "heading") or line spacing 4. Leave space on the right and left of each line; don't crowd the screen 5. Generously utilize headings 6. Use short paragraphs Block level striping stripes blocks across multiple disks. It treats the array of disks as a large disk, and gives blocks logical numbers
22	**What is an Iconography? BTL1** The most common form of graphics used in mobile design is icons. Iconography is useful to communicate ideas and actions to users in a constrained visual space. The challenge is making sure that the meaning of the icon is clear to the user.
	PART-B
1	**Explain web interface design.(13M)**BTL5 **Answer: Page 19.1–19.6 – Dr. Latha jothi** Web interface design (3M) The event (3M) The actor(3M) Interesting moments grid (4M)
2	**Write down the purpose of drag and drop.(13M)**BTL5 **Answer: Page 19.7–19.18 – Dr. Latha jothi** Drag and drop list(4M) Drag and drop object(3M) Drag and drop action(3M) Drag and drop collection(3M)
3	**List out various modules in drag and drop.(13M)**BTL5 **Answer: Page 19.19–19.30 – Dr. Latha jothi** Placeholder target(2M) Insertion target(3M) Drag distance(3M)

	Drag lens(3M) Drag feedback(2M)
4	**Explain direct selection.(13M)**BTL5 **Answer: Page 20.1–20.17 – Dr. Latha jothi** Toggle selection(4M) Collection schema(3M) Object selection(3M) Selection explicit(3M)
	PART C
1	**Explain mobile design tools.(15M) BTL5** **Answer: Page 18.18–18.20 – Dr. Latha jothi** Designing for the right device(3M) Designing for different screen size(3M) Layout(3M) Anti-pattern(3M) Discoverability(3M)
2	**Discuss different text-based communication.(15M) BTL5** **Answer: Page 12.1–12.18 – Dr. Latha jothi** Back channels and affective state(3M) Grounding constraints(3M) Context and dixies(3M) Pace and granularity(3M) Linear text and hypertext(3M)

Subject Code: CS6008 **Year/Semester: IV/08**
Subject Name: HUMAN COMPUTER INTERACTION **Subject Handler: N.GLADISS MERLIN**

UNITV WEB INTERFACE DESIGN	
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. L: 45, T: 0	
PART * A	
Q.No.	Questions
1	**List any five events available for cueing the user during a drag and drop interaction? BTL1** 1. Page Load 2. Mouse Hover 3. Mouse Down 4. Drag Initiated 5. Drag Leaves Original Location.
2	**Define Grid. BTL1** The grid is a handy tool for planning out interesting moments during a drag and drop interaction. It serves as a checklist to make sure there are no "holes" in the interaction.
3	**Explain Placeholder targeting and Midpoint boundary. BTL1** 1. Placeholder targeting - Most explicit way to preview the effect. 2. Midpoint boundary - Requires the least drag effort to move modules around.
4	**Explain Full-size module dragging and Ghost rendering. BTL1** Full-size module dragging - Coupled with placeholder targeting and midpoint boundary detection, it means drag distances to complete a move are shorter. Ghost rendering - Emphasizes the page rather than the dragged object. Keeps the preview clear.
5	**What do you mean by drag lens? BTL1** A drag lens provides a view into a different part of the list that can serve as a shortcut target. It could be a fixed area that is always visible, or it could be a miniature view of the list that provides more rows for targeting. The lens will be made visible only during dragging. Example: Dragging the insertion bar while editing text on the iPhone.
6	**When a drop will be invalid in Yahoo! Mail? BTL1** 1. The dragged object's icon becomes a red invalid sign. 2. If over an invalid folder, the folder is highlighted as well.
8	**Write the good rule of thumb on drag initiation from the Apple Human Interface Guidelines. BTL1** Your application should provide drag feedback as soon as the user drags an item at least three pixels. If a user holds the mouse button down on an object or selected text, it should become drag gable immediately and stay drag gable as long as the mouse remains down
9	**What do you mean by drag and drop collection? BTL1** A variation on dragging objects is collecting objects for purchase, bookmarking, or saving into a temporary

	area. This type of interaction is called Drag and Drop Collection
10	**What do you mean by Object Selection? BTL1** On the desktop, the most common approach is to initiate a selection by directly clicking on the object itself. We call this selection pattern Object Selection. Object Selection is used for initiating a drag drop.
11	**What is meant by Toggle Selection? BTL1** The most common form of selection on the Web is Toggle Selection. Checkboxes and toggle buttons are the familiar interface for selecting elements on most web pages. Example: Yahoo! Mail Classic. Toggle Selection is used for selecting bookmarks for editing, deleting, etc..
12	**Define Collected Selection. BTL1** Collected Selection is a pattern for keeping track of selection as it spans multiple pages. Gmail does provide a way to select all items across different pages. When selecting all items on a individual page (with the "All" link), a prompt appears inviting the user to "Select all 2785 conversations in Spam". Clicking that will select all items across all pages. The "Delete Forever" action will operate on all 2785 conversations, not just the 25 selected on the page.
13	**Explain Hybrid Collection. BTL1** Hybrid Selection brings with it the best of both worlds. You can use the checkbox selection model as well as normal row selection. You get the benefit of explicit selection and simplified multiple selection that Toggle Selection brings. And you get the benefit of interacting with the message itself and direct object highlighting.
14	**Define Fitts's Law. BTL1** Fitts's Law is an ergonomic principle that ties the size of a target and its contextual proximity to ease of use. Bruce Tognazzini restates it simply as: The time to acquire a target is a function of the distance to and size of the target. In other words, if a tool is close at hand and large enough to target, then we can improve the user's interaction.
15	**What do you mean by Contextual Tools? BTL1** Contextual Tools are the Web's version of the desktop's right-click menus. Instead of having to right-click to reveal a menu, we can reveal tools in context with the content.
16	**What are the issues with showing contextual tools in an overlay? BTL1** 1. Providing an overlay feels heavier. An overlay creates a slight contextual switch for the user's attention. 2. The overlay will usually cover other information—information that often provides context for the tools being offered. 3. Most implementations shift the content slightly between the normal view and the overlay view, causing the users to take a moment to adjust to the change. 4. The overlay may get in the way of navigation. Because an overlay hides at least part of the next item, it becomes harder to move the mouse through the content without stepping into a "landmine."
17	**Define Mystery Meat and Soft Mode. BTL1** Mystery Meat - It is a common anti-pattern that occurs when you have to hover over an item to understand how to use it. Soft Mode - If a mode is soft it is usually acceptable. By "soft" we mean the user is not trapped in the mode.
18	**Define Muttons. BTL1** Muttons (menu + button = mutton) are useful when there are multiple actions and we want one of the actions to be the default. Yahoo! Mail uses a mutton for its "Reply" button. It is a variation on Multi-Level

	Tools. Muttons are used to: 1. Provide a default button action ("Reply to Sender") 2. Provide a clue that there are additional actions. 3. Provide additional actions in the drop-down.
19	**Define overlays and inlays. BTL1** Overlays - Instead of going to a new page, a mini-page can be displayed in a lightweight layer over the page. Inlays - Instead of going to a new page, information or actions can be inlaid within the page
20	**List the three specific types of overlays. BTL1** 1. Dialog Overlays 2. Detail Overlays 3. Input Overlays
21	**When should an overlay be used? BTL1** 1. Use an overlay when there may be more than one place a dialog can be activated from 2. Use an overlay to interrupt the process. 3. Use an overlay if there is a multi-step process.
22	**When should an inlay be used? BTL1** 1. Use an inlay when you are trying to avoid covering information on the page needed in the dialog. 2. Use an inlay for contextual information or details about one of many items
23	**What are the Patterns that support virtual pages? BTL1** 1. Virtual Scrolling 2. Inline Paging 3. Scrolled Paging 4. Panning 5. Zoomable User Interface
24	**List out the process flow patterns. BTL1** 1. Interactive Single-Page Process 2. Inline Assistant Process 3. Configurator Process
	PART- A
1	Explain dialog INLAYS in detail.(**13M) BTL5** **Answer: Page 23.1–23.11 – Dr. Latha jothi** List inlay (5M) Detail inlay(5M) Tabs(3M)
2	Explain virtual scrolling and inline paging.(**13M) BTL5** **Answer: Page 24.1–24.9 – Dr. Latha jothi** Desktop Style application (3M) Loading status (2M) Progressive loading (2M) Inpage update (2M) Natural chunking (2M)

	Interactive content loading(2M)
3	How process flow occur in google blogger. .(**13M) BTL5** **Answer: Page 24.1–24.9 – Dr. Latha jothi** The magic principle (3M) Interactive single page process (3M) Inline assistant process(3M) Dialog overlay process(2M) Configurator process(2M)
	PART C
1	**Discuss positioning, pointing and drawing. (15M)** BTL4 **Answer: Page 2.11– 2.16 – Dr. Latha jothi** The mouse (3M) The touchpad (3M) Trackball and thumbwheel (3M) Joystick and keyboard nipple (3M) Touch sensitive screens (3M)
2	**Explain the evaluation technique.(15M)**BTL5 **Answer: Page 7.1–7.11 – Dr. Latha jothi** Evaluation through expert analysis(1M) Cognitive walkthrough(3M) Heuristic evaluation(3M) Model based evaluation(3M) Style of evaluation(3M) Query technique (2M)

GE6075 Professional Ethics in Engineering

Objectives:

- To enable the students to create an awareness on engineering ethics and human values, to instill moral and social values and loyalty and to appreciate the rights of others.

Unit I Human Values 10

morals, values and ethics – integrity – work ethic – service learning – civic virtue – respect for others – living peacefully – caring – sharing – honesty – courage – valuing time – cooperation – commitment – empathy – self confidence – character – spirituality – introduction to yoga and meditation for professional excellence and stress management.

Unit II Engineering Ethics 9

senses of 'engineering ethics' – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – kohlberg's theory – gilligan's theory – consensus and controversy – models of professional roles – theories about right action – self-interest – customs and religion –uses of ethical theories.

Unit III Engineering as social experimentation 9

Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law.

Unit IV Safety, responsibilities and rights 9

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – intellectual property rights (IPR) – discrimination.

Unit V Global issues 8

Multinational corporations – environmental ethics – computer ethics – weapons development engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership –code of conduct – corporate social responsibility.

Total: 45 Periods

Outcomes:

Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

Text Books:

1. Mike W. Martin and Roland Schinzinger, "Ethics In Engineering", Tata Mcgraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall Of India, New Delhi, 2004.

References:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard And Michael J. Rabins, "Engineering Ethics – Concepts And Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics And The Conduct Of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer And Robert L Barry, "Fundamentals Of Ethics For Scientists And Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman And Joe Desjardins, "Business Ethics: Decision Making For Personal Integrity And Social Responsibility" Mc Grawhill Education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri Publications, Erode, 2011

SUB CODE: GE6075 SUB NAME: PROFESSIONAL ETHICS IN ENGINEERING

SUBJECT HANDLER: Mr. S. DEEPAN YEAR /SEM: IV/08

	UNIT –I HUMAN VALUES
	Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.
Q.NO	**PART * A**
1	**What are human values?**BTL1 Values decide the standard of behavior. Some universally accepted values are freedom justice and equality. Other principles of values are love, care, honesty, integrity, self-respect.
2	**Define ethics. What are ethical values?(MAY-JUNE 2016) (NOV-DEC 2015)** BTL1 the philosophical study of the moral value of human conduct and of the rules and principles that ought to govern it. Trustworthiness, respect, responsibility, fairness, caring is ethical values
3	**Distinguish values from ethics and culture. (MAY-JUNE 2016)** BTL1 Values are mainly related to individuals and since they are related to justice, they remain the same for everyone. E.g. Truth, honesty, empathy, self respect. Values do not change from individual to individual. Ethics is common to a group of individuals; the group may be religious or professional. Ethics is mostly based on some code or law and judgment of any action is based on code of conduct or law. Ethics change from individual to individual Culture commonly refers to conduct of a group. e.g system of worship, marriage. It may differ from society to society, nation to nation or religion to religion.
4	**What is integrity? (NOV-DEC2018)** BTL1 Integrity is the unity of character based on moral values. Consistency in attitudes, emotions and conduct in relations to morally justified actions and values are also the part of integrity of individual. It implies honesty, trustworthiness.

5	**What is courage as a value?** BTL1 Courage implies self-respect and governs confrontations with danger and risk. It is not excessive rashes or cowardice, but it is the middle ground. Taking calculated risks and boldness in facing crises are the hallmarks of courage as a human value. It defines the mental makeup of an individual in taking bold decisions even under adverse situations.
6	**Define work ethics.**BTL1 By one's work one cannot harm others. Any worker cannot escape accountability. Worker has the moral responsibility to see that no other person's right, private or freedom is impaired or transgressed.
7	**What is service learning? (APR-MAY 2017)** BTL1 Service learning tells that one has moral responsibility to increase the desirable effects and to decrease the harmful effects. Any service should increase the desirable result.
8	**Mention some civic virtues.** BTL1 Good citizen demand civic virtue. It is the principle of not harming the surroundings .it also includes living peacefully, respect for others, protecting the environment and being normally and ethically good.
9	**Write short notes on caring and sharing.** BTL1 Caring is the essence of moral life. Caring involves feelings, relationship, contends with other persons and protecting others and causing least damage to others. Sharing means sharing of feelings, ideas thoughts, resources and profits. Sharing is always mutually beneficial. Sharing morally acceptable feelings, resources and materials is a value.
10	**Write notes on honesty.** BTL1 Any human being should imbibe honesty-honesty in acts, honesty in speech and honesty in beliefs. Honesty is the fundamental virtue in human relationship even though in may be difficult to follow some times.
11	**Give short notes on co-operation.** BTL1 Co-operation means extending help to others, for a good cause. Co-operation may be through an idea, a suggestion, an assistance or physical work which extends to others for common benefit.
12	**Define empathy.** BTL1 Empathy means putting self in a position of someone else and thinking as the later and reasoning suitable action.
13	**Write a note on Integrity.** BTL1 Integrity is the bridge between responsibility in private and professional life.
14	**What do you mean by Compromise?** BTL1 In a negative sense it means to undetermined integrity by violating one's fundamental moral principles. In a positive sense, however, it means to settle differences by mutual concessions or to reconcile conflicts through adjustments in attitude and conduct.
15	**Give the two aspects of Honesty.(NOV-DEC 2016)** BTL1 Truthfulness – meeting responsibilities concerning truth-telling. Trustworthiness –Meeting responsibilities concerning trust.
16	**Differentiate Self-respect and Self-esteem.** BTL1 Self-respect: It is a moral concept; refers to the virtue properly valuing oneself. Self-esteem: It is a psychological concept; means having a positive attitude toward Oneself, even if the attitude is excessive or otherwise unwarranted.

17	**What are Human values? (NOV –DEC 2016)** BTL1 Values are the rules by which we make decisions about right and wrong, should and shouldn't, good and bad. "Emotional beliefs in principles regarded as particularly favorable or important for the individual." Types of Values: (a) Right conduct, (b) Peace (c) Truth, (d) Love, (e) Nonviolence.
18	**What are the factors that demonstrate a strong work ethic?** BTL1 1 Integrity, 2 Sense of Responsibility 3 Emphasis on Quality 4 Discipline 5 Sense of Teamwork.
19	**List the characteristics of a Good Work Ethic.** BTL1 Reliability, Dedication, Productivity, Cooperation, and Character
20	**State the term called civic virtue.** BTL1 Civic virtues are the moral duties and rights, as a citizen of the village or the country or an integral part of the society and environment. **Civic virtues are divided into four categories**: 1. Civic Knowledge 2. Self-Restraint 3. Self-Assertion 4. Self-Reliance
21	**Give short notes on Respect for others.** BTL1 Respect is a positive feeling of admiration or deference for a person. Respect can be a specific feeling of regard for the actual qualities of the one respected. It can also be conduct in accord with a specific ethic of respect. Treating people with respect makes your world a nicer place to live in, whether it's at home, at school, or out in your community. Don't insult people or make fun of them.
22	**Write a note on living peacefully.** BTL1 To live peacefully, one should start install peace within (self). Charity begins at home. Then one can spread peace to family, organization where one works, and then to the world, including the environment. Only who are at peace can spread peace. You cannot gift an article which you do not possess. The essence of oriental philosophy is that one should not fight for peace. It is oxymoron. War or peace can be won only by peace, and not by wars.
23	**Write short notes on various terms Self- Confidence, Character and Spirituality.** BTL1 **(May/June 16)(NOV-DEC2018) (NOV-DEC 2015)** **Self- Confidence**: Certainty in one's own capabilities, values, and goals. These people are usually positive thinking, flexible and willing to change. They respect others so much as they respect themselves. **Character**: To determine the ideals. **Spirituality:** Spirituality is a way of living that emphasizes the constant awareness and recognition of the spiritual dimension (mind and its development) of nature and people, with a dynamic balance between the material development and the spiritual development.
24	**Define moral values. (APR- MAY 2017) (APR- MAY 2015) (NOV-DEC 2015)**BTL1 Moral value is value that must be separated with other values. Every value will get quality if it has relation with other values. For example, Honesty is example of moral values; this value

<table>
<tr><td></td><td>has no meaning if it does not be applied with other values. Economic Value is relation of human and thing. Thing is needed because its usefulness. Economic Value relate with purpose value. Loyalty is moral value, but it must be applied with other, humanity value for general, for example, love of husband and wife.</td></tr>
<tr><td>25</td><td>Define spirituality. (NOV-DEC 2015)BTL1
, “Spirituality is often experienced as a source of inspiration or orientation in life. It can encompass belief in immaterial realities or experiences of the immanent or transcendent nature of the world.”</td></tr>
<tr><td>26</td><td>Difference between Mortality and Ethics. [Dec 2012] BTL1
<table>
<tr><td>Mortality</td><td>Ethics</td></tr>
<tr><td>Based on customs and tradition.</td><td>It is a critical reflection of moral</td></tr>
<tr><td>Concerned with wrong action when done</td><td>Concerned with right action when not</td></tr>
<tr><td>Top Priority is given because damage is L</td><td>ess priority & less serious</td></tr>
<tr><td>Example: corruption and crime</td><td>Example: belief about manners</td></tr>
</table></td></tr>
<tr><td></td><td>PART * B</td></tr>
<tr><td>1</td><td>Explain in detail about important human values. (13M) (April 2014) BTL2

Answer Page.no.0.1 to 0.2 - V.Jayakumar

Important human values :(9 M)
The five core human values are: (1) Right conduct, (2) Peace, (3) Truth, (4) Love, and (5) Nonviolence.
1. values related to right conduct are:
(a) Self-help skills: care of possessions, diet, hygiene, modesty, posture, self reliance, and tidy appearance
(b) Social skills: good behavior, good manners, good relationships, helpfulness, no wastage, and good environment.
(c) Ethical skills: code of conduct, courage, dependability, duty, efficiency, ingenuity, initiative, perseverance, punctuality, resourcefulness, respect for all, and responsibility.
2. Values related to peace are: attention, calmness, concentration, contentment, dignity, discipline, equality, equanimity, faithfulness, focus, gratitude, happiness, harmony, humility, inner silence.
3. Values related to truth are: accuracy, curiosity, discernment, fairness, fearlessness, honesty, integrity (unity of thought, word, and deed), intuition, justice.
4. Values related to love are: acceptance, affection, care, compassion, consideration, dedication, devotion, empathy, forbearance, forgiveness, friendship, generosity.
5. Values related to non-violence are:
(a) Psychological: benevolence, compassion, concern for others, consideration , forbearance, forgiveness, manners, happiness, loyalty, morality, and universal love
(b) Social: appreciation of other cultures, religions, brotherhood, care of environment, citizenship, equality, harmlessness,</td></tr>
</table>

	c) Perseverance persistence, determination, resolution, tenacity, dedication, commitment, constancy, steadfastness, stamina, endurance and indefatigability. d) Accuracy means freedom from mistake or error; conformity to truth or to a standard or model and exactness. e) Discernment means discrimination, perception, penetration, and insight. Discernment, powers to see not obvious to average mind. Stresses accuracy, especially in reading character, motives. **Evolution of Human Values: (4 M)** The human values evolve because of the following factors: 1. The impact norms of the society, fulfillment of the individual's needs or desires. 2. Developed or modified one's own awareness, choice, and judgment in fulfilling the needs. 3. By the teachings and practice of Preceptors (Gurus) or Saviors or religious leaders. 4. Fostered or modified by social leaders, rulers of kingdom, and by law (government).
2	**Illustrate a detailed note on work ethics and explain problems exist in the industrial/business scenario(13M)** BTL2S **Answer Pg.no.0.1 to 0.2 - V.Jayakumar** **DEFINITION:(2 M)** Work ethics is defined as a set of attitudes concerned with the value of work, which forms the motivational orientation. The 'work ethics' is aimed at ensuring the economy productivity , safety , health and hygiene, privacy , security , cultural and social development (leisure, hobby, and happiness), welfare (social work), environment (anti-pollution activities), and offer opportunities for all, according to their abilities, but without discrimination. **ELEMENTS OF A STRONG WORK ETHIC: (6 M)** **1.Interpersonal skill:** It include the habits, attitude, manners, appearance and behaviors which affect how we get along with other people **2.Initiative:** Without initiative procrastination and missed opportunities can become problem. **3. Professionalism** Being professional involves everything, how you dress and present yourself in business world, way you treat others. **4. Accountability** Take personal responsibility, actions and out comes, every situation. Mistakes taken as learning experiences, ability to always better, must be upholder.

	5. Respectfulness Serving a customer, meeting with a client or collaborating with colleagues, do best respect everyone's opinions, especially under difficult circumstances. Value people's individual worth, their professional contributions. **6. Dedication** Don't stop until job done, and done right. Fully dedicated, to strive, to achieve, best results alongside putting extra hours,get things right. **7. Determination** Don't let obstacles stop, enthusiastically embrace challenges, job as an entrepreneur solve clients' problems. **8. Humility** Acknowledge everyone's contributions, and freely share credit accomplishments. Gratitude to colleagues who work hard, and appreciation to loyal clients. 9.**Dependability** Relates closely to when always on time and prepared for meetings. The ability to deliver work on time. **Many complex social problems exist in the industrial/business scenario, because: (5 M)** 1. Desire to be recognized as individuals and treated dignity, living human beings. 2. Work intrinsically valuable, enjoyable or meaningful in allowing personal expression and self-fulfillment. 3. Meaningful work , sense of personal identity and the self-esteem 4. Work, major instrumental good in life. 5. main source providing income needed to avoid economic dependence , 6. Pay, pace of work be in commensurate with the expertise required, acquired, utilized in persons. 7. Privacy of employee, including women, protected. 8. Security during job upon retirement, accepted, government jobs, public limited companies, corporate organizations. 9. Recognition non-work activities, leisure, paid holiday day, visit, dignitary, social service, developmental activities. 10. Hard work, productivity essential success industry. 11. Hard labor, undignified jobs, hazardous jobs, made less straining, dignified, safer. 12. Employee alienation, Absence of or inadequate 'recognition and reward system' and 'grievance redressal system', lack of transparency policy implementation, factions trade unions etc. 13. A different view of work ethics: Work is considered as a necessary evil. 14. Protestant Work Ethics, the financial success sign, favored by God. 15. Obtaining desired materials and services, achieving status and recognition others. 16. Exploitation and bargained pay should be discouraged. 17. Confidentiality of employer to be protected. 18. The quality of work life deserves to be improved. 19. Lead to ethical problems, affecting the work ethics.
3	**Explain integrity and honesty in ethics. (13 M) (NOV-DEC 2015) (NOV-DEC 2016)** BTL2 **Answer: Page No:190 - Mike W. Martin** **Answer Pg.no:0.9 to0.10 - V.Jayakumar** **Integrity: (6 M)**

	1. Integrity defined unity of thought, word, deed, open mindedness. 2. Capacity to communicate factual information, others make well-informed decisions. 3. Yields, person's 'peace of mind', hence add strength and consistency in character, decisions, and actions. 4. Paves way to one's success. 5. Enthuse people, not only execute job well, and achieve excellence in performance. 6. To own the responsibility, earn self-respect, recognition by doing job. 7. Moral integrity defined as a virtue **8.** Reflects consistency of one's attitudes, emotions, and conduct in relation to justified moral values**.** 9. I self-direction virtues **Honesty:(7 M)** Honesty is a virtue, and it is exhibited in two aspects namely, (1) **Truthfulness** i. Truthfulness faces the responsibilities upon telling truth. ii. One should keep one's word or promise. iii. By admitting one's mistake committed, it is easy to fix them. iv. Reliable engineering judgment, maintenance of truth, defending the truth, and communicating the truth, 'good' to others, (2) **Trustworthiness.** i) Trustworthiness, maintaining integrity and taking responsibility, personal performance. ii) right way to win, according to the laws or rules (legally and morally). iii. Build trust through reliability and authenticity. iv. Admit their own mistakes and confront unethical actions in others and take tough and principled stand, even if unpopular. v. Honesty is mirrored in many ways. Vi.People abides by law and lives by mutual trust. The common reflections are: (a) Beliefs (intellectual honesty). (b) Communication (writing and speech). (c) Decisions (ideas, discretion). (d) Actions (means, timing, place, and the goals). And (e) Intended and unintended results achieved.
4	**Explain the characteristics and importance of self confidence in ethics. (13M) (MAY-JUNE 2016)** BTL2 **Answer: Pg.no.0.29 - V.Jayakumar** **SELF-CONFIDENCE:** (3 M) 1. Certainty in one's own capabilities, values, and goals, self-confidence. 2. People usually positive thinking, flexible, willing to change. 3. Respect others so much as they respect themselves. 4. Self- confidence positive attitude, individual has some positive and realistic view, with respect to the situations, which one gets involved. 5. The people with self-confidence exhibit courage to get action and unshakable faith, abilities, whatever their positions. 6. Not influenced by threats, challenges and prepared to face the, natural or unexpected consequences. 7. The self- confidence person develops a sense of partnership, respect, and accountability,

	8. Helps organization, obtain maximum ideas, efforts, and guidelines from employees. **The people with self- confidence have the following characteristics: (4 M)** 1. A self-assured standing, 2. Willing to listen to learn from others and adopt (flexibility), 3. Frank to speak the truth, and 4. Respect others' efforts and give due credit. On the contrary, some leaders expose others when failure occurs, and own the credit when success comes. **The factors that shape self-confidence in a person are:(3 M)** 1. Heredity (attitudes of parents) and family environment (elders), 2. Friendship (influence of friends/colleagues), 3. Influence of superiors/role models, and 4. Training in the organization (e.g., training by Technical Evangelists at Infosys Technologies). **The following methodologies are effective in developing self-confidence in a person(3 M)** 1. Encouraging SWOT analysis. Evaluating their strength and weakness, anticipate and be prepared to face the results. 2. Training to evaluate risks and face them (self-acceptance). 3. Self-talk, conditioning mind for preparing self to act, without any doubt on his capabilities. 4. Make one accepts himself while striving for improvement. 5. Study, group discussion, on the history of leaders and innovators
5	**Discuss the importance time wasters. How can one manage time properly? (13 M)** BTL1 **Answer: Pg.no.0.24 to 0.25 - V.Jayakumar** **INTRODUCTION:(2 M)** Time is rare resource. Once spent, lost forever. Cannot be either stored or recovered. Time is the most perishable and most valuable resource too. Resource continuously spent, whether any decision or action is taken or not. History of great reformers and innovators, stressed, importance of time and valuing time. Time management: It is the rational way to ensure that our limited time is always used effectively. **Identifying time wasters: (3M)** Unscheduled and scheduled meetings Lack of adequate meetings Poor delegation Too much socializing Ineffective communication Lack of goal objectives Poorly organized supervision Poor use of telephone **Time management principle:(5M)** 1.clear objectives 2.prioritize tasks 3.stick to scheduled tasks

	4.Allow time to manage your time 5.The unexpected 6.Managing time wasters **An anecdote to highlight the 'value of time' is as follows:(3 M)** 1. To realize, value of one year, ask student who failed in the examinations; 2. To realize, value of one month, ask mother who delivered premature baby; 3. To realize, value of one week, ask editor of weekly; 4. To realize the value of one day, ask daily-wage laborer; 5. To realize, value of one hour, ask the lovers longing to meet; 6. To realize, value of one minute, ask person who missed train; 7. To realize value of one second, ask person who survived an accident; 8. To realize, value one Milli second, ask person who won the bronze medal in Olympics; 9. To realize value of one micro second, ask NASA team of scientists; 10. To realize value of one nano-second, ask a Hardware engineer!; If you have still not realized the value of time, wait; are you an Engineer?
6	**Discuss the concept of Caring, Sharing And Living Peacefully in detail. (13 M)** BTL2 **Answer: Page .no. 0.19 and 0.20 and 0.18 - V.Jayakumar** **Caring: (4 M)** 1. Caring, feeling for others. 2. A process which exhibits interest, support, the welfare of others with fairness, impartiality, justice all activities, employees, context of professional ethics. 3. Respect to feelings of others, respecting, preserving interests of others concerned. 4. Caring reflected in activities- friendship, membership in social clubs and professional societies, through various transactions in family, fraternity, community, country and in international councils. 5. In present day context, caring for environment, necessity for our survival. 6. Do not care environment, environment scare us. **SHARING: (4M)** 1. Primarily, caring influences 'sharing'. 2. Transfer of knowledge, experience, commodities, facilities with others. 3. Transfer genuine, legal, positive, voluntary, without expectation in return. 4. Proprietary information, not be shared with outsiders. 5. Process of sharing, experience, expertise, wisdom benefits reach more people faster. 6. Sharing voluntary, cannot be driven by force, 7. Motivated successfully through ethical principles. 8. sharing is 'charity' For humanity, 9. 'Sharing' a culture. 10. 'Happiness, wealth' multiplied 'crimes sufferings' reduced, by sharing. 11. Paves way for peace obviates militancy. 12. Philosophically, the sharing maximizes happiness for all human beings.

	13. Psychologies, fear, divide, and distrust between 'haves' 'have-nots' disappear. **LIVING PEACEFULLY:(5 M)** 1. To live peacefully, start install peace within. 2. Charity begins at home. 3. Then one can spread peace to family, organization where one works, and then to the world, including the environment. 4. Only who are at peace can spread peace. 5. You cannot gift an article which you do not possess. 6. Essence, oriental philosophy, one should not fight for peace. 7, It is oxymoron. War or peace, won by peace, and not by wars! One should adopt the following means to live peacefully, in the world: 1. Order in one's life 2. Pure thoughts in one's soul 3. Creativity in one's head. 4. Beauty in one's heart

	Explain commitment and empathy. (13 M) BTL2 **Answer: Pg.no.0.28 -V. Jayakumar** **Commitment:(5 M)** 1. Commitment means acceptance, responsibilities, duties, cooperation means help assistance. 2. By developing team commitment and cooperation in a work team assisting team to meet, goals and objectives. 3. Work teams that committed and cooperative more likely to achieve the goals the business has set. **Empathy: (8 M)** 1. Empathy capacity to understand feel another person, experiencing within other being's frame of reference, i.e., capacity, place oneself another's position. 2. Empathy seeing, eyes another, listening ears another feelings heart, another. 3. Many definitions, empathy encompass, broad range of emotional states. 4. Types of empathy cognitive empathy, emotional empathy, and somatic empathy. 5. Development human empathy, individual differences appear, ranging. no apparent empathic ability, empathy, harmful, self others 6. To well-balanced empathy, ability to distinguish between self other. **Daniel Goleman identified five key elements of empathy.** 1. Understanding Others. 2. Developing Others. 3. Having a Service Orientation. 4. Leveraging Diversity. 5. Political Awareness.
8	**Explain character and spirituality and their Importance in ethics.(13M)(MAY-JUNE 2016)** BTL2 **Answer: Pg .no.0.32 - V. Jayakumar** **INTRODUCTION: (4 M)** 1.Spirituality way of living emphasizes constant awareness recognition spiritual 2. Dimension, nature people, dynamic balance between material development, spiritual developments. 3. Great virtue of Indian philosophy for Indians. 4. Sometimes, spirituality includes faith, belief in supernatural power/ God,

	regarding worldly events. 5. Functions fertilizer for soil 'character' to blossom into values morals. **Spirituality in Workplace: (9 M)** Building spirituality in workplace: Spirituality promoted workplace by adhering to following activities: 1. Verbally respect individuals as humans recognize, values in all decisions actions. 2. Get to know people with whom you work know what important 3. Know goals, desires, and dreams too. 4. State your personal ethics your beliefs clearly. 5. Support causes outside business. 6. Encourage leaders to use value-based discretion, making decisions. 7. Demonstrate own self-knowledge spirituality in all actions. 8. Do unto others as you would have m do unto you.
9	**Briefly explain terms Values, Morals & Ethics. (13M)** BTL1 **Answer: Pg. no.0.4 - V. Jayakumar** **Morals: (4 M)** **Morals** principles on which one's judgments of right, wrong based. Morals refer to beliefs what not objectively right, but what considered right for situation What morally correct, not be objectively correct. Some moral principles : 1. Do not cheat 2. Be loyal 3. Be patient 4. Always tell truth 5. Be generous **Ethics: (6 M)** 1. Ethics principles of right conduct. . 2. main difference, morals more abstract, subjective, often personal or religion-based, 3. Ethics more practical conceived principles promoting fairness, social business interactions. Some ethical principles : 1. Truthfulness 2. Honesty 3. Loyalty 4. Respect 5. Fairness 6. Integrity **Values: (3 M)** **Values —**things have an intrinsic worth in usefulness or importance to possessor, or principles, standards, qualities considered worthwhile, desirable. 1. Tend to think of a value as something good, virtually all values morally relative neutral, really qualified by asking, –How it good? –Good to whom? 2 –good sometimes just a matter of opinion, taste, driven by culture, religion, habit, circumstance, environment, etc.

10	**What is integrity? Explain number of accounts viewed under integrity. What are the salient features of courage? (13 M)** BTL2 **Answer: Pg.no.0.10 - V.Jayakumar** **MEANING: (2M)** 1. Integrity elementary value for profession. 2. Important for all who exhibit strong moral ethical principles. 3. Deals exhibiting fairness honesty, all professional, personal relations. 4. Personal choice which uncompromising under any kind of circumstances. **Number of accounts viewed under integrity. (7M)** **1. Integrity as self-integration** • Establishes a formal relation to self people integrate different facets of ir personality to an intact whole. • Mainly a matter of keeping oneself totally intact uncorrupted. **2. Integrity as identity** • Commitment, one makes, oneself, people, relations, institutions, traditions culture etc. **3. Integrity as sting for something** • Self-integration identity sees integrity, matter of personal choice. • Person, high integrity, consistent endorsements, takes something within community. • Integrity considered, proper regard, role community process deliberation over valuable worth doing. **4. Integrity as purpose** • Places moral checks on kinds, commitments person of integrity must honor. • Integrity, morally correct despite, substantial moral disagreement, some issues with section of society. **5. Integrity as-Individual, Professional Institutional** • Integrity forms building block, ethical conduct competency. • Three different levels essential for an individual's professional survival. 1.Personal integrity Accountability for personal actions conducting personal relationships fairly honestly. 2.Professional integrity Professional duties obligations complete honesty in conformity, professional code of ethics. 3.Institutional integrity • Wider concept driven by mission--vision statements of an organization, established code of conduct procedures. • Ethical conduct throughout organization through personal example, management practices ethical training. **The salient features of courage:(4 M)** **a)**Moral courage b)Physical courage
	PART * C
1	**Distinguish values from ethics and explain comparison between them . (15M)** BTL2 **Answer: Pg.no.0.11 - V.Jayakumar** **Values: (2 M)**

- Values can be defined as those things that are important to or valued by someone.
- That someone can be an individual or, collectively, an organization.
- One place where values are important is in relation to vision.
- One of the imperatives for organizational vision is that it must be based on and consistent with the organization's core values.

Ethics: (3 M)

At its simplest, ethics is a system of moral principles. They affect how people make decisions and lead their lives.

Ethics is concerned with what is good for individuals and society and is also described as moral philosophy.

The term is derived from the Greek word *ethos* which can mean custom, habit, character or disposition.

Ethics covers the following dilemmas:

- How to live a good life
- Our rights and responsibilities
- The language of right and wrong
- Moral decisions - what is good and bad?

Explanation: (10 M)

Comparison Chart:

BASIC COMPARISON	ETHICS	VALUES
MEANING	Ethics refers to the guidelines for conduct, that address question about morality.	Value is defined as the principles ideals that helps them in making judgment of what is more importa
WHAT ARE THEY?	System of moral principles.	Stimuli for thinking.
CONSISTENCY	Uniform	Differs from person to person
TELLS	What is morally correct or incorrect, in the given situation?	What we want to do or achieve.
DETERMINES	Extent of rightness or wrongness of our options.	Level of importance.
WHAT IT DOES	Constrains	Motivates

2	**Briefly explain the importance of Yoga and meditation for successful life. (15M) (NOV-DEC 2015) (NOV-DEC 2016) (Nov/Dec2013)** BTL2

Answer: Refer notes

Yoga:(2M)

Yoga is a type of exercise in which you move your body into various positions in order to become more fit or flexible, to improve your breathing, and to relax your mind.

Yogic exercise recharge body with cosmic energy facilitates: (3M)

1. Attainment of perfect equilibrium harmony
2. Promotes self- healing.
3. Removes negative blocks from mind toxins from body
4. Enhances personal power
5. Increases self-awareness
6. Helps in attention, focus concentration, especially important for children
7. Reduces stress tension physical body ,activating nerve system

Importance of Yoga (4M)

1. Yoga for all-round fitness
2. Yoga for weight loss
3. Yoga for stress relief
4. Yoga for inner peace
5. Yoga to improve immunity
6. Yoga to live with greater awareness
7. Yoga for better relationships
8. Yoga to increase energy
9. Yoga for better flexibility & posture
10. Yoga to improve intuition

Meditation:(2M)

Meditation is a precise technique for resting the mind and attaining a state of consciousness that is totally different from the normal waking state. It is the means for fathoming all the levels of ourselves and finally experiencing the centre of consciousness within.

Importance of Meditation: **(4 M)**

- Focused attention
- Relaxed breathing
- Gives a sense of calm
- Gaining new perspective on stressful situation
- Increasing self awareness
- Reducing negative emotions

3	**Explain the need of stress management in detail. (15M) (April / May2017) (NOV-DEC 2015)** BTL2 **Answer: Refer Notes**. **INTRODUCTION: (3 M)** i. We all react differently to stress. ii. Based on available resources skills, you decide whether a situation stressful to you. iii. might become aggressive take your stress out on your loved ones or colleagues whilstors hold it in rare use escape techniques such as eating disorders or substance abuse, which ultimately more destructive. **Cause of stress:** a. constantly irritable or having sleep problems b. Snappy short fused c. Feeling anxious or depressed d. Excessively eating, drinking or smoking e. High, cholesterol, high blood pressure, eczema or skin problem f. Struggle with concentration, feeling unmotivated or insecure g. insecure feelings about money, your employment or your relationship **NEED FOR STRESS MANAGEMENT:(12 M)** **1. Set daily goals.** It important to set goals for before going to work next day. Setting specific daily goals for business, help stay focused, saving time money long run. **2. Delegate.** Delegate your business family responsibilities. If your job, delegate some of your responsibilities to qualified employees. **3. Prioritize your tasks.** Determine what needs done right away do those particular task order importance. That way, you won't be constantly worrying about completing se vital projects can relax after complete. **4. Communicate.** Don't waste your time assuming that certain people will do what y need to do. Talk to your co-workers your family so that everybody on same page. Can not only save you a lot of time but also will reduce your stress level. **5. Prepare for unexpected events.** Sometimes certain events may happen that might take everyone by surprise. Be flexible when unexpected events, deal immediately. **6. Don't procrastinate.** Do not put things off when you can do m today. An entrepreneur, important, staff, family members' complete tasks in a timely manner. **7. Reduce any potential conflicts.** When a potential problem starts to develop with workers or family members, try to find a solution immediately. Do not let potential conflicts drag on from one week to next. Use your problem-solving skills to prevent any arguments. **8. Get help if you need it.**

	Sometimes a person might need to speak to a counselor or take some educational classes in time management.

	UNIT II ENGINEERING ETHICS
	Senses of "Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.
	PART * A
1	**Define moral Dilemma. (MAY/JUNE 2012)** BTL1 Dilemmas are certain kind of situations in which a difficult choice has to be made. Moral dilemmas can also be called moral problems. Moral Dilemmas have two or more folding's- moral obligations, duties, rights, goods, or ideals come disagreement with each other.
2	**What are the chief characteristics of a profession? (MAY/JUNE 2012)** BTL1 • It renders an essential social service. • It demands continuous in service training of its members • It involves a code of ethics. • It sets up its own professional organization. • It assures its members a professional career. • It has a truth and loyalty. • It has a transparency of work. • It gives instantaneous results.
3	**List out significance of engineering ethics. (MAY/JUNE 2011)** BTL1 An engineer should have the ability and judgement to refine one's behaviours, decisions and actions in performing the duty to the family, organization and to the society. An engineer needs to be a free thinker. he needs to be an intellectual who has the proficiency in recognizing moral problems in engineering, comprehend and assess those views from different viewpoints
4	**Define engineering ethics. (MAY/JUNE 2011, MAY/JUNE 2014)** BTL1 Study of the moral issues and decisions confronting individuals and organizations engaged in engineering / profession. Study of related questions about the moral ideals, character, policies and relationships of people and corporations involved in technological activity. Moral standards /values and system of morals.
5	**Define normative inquiry? (MAY/JUNE 2011)** BTL1 Engineering ethics involves normative inquiry in order to aim at identifying and justifying the morally desirable norms or standards that ought to guide individuals or groups. Normative questions include what ought to be? And what is good?
6	**Define ethical pluralism?(APRIL/MAY 2010)** BTL1 Ethical pluralism is the view that there may be alternative moral perspectives that are reasonable, but no one of which must be accepted completely by all rational and morally concerned persons.
7	**Differentiate Moral and Ethics. (MAY/JUNE 2010)** BTL1 **Moral:** • Refers only to personal behaviour. • Refers to any aspect of human action. • Social conventions about right or wrong conduct.

	Ethics: Involves defining, analyzing, evaluating and resolving moral problems and Developing moral criteria to guide human behaviour. Critical reflection on what one does and why one does it. Refers only to professional behaviour.
8	**Write any three uses of ethical theories. (NOV/DEC2010, MAY/JUNE 2014)** BTL1 Ethical theories are very useful in understanding and resolving moral dilemmas. In estimating the professional obligations and ideals. Determine to what extent, the obligations can be exercised in a given situation.
9	**List out types of Theories about Morality/ Right action. (MAY/JUNE 2009) (NOV-DEC2018)** BTL1 Virtue ethics – Virtues and vices Utilitarianism – Most good for the most people Duty ethics – Duties to respect people Rights ethics – Human rights
10	**Define Ethical Egoism. (MAY/JUNE 2009)** BTL1 It deals with self-interest. Each person is the best judge of their own self-interest and is responsible for maximizing their own interest. Egoism preaches selfishness but morality should encourage love, compassion etc.
11	**Differentiate Ethical Relativism and Ethical Egoism. (MAY/JUNE2008)** BTL1 Ethical egoism – the view that right action consist in producing one's own good. Ethical relativism – the view that right action is merely what the law and customs of one's society require**.**
12	**What is moral integrity? (MAY/JUNE2008)** BTL1 Moral integrity is the strength of character on the basis of moral concern and moral values. Integrity is the bridge that links the responsibilities between personal life and professional carrier.
13	**Differentiate profession and professionalism. (NOV/DEC 2008)** BTL1 Profession is a job through which someone makes living. Professionalism covers comprehensively all areas of practice of a particular profession. It requires skills and responsibilities involved in engineering profession.
14	**Give the importance of Lawrence Kohlberg's and Carol Gilligan's theory. (NOV/DEC2008)** BTL1 Kohlberg gives greater emphasis to recognizing rights and abstract universal rules. Gilligan Stresses the importance of maintaining personal relationships based on mutual caring.
15	**What is consensus and controversy?** BTL1 Consensus means agreement and controversy means disagreement. Both plays the vital roles while considering moral autonomy.
16	**What is the relationship between moral autonomy and authority?** BTL1 Moral' autonomy is exercised on the basis of moral concern for other people and recognition of good moral reasons. Authority provides the frame work in which learning can takes place in class room/work place.
17	**What are the concepts of pre-conventional & conventional level in Gilligan's theory?** BTL1 Carol Gilligan recast the theory of Kohlberg as follows. Pre conventional level: Desire to derive benefits for oneself. Right conduct is viewed in a selfish manner as solely what is good for oneself. Conventional level: Here the basic motive is willingness to sacrifice one's own interests and a strong desire to hurt other's interests. Mostly women are always willing to give up their personal interests in order to serve the needs of others.
18	**Define Ethics. Mention some universally accepted ethical standards. (NOV/DEC 13)**BTL1 "Ethics" as the "discipline dealing with what is good and bad and with moral duty and obligation," "a set of moral principles or value" or "a theory or system of moral values." Ethics assists individuals in deciding when an act is moral or immoral, right or wrong. Ethics can be grounded in natural law, religious tenets,

	parental and family influence, educational experiences, life experiences, and cultural and societal expectations. Ethical Standard such as Focus on ethics, Corporate culture, Managerial
19	**Define Professionalism. (APRIL/MAY 2015)** BTL1 Professionalism means behaving in an ethical manner while assuming and fulfilling your rightful responsibilities in every situation every time, without fail. To get a bit more granular, one can say that it means, in part, conducting your affairs in such a way as to engender trust and confidence in every aspect of your work.
20	**Define Moral Autonomy (NOV/DEC2014/2018)** BTL1 Moral autonomy, usually traced back to Kant, is the capacity to deliberate and to give oneself the moral law, rather than merely heeding the injunctions of others. Personal autonomy is the capacity to decide for one self and pursue a course of action in one's life, often regardless of any particular moral content.
	PART * B
1	**Explain the stages of moral development according to Gilligan? Discuss it.(13M)(Nov/Dec2006) (Nov/Dec2007) (April/ May2011) (Nov/Dec2012) (Nov/Dec2013)** BTL2 **Answer Page.no:1.17 V.Jayakumar** **INTRODUCTION: (2 M)** • **Carol Gilligan Moral Development Theory Explained** Carol Gilligan moral development theory used, approach to reasoning. Women tended, score lower, scales of morality compared to men. Not agreeing, idea, women morally inferior to men Began, process of interviewing women, make difficult decisions in lives. Process develop a moral development theory, closely associated, women instead, men. **The Three Stages of Gilligan's Moral Development Theory: (6 M)** Gilligan produced, theory, three stages of moral development. • **The Pre-conventional Stage:** Goal of a woman, to survive. Focused on individuality Making sure basic needs been met. Priority to meet others needs. • **The Conventional Stage:** A woman recognizes, self-sacrifice, source "goodness" in life. Finds moral satisfaction, by helping other people Focusing on helping others to survive best way possible. • **The Post-conventional Stage:** "Ends no longer justify the means" to have needs met. A principle of non-violence, applies to every decision. Not wish to hurt or hurt others, looking alternative methods to meet needs. Diagram: (2 M)

	Gilligan's Stages of the Ethic of Care

Stage	Goal
Preconventional	*Goal is individual survival*
Transition is from selfishness -- to -- responsibility to others	
Conventional	*Self sacrifice is goodness*
Transition is from goodness -- to -- truth that she is a person too	
Postconventional	*Principle of nonviolence: do not hurt others or self*

Gilligan suggests two transitions that occur during the stages. (2 M)

The first transition:

- Occurs between the pre-conventional and conventional stages
- Moves a woman's moral ethics from selfish to shares a responsibility to care others.

The second transition:

- Occurs between the conventional and post-conventional stages
- Moves a woman being focused on "good" to being focused on "truth."
- Looking, ways to survive for herself and for others
- Begins, look, options fueled, need to stay true to certain moral constants.

2

Explain the uses of ethical theories. (13M) (Nov/Dec2006) BTL2

Answer Page No.:60-66 Mike W. Martin

The uses of ethical theories.: (13 M)

- Identifying moral considerations, reasons to constitute a dilemma.
- Precise sense of information, relevant to solving moral development.
- Provide guidance in solving moral problems.
- moral ramifications of alternative courses action
- Providing systematic framework of comparing alternatives.
- Discussing moral issues with colleagues.
- By providing frame works development of moral arguments
- It strengthens ability to reach balanced and insightful judgments.
- Justifying professional obligations and ideas.
- 10. Relating ordinary and professional morality.

3

Explain in detail about: (13 M) (Nov/Dec2007) BTL2

1. Professional responsibility. Answer Page. no. 2.3 V. Jayakumar

2. Self- respect. Answer: Page. no. 2.5 & 2.6 V. Jayakumar

3. Utilitarianism. Answer Page No. 55 Mike W. Martin

Professional responsibility : (6 M)

- The **duties** of attorneys to act in a professional manner
- Obey the law, avoid conflicts of interest
- Put the interests of clients ahead of their own interests.
- Being morally responsible as a professional.

Most basic and comprehensive professional virtue.

A wide variety of more specific virtues grouped as follows:

- **SELF DIRECTION VIRTUES:**

Fundamental virtues in exercising moral autonomy and responsibility.
e.g. self understanding, humility and good moral judgment

- **PUBLIC SPIRITED VIRTUES:**

Focusing on good of clients and public affected by engineers‟ work

- **TEAMWORK VIRTUES:**

Enables professionals to work successfully with others.
E.g. collegiality, cooperativeness, the ability to communicate

- **PROFICIENCY VIRTUES:**

Mastery of one's craft that characterize good engineering practice
e.g. competence, diligence, creativity

 MORAL INTEGRITY

The unity of character on the basis of moral concern
Consistency among our attitudes in relation to justified moral values.

SELF-RESPECT (3 M)

- Valuing oneself in morally appropriate ways.
- Integral to finding meaning in one's life and work
- A pre-requisite for pursuing moral ideals and virtues.
- Self-respect is a moral concept of properly valuing oneself
- Self-esteem is a concept of positive attitude towards oneself.

Self-respect takes two forms.

- Recognition self-respect is properly valuing oneself
  One's inherent moral worth, every other human being has.
- Appraisal self-respect is properly valuing ourselves
  How well we meet moral standards, our personal ideals.

 Utilitarianism: (4 M)

Utilitarianism is a normative ethical theory

Places the locus of right and wrong solely on the outcomes

There are two main types of Utilitarianism. They are:

 Act Utilitarianism

Act Utilitarianism states that "A particular action is right if it is likely to produce the higher level of good for the most people in a given situation, compared to alternative choices that might be made."

 Rule Utilitarianism

The Rule Utilitarianism states that "Right actions are those required by rules that produce the higher level of good for the most people."

Formulation of Ethical Theories

- The concepts of the theory formulated must be coherent.
- The tenets of the theory should never contradict the other.
- The theory should never be defended upon false information.
- Guide in specific situations comprehending all aspects possible.

	• Compatible with individual's moral convictions in any situation.
4	**Explain Kohlber's theory in detail. (13 M) (MAY/JUNE2011) (NOV-DEC2018)** BTL2 **Answer Page. no. 1.15 V. Jayakumar** **Kohlberg's Stages of Moral Development (6 M)** **Level 1 - Pre-conventional morality (7 M)** • We don't have a personal code of morality. • Our moral code is shaped by the standards of adults • Stage 1. Obedience and Punishment Orientation. • The child/individual good in order to avoid being punished. • Stage 2. Individualism and Exchange. • Different individuals have different viewpoints. **Level 2 - Conventional morality** • To internalize the moral standards of valued adult role models. • Stage 3. Good Interpersonal Relationships. • The child, good in order to be seen as good person by others. • Stage 4. Maintaining the Social Order. • The child/individual becomes aware of wider rules of society. **Level 3 - Post-conventional morality** • Individual judgment is based on self-chosen principles. • Moral reasoning is based on individual rights and justice. • Stage 5. Social Contract and Individual Rights. • The child/individual aware of rules/laws, exist for the good of greatest number. • Stage 6. Universal Principles. • Develop own set of moral guidelines, may or may not fit law.
5	**Discuss the scopes of engineering ethics. (13 M)(April/ May2008) (April/ May2011)** BTL2 **Answer Page. no. 2 Mike W. Martin** **INTRODUCTION: (2 M)** **Engineering Ethics** Moral issues, decisions confronting individuals and organizations engaged in **engineering**. **EXPLANATION: (11 M)** **Moral reasoning and ethical theories:** By "morality," meant the standards of rightness and goodness "Ethics" means those moral standards that appropriate to particular occupations **Engineers As Social Experimentation:** In developing a product, an engineer learns through experimentation. A trial and error method is the mostly used one to obtain results, **Engineers responsibility for safety:** To maintain the safety of human beings. To procure their rights of consent. To warn them about the probable safety hazards. **Respect to employees and right to engineer:** A safe and healthful workplace To ask your employer to correct dangerous conditions. To file a complaint about workplace hazards **GLOBAL ISSUES:** Increases through trade, investment, transfer of technology, exchange of ideas, culture.

	Engineers as Managers • An Engineer is responsible in promoting ethics in an organization, • Framing organizational policies, responsibilities and obligations.
6	**Explain the different ethical theories right action, self-interest, duty ethics. (13M) (April / May2007)** BTL2 **Answer Page No. 60-72 Mike W. Martin** **Duty ethics theory: (4 M)** • Consequences of performance of one's duties. • Being honest, not cause suffering of other • Being fair to others including the meek and week • Being grateful, keeping Promises etc. **The RIGHTS EHICS:(5 M)** • The right to access the truth • The right of privacy • The right not to be injured • The right to what is agreed **Self-Interest Ethics: (4 M)** • Right action consists in seeking self-fulfilment. • Self to be realized, defined by caring relationships with individuals and society. • Ethical egoism, right action consists in always promoting what is good for oneself.
7	**Discuss the different models of professional roles.(13M)(May/June 2009) (NOV-DEC2018)** BTL2 **Answer Page. no. 1.23 V. Jayakumar** **EXPLANATION: (13 M)** • **SAVIOR:** Redeem society from poverty, inefficiency Waste and the drudgery of manual labour. • **GUARDIAN:** Directions in which, pace at which, technology should develop. • **BUREAUCRATIC SERVANT:** Loyal organization person uses special skills to solve problems. • **SOCIAL SERVANT:**

	Co-Operation with management, task of receiving society's directives, satisfying society's desires • **SOCIAL ENABLER AND CATALYST:** Vital role beyond mere compliance with orders. Management and society understand, own needs, to make informed decisions. • **GAME PLAYER:** Neither servants nor masters of anyone. Economic game rules that happen to be in effect at a given time.
8	**Explain the need of tolerance for different customs and ethical relativism in adverse society with suitable example. (13 M) (April /MAY 2014)** BTL2 **Answer Page No:2.16 V.Jayakumar** **Customs and Ethical Relativism: (6 M)** • There may be alternative moral attitudes that are reasonable. • Ethical pluralism allows in deciding how we should act. • Moral values are many, varied and flexible. • Reasonable persons always have reasonable disagreement on moral issues • Ethical relativism says actions morally right when they approved by law, custom • Ethical relativism tries to reduce moral values to laws. **Reasons for accepting ethical relativism: (7 M)** • The laws and customs seem to be definite, real and clear – cut. Help to reduce the endless disputes about right and wrong. Laws seem to be an objective way to approach values. • It believes values are subjective at cultural level. The moral standards varied from one culture to another. Morality encourages virtue of tolerance of difference among societies. • The moral renationalise or moral contextualise. Making simple and absolute rules are impossible in this way. Customs, laws considered as morally important factors for making judgments.
9	**Explain the vital role of consensus and controversy while considering moral autonomy in Engineering ethics. (13 M) (Nov/Dec2012)** BTL2 **Answer Pg. no. 1.18 V. Jayakumar** **CONSENSUS AND CONTROVERSY** **Models of professional roles: (6 M)** • **SAVIOR:** Redeem society from poverty, inefficiency Waste and the drudgery of manual labour. • **GUARDIAN:** Directions in which, pace at which, technology should develop. • **BUREAUCRATIC SERVANT:** Loyal organization person uses special skills to solve problems. • **SOCIAL SERVANT:** Co-Operation with management, task of receiving society's directives, satisfying society's desires • **SOCIAL ENABLER AND CATALYST:** Vital role beyond mere compliance with orders. Management and society understand, own needs, to make informed decisions. • **GAME PLAYER:** Neither servants nor masters of anyone. Economic game rules that happen to be in effect at a given time.

	Consensus and Controversy (4 M) • Literally, consensus means _agreement', controversy means _disagreement'. • Individual exercise moral autonomy, to attain same results as other people obtain • This kind of controversies i.e., disagreements are inevitable. • Exercising moral autonomy is not as precise, clear-cut as arithmetic • The moral disagreements are natural and common. • Promoting tolerance in practical applications of moral autonomy by engineers. **Relationship between autonomy and authority (3 M)** • Moral autonomy and respect for authority compatible with each other. • Exercising moral autonomy based on moral concern for other people • Exercising moral autonomy recognition of good moral reasons. • Also moral autonomy emphasizes the capabilities and responsibilities of people. • Authority provides framework, through which learning attitudes are encouraged. • Conflicts will arise between individuals need for autonomy, consensus about authority. • This situation can be rescued by having open and frank
10	**State Meaning of moral dilemma. Describe the types and few steps in confronting Moral Dilemma in the life (13 M) (April/ May2007)** BTL2 **Answer Pg. no. 32 Mike W. Martin** **Definition: (2 M)** A moral dilemma is defined as any situation in which the person making the decision experiences a conflict between the moral rightness of a decision and the quality of the results it produces. Many times, these dilemmas involve a morally wrong decision that produces a desirable result, or vice versa. **The following three categories of complex and gloomy moral situations: (8 M)** • **Vagueness** The condition where the doubt lies in whether the action refers to good or bad. • **Conflicting reasons** Fixing the priorities depends upon the knowledge and the moral values one has. The reason why the particular choice makes sense. • **Disagreement** When two or more solutions and none among them is mandatory The final solution selected should be best most probable conditions. • **Steps in Facing Moral Dilemmas (3 M)** Whenever a person is faced with a moral dilemma, the issue is to be solved with a stepwise approach as this will generate a better output. **The step of identification involves the following −** • The issue has to be thoroughly understood. • The duties, responsibilities of persons involved to be clearly known. • The moral factors related to the issue are to be understood. • The conflicting responsibilities
	PART * C
1	**Discuss the moral problems faced by an Indian common man. (15 M) (April / May2008)** BTL2 **Answer Page. no: 5 Mike W. Martin 3rd Edition Refer notes** **Morality: (3 M)** Morality is the human attempt to define what is right and wrong about our actions and thoughts, and what is good and bad about our being that we are. *"Moral issue is a working definition of an issue of moral concern is presented as any issue with the potential to help or harm anyone, including oneself."*

Types of Moral Issues (5 M)

There are mainly two types of Moral issues. They are –

- **Micro-ethics**

Problems that occur on a daily basis in field of engineering, its practice by engineers.

- **Macro-ethics**

This approach deals with social problems which are unknown.

Problems may unexpectedly face the heat at both regional, national levels.

Examples: (3 M)

1. Animal Welfare - Is it okay to eat meat or dairy?

Moral problems faced by an Indian common man: (4 M)

- Discrimination based on caste, creed and colour.
- Reservation in education and employment field enjoyed by "backward class" for 3 generations and still continue to use.
- To meet basic amenities-food, clothing and shelter.
- Garbage collection and disposal
- Traffic congestion in urban areas
- Farmers not getting support prices for crops
- Corruption

2

Explain the various types of Ethical inquiries available. Analyze in detail the *Self –Interest and Ethical Egoism* (15M)BTL1

Answer Page. no. 72 Mike W. Martin(*Self –Interest and Ethical Egoism)*

Answer refer notes.

Types of Inquiries (8 M)

Normative inquiries
Conceptual inquiries
Factual or descriptive inquiries

- **Normative Inquiries**

The description that describes what one ought to do under a specific circumstance.

- **Conceptual Inquiries**

The description of meaning of concepts, principles and issues related to engineering ethics.

- **Factual and Descriptive Inquiries**

The descriptive inquiry help to provide the facts for understanding
Finding solutions to the value based issues.

Self-interest: (4 M)

It refers to the goodness of oneself in the long run.

- The ethical theories recognize the importance of self-respect.
- Utilitarian considers one's own good as well as the good of others.
- Duty ethicists stress duties to us and for won well-being.
- Ethicists of rights emphasize our rights to pursue our own good.
- Virtue ethicists accent the importance of self – respect.

	• Pursuit of self – interest must be balanced • Kept under control by moral responsibilities to other people. **Ethical Egoism (3 M)** • It tries to reduce morality to the pursuit of self - interest. • The main duty of us is to maximize our own good. • Make a differentiation between narrower and wider forms of self-interest • Ethical Egoists try to protect their positions by arguing • Pursue their self – interest in a very cautious manner to value, interest rationally on facts. • Not a persuasive or probable theory to state what is morality • It is only a convinced rejection of morality.
3.	**Explain the theory of human right ethics and its classification. (15 M) (Nov/Dec 15)** BTL2 **Answer Page. no. 55 to 66 Mike W. Martin** **THEORIES ABOUT RIGHT ACTION:** These theories are essential for cause of right action and morality. They are: • **"Golden mean"** ethics **(3 M)** The best solution is achieved through reason and logic A compromise or "golden mean" between extremes of excess, deficiency. **Problem:** Variability from one person to another in their powers of reasoning The difficulty in applying the theory to ethical problems**.** • **"Rights –** based" ethics **(4 M)** Every person is free and equal Has the right to life, health, liberty and possessions **Problem:** One person's right may be in conflict with another's rights. • **"Duty –** based" ethics **(4 M)** Each person has a duty to follow a course of action **Problem:** Universal application of a rule can be harmful. • **"Utilitarian"** ethics **(4 M)** The best choice, which produces maximum benefit for greatest number of people **Problem:** Qualification of the benefits can be difficult.

	UNIT –III **ENGINEERING AS SOCIAL EXPERIMENTATION**
	Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook
1	**List out the pros and cons of industrial standardization. (MAY/JUNE 2012) (NOV-DEC2018)**BTL1 **Advantages of Standards:** • Reducing costs • Increasing productivity • Reducing unnecessary variety • Ensuring inter changeability • Minimizing waste • Ensuring safety • Quality assurance **Disadvantages of standards:** • The implementation of standard removes the creative element of the program • Standards force people to change their methods • Standards reduce productivity by forcing unnecessary actions • Standards do not prevent bugs.
2	**List out the limitations of ethical code. (MAY/JUNE 2011)(NOV/DEC 2014)** BTL1 • Some issues cannot be handled in the context of a code. • There are some difficulties with enforcing the code, or at least the public may believe that enforcement committees are not tough enough on their peers. • There is often no way to bring the interests of the client, patient, or research participant systematically into the code-construction process. • There are parallel forums in which the issues in the code may be addressed, with the results sometimes at odds with the findings of the code (for example, in the courts).
3	**Define ethical accountability. (MAY/JUNE 2011)** BTL1 The inherent tendency of accepting moral responsibility for the actions of an individual and also the spontaneous willingness to subject him to the moral scrutiny in an open-minded manner is called ethical accountability.
4	**Name the aerospace ace experts and scientists who were associated with the Launching of challenger. (MAY/JUNE 2010)** BTL1

	Allan McDonald of Morton-Thiokol at Cape Kenned y, Arnold Thomson and Roger Bois jolywho were the seal experts at Morton-Thiokol a n d engineering managers, Bob Lund and Joe Kil minster were the experts associated with the launching of challenger space program.
5	**List out some of the important code of ethics published by engineering societies. (MAY/JUNE 2010)** BTL1 National society of professional Engineers. Board of Ethical review. NSPE opinion of the Board of ethical review. American Association of Engineering societies (AAES). Institute of Electrical and Electronics Engineers (IEEE).
6	**List out the problems with the law in engineering?(NOV/DEC 2010)** BTL1 The numerous legal considerations that must be taken into account by engineers, considerations that are typically outside of the traditional knowledge base and experience of an engineer. Patents and the process of obtaining one; maintenance of licensing and certification; and having a firm understanding of codes and standards are just some of the many issues facing engineers in their career path.
7	**How engineering could be regarded as preventive technology? (MAY/JUNE 2009)** BTL1 As per the familiar proverb that "prevention is better than cure", the ultimate process of solving the scientific-based problems is not by curing alone, but effectively by the preventive measures. Such type of defensive measures to prevent scientific ills is called preventive technology.
8	**What are the general features of morally responsible engineers?(MAY/JUNE 2009)** BTL1 • Conscientiousness. • Comprehensive perspective. • Autonomy. • Accountability.
9	**Write some of the specific role of informed consent in engineering experimentation**. BTL1 Informed consent is the vital concept to interact engineers with public society. It reflects the respects for the fundamental rights of minority people involved in the experimental procedures.

	It enables both the public and clients to be aware of the practical risks and benefits of that experimentation.
10	**Differentiation between engineering and standard experiments.** BTL1 Engineering experimentation involves human subjects as control groups, Unlike in the standard experimentation .The process of obtaining the informed consent from the human-engineering experimentation. Unlike in the scientific experiments, new knowledge is not gained in engineering experiment.
11	**Differentiate scientific experiments and engineering projects** BTL1 Scientific experiments are conducted to gain new knowledge, while ―engineering projects are experiments that are not necessarily designed to produce very much knowledge.
12	**How Titanic tragedy be brought under engineering as social experimentation?** BTL1 Failure in the far-sighted approach of not providing enough number of lifeboat sand non-availability of proper safe exits handled to the sinking of titanic ship that caused the death toll of 1522 persons on b o a r d . These in designing a r e the reasons for bringing titanic tragedy under engineering as social experimentation
13	**Write down some of the uncertainties occur in the model designs.(APR-MAY2018)**BTL1 Model used for the design calculations. Exact characteristics of the materials purchased. Constancies of materials used for processing and fabrication. Nature of the pressure, the finished product will encounter.
14	**Give short notes on engineering as experimentation. (MAY/JUNE2014) (APR/MAY 2015)(NOV/DEC 2014)** BTL1 Experimentation (Preliminary tests or Simulations) plays a vital role in the design of a product or process.In all stages of converting a new engineering concept into a design likes, first rough cut design,Usage of different types of materials and processes, detailed design, Further stages of work design.
15	**State the importance of Ethics codes. (MAY/JUNE2014)** BTL1 Engineers shall uphold and advance the integrity, honour, and dignity of the engineering Profession by: •Using their knowledge and skill for the enhancement of the human race; •Being honest and impartial and serving with fidelity the public, their employers, and clients. •Striving to increase the competence and prestige of the engineering profession.

	•Supporting the professional and technical societies of their discipline
16	**List the conditions required to define a valid Consent.** BTL1 It must be voluntary and informed, and the person consenting must have the capacity to make the decision. Capacity – the person must be capable of giving consent, which means they understand the information given to them and they can use it to make an informed decision.
17	**Give some universally accepted ethical principles.** BTL2 • Honesty • Commitment • Empathy • respect for the dignity • Competent Caring for the Well-Being of Persons and Peoples • Integrity • Professional And Scientific Responsibilities To Society
18	**List out the advantages of industrial standards. (APR/MAY 2015)**BTL1 • Increased marketability • Reduced operational expenses • Better management control • Increased customer satisfaction • Improved internal communication
19	**Define balanced outlook Law.**BTL1 A balanced outlook on laws stresses the necessity of laws and regulations and their limitations in directing engineering practice. In order to live, work and play together in harmony as a society, there must be a balance between individual needs and desires against collective needs and desires. Only ethical conduct can provide such a balance. This ethical conduct can be applied only with the help of laws. Laws are important as the people are not fully responsible and because of the competitive nature of the free enterprise system which does not encourage moral initiative.
20	**Define Whistle Blowing.** BTL1 This is an act by an employee informing the public or higher management of unethical or illegal behavior by an employee or supervisor. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers.
21	**List the advantages of code of ethics.(NOV-DEC2018)** BTL1 • Guide employees in situations where the ethical course of action is not immediately obvious.

	• A code can help create a climate of integrity and excellence. • Help the company communicate its expectations to the staff to suppliers, vendors and customers. • Minimize subjective and inconsistent management standards. • Help a company remain in compliance with complex government regulations. • Build public trust and enhance business reputations. • Offer protection in preempting or defending against lawsuits. • Enhance morale, employee pride, loyalty and the recruiting of outstanding employees. • Help promote constructive social change by raising awareness of the community's needs and encouraging employees and other stakeholders to help. • Promote market efficiency – especially in areas where laws are weak or inefficient – by rewarding the best and most ethical producers of goods and services.
21	**How does the law facilitate the ethics in engineering?(APR-MAY 2017)** BTL1 Engineering ethics is the field of system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. As a scholarly discipline, it is closely related to subjects such as the philosophy of science, the philosophy of engineering, and the ethics of technology.
	PART * B
1	**Explain in detail about** **i. Assess how Engineering societies can promote ethics.** **ii. Evaluate the General responsibilities of moral engineers.(13M)** (BTL2) **Answer refer notes.** **Engineering societies and promoting ethics.(4 M)** • Hold paramount safety, health, welfare of public. • Perform services in areas of their competence. • Issue public statements in an objective, truthful manner. • Act for each employer, client as faithful agents, trustees. • Avoid deceptive acts. • Conduct them honorably, responsibly, ethically, lawfully • To enhance the honor, reputation, usefulness of profession. • **The responsibilities of moral engineer.(7 M)** Loyalty to corporations, respect for authority, collegiality. Teamwork is a few important virtues in the field of Engineering. • **Loyalty**

	Loyalty is the faithful adherence to an organization, employer. **Loyalty to an employer can be either of the two types:** • **Agency-loyalty:** Acting to fulfill one's contractual duties to an employer. • **Attitude-loyalty :** A lot to do with attitudes, emotions A sense of personal identity as it does with actions. • **Collegiality** A work environment where responsibility, authority shared among colleagues. **Main factors that help in maintain harmony among members at a workplace are(2 M)** Respect Commitment Connectedness
2	**Explain a Balanced Outlook on Law. (13 M) (NOV/DEC2010)** BTL2 **Answer Page 100- Mike W. Martin** **Explanation – (6 M)** • It stresses the necessity of laws and regulations • Limitations can understand with an overview of laws in engineering profession. • Individual needs, collective needs of the society stimulate harmony in society. • The ethical conduct can be applied with the help of laws. • Laws are important as people are not completely responsible. • The competitive nature of free enterprise system, does not encourage moral initiative. **Let us look at a few examples from the past that represent the importance of law.(7 M)** Babylon's Building Code Bhopal disaster
3	**Explain in detail about engineers as responsible Experimenters. (13 M) (APR-MAY2017)** BTL2 **Answer Page. 95 Mike W. Martin** **General responsibility of engineering as society(4 M)** • Engineers primarily considered as technical enablers, facilitators, rather than sole experimenters. • Responsibility is shared with management, the public and others. • The engineers should display virtue of being morally responsible person. **General features of moral responsible engineers(9 M)**

	• Conscientiousness • Relevant information • Moral Autonomy • Accountability **Conscientiousness:** Commitment to live according to certain values. **Relevant information:** Engineers properly gauge all information related to meeting one's moral obligations. **Moral autonomy:** The ability to think critically and independently about moral issues Apply moral thinking to situations, arise during professional engineering practice. **Accountability:** 'Accountability 'means being responsible, liable, answerable or obligated. Willingness to present morally convincing reason for ones action, conduct.
4	**Illustrate the codes of ethics set by professional societies. (13 M)** BTL2 **Answer refer notes.** **Codes of ethics set by professional societies (13 M)** Guided in all their relations by the highest standards of honesty and integrity. Engineers shall at all times strive to serve the public interest. Engineers shall avoid all conduct or practice that deceives the public. Not disclose, without consent, confidential information concerning business affairs. Engineers shall not influence in their professional duties by conflicting interests. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly. Guilty of unethical, illegal practice shall present information to proper authority for action. Credit for engineering work to those to whom credit is due, recognize proprietary interests of others.
5	**Examine the roles played by the codes of ethics. (13 M) (MAY/JUNE2011,NOV/DEC 2013)(NOV/DEC2014)** BTL2 **Answer Page no. 44 Mike W. Martin** **Code of ethics Meaning:(2 M)**

	To provide basic framework for ethical judgment for a professional. **Roles of Code of Ethics: (13 M)** **The code of ethics propagated by professional societies play a vital role. They are,** • Inspiration • Guidance • Support for responsible conduct • Deterring and disciplining unethical professional conduct • Educational and promotion of mutual understanding • Contributing to positive public image of profession • Protecting the status quo suppressing dissent within the profession • Promoting business interest through restraint of trade.
6	**Illustrate engineering project differ from standard experimentation? (13 M)(NOV/DEC 2013)** BTL2 **Answer page no: 91 Mike W. Martin** **The scientific experiments in the laboratory and the engineering experiments in the field exhibit several contrasts as listed below: (13 M)** **Experimental control:** • Members for study selected into two Groups namely A, B at random. • Group A are given special treatment. • The group B Given no treatment, called 'controlled group'. • Placed in the same Environment as other group A. • Engineering, through random sampling, survey made among users • To assess results on product. **Humane touch:** • Engineering experiments involve human souls, their needs, views,& expectations, • Creative use as in case of social experimentation. • This view not agreed by many of engineers. • Quality engineers, managers fully realized this humane aspect. **Informed consent:**

	• Engineering experimentation viewed as Societal Experiment • Since subject, the beneficiary is human beings. • Medical practice- moral, legal rights Have recognized while planning experiments
7	**i. Explain limitations of code of ethics.** **ii. Briefly discuss the importance of code of ethics. (13M) (APR-MAY2017)** BTL1 **Answer: (Refer notes)** **Definition of code of ethics (2 M)** The definition of a code of ethics is "a collection of principles and practices that a business believes in and aims to live by." It should be a document that goes along with the company mission and vision statement. Anyone who interacts with the company or works for the company should understand the code. Much of this is part of employee policy and guidelines, but it also carries over to dealing with vendors and partners. ***Limitations of Codes:*** **(3 M)** • Codes are restricted to general and vague wordings. • Engineering codes often have internal conflicts. • They cannot be treated as final moral authority for professional conduct. • Only a few practicing engineers are members of Professional Societies • Members of Professional Societies not aware of existence of codes oftheir societies never go through it. • Codes can be reproduced in a very rapid manner. • Codes said to be coercive i.e., implemented by threat, force. **The importance of code of ethics.(8 M)** • Step one: Get your priorities straight • Step two: Where to get your input • Step three: Common major pitfalls • Step four: Where to get help • Step five: Assigning someone to be in charge
8	**Explain in detail about ethics in research (13M) (NOV/DEC2013/2018)** BTL2 **Answers refer notes.** **INTRODUCTION: (3 M)** People think of ethics, think of rules for distinguishing between right, wrong, such as Golden Rule. **EXPLANATION: (10 M)**

	The following is a rough and general summary of some ethical principles: • Honesty • Integrity • Carefulness • Openness • Respect for Intellectual Property • Confidentiality • Responsible Publication • Responsible Mentoring • Respect for colleagues • Social Responsibility • Non-Discrimination • Competence • Legality • Animal Care • Human Subjects Protection
9	**Illustrate in detail about engineering as experimentation. (13M)** BTL2 **Answer Page no 89 to 94 Mike W. Martin.** **Engineers as Experimenters: (4 M)** • Process of developing a product, an engineer generally learns through experimentation. a trial and error method is mostly used one to obtain results • Hence, primarily any experiment carried out with partial ignorance. • Outcomes of the experiments may not be as expected. • An engineer should always be ready for unexpected output. **Consider following points which are related to moral aspects of human behaviour(9 M)** • To maintain safety of human beings. • To procure their rights of consent. • To keep them aware regarding experimental nature of project. • To warn them about probable safety hazards. • Monitor results of experiment continuously.

	• Having autonomy in conducting experiments. • Accepting accountability for results of tproject. • Exhibiting their technical competence, characteristics of professionalism.
10	**Justify how the ethical codes provide discipline among the engineers? (13M) (MAY/JUNE2014), (APR/MAY2015) (NOV/DEC 2014)** BTL2 **Answer refer notes.** **EXPLANATION: (13 M)** • Engineers hold paramount safety, health, welfare of public • To comply with principles of sustainable development in performance of professional duties. • Engineers perform services only in areas of their competence. • Engineers issue public statements only in an objective, truthful manner. • Engineers act in professional matters for each employer • Avoid conflicts of interest. • Engineers build their professional reputation on the merit of their services • Not compete unfairly with others. • Engineers act in such a manner as to uphold and enhance the honor, integrity. • Act with zero tolerance for bribery, fraud, and corruption.
	PART * C
1	**Explain in detail about the types and importance of industrial standards. (15M) (APRIL/MAY 2015)** BTL2 **Answer refer notes.** **Types of standards:(11 M)** **Optimum standards:** • Facilitate the creation of political as well as business related advantages. **Formal standards:** • Strategic initiatives with broad applicability, with roles for ANSI, standards developers, industry, government. **Private standards:** • Developed by an organization or a trade association. **Testing standards:** • They provide a method to test products or materials.

	Performance standards: • Performance requirements usually measured using a specified test procedure, standard. **Dimensional standards:** • They establish a number of key dimensions that must be met. • This allows product inter changeability. **Quality standards:** • They describe certain characteristics that must be met • Insuring the buyer that some minimum level of quality is met. **Importance of standards (4 M)** • Administration, legislative bodies also benefited by Industry standard. • Standardization facilitates a healthy competition, designing of new concepts. • It ascertains the rank of an industry in the economic set up of a country. • Optimum standards facilitate creation of political, business related advantages. • Setting industry standard, to provide a platform for giving shape to new creations.
2	**Discuss the various ethical issues involved in Bhopal disaster. (15M) (May/June2009)** BTL2 **Answer refer notes.** **EXPLANATION:(15 M)** • In case of Bhopal tragedy all of them were neglected. • The poor quality of the facility • Lack of many instruments was the reason for the leak. • Two out of three main safety systems unable to cope with situations. • The flare tower, water sprays for not functioning properly. • Public were never given any information about MIC, safety measures. • Location of plant close to settlement also one of ethical question to be raised. • "Perform services only in areas of their competence". • leak started after wash out of a pipe, had not sealed properly by a worker • Training did not meet standards and was ordered by novice supervisors.

3	**Compare and contrast engineering experiments with standard experiments. (15M) (Ma Y/June 2009) (NOV-DEC 2018)** BTL3 **Answer Page No.89 to 94 Mike W. Martin Key points:** **Similarity to Standard Experiments(6 M)** • Carried out in partial uncertainties. • Outcomes of engineering projects, generally uncertain like other experiments • Requires thorough knowledge about products at pre-production, post-production stages. • Requires constant monitoring, alertness, • Vigil on part of the engineers at every stage of the project. **Differences between engineering experiments and other standard experiments. Experimental control (9 M)** **Experimental control:** • Members for study selected into two Groups namely A, B at random. • Group A are given special treatment. • The group B Given no treatment, called 'controlled group'. • Placed in the same Environment as other group A. • Engineering, through random sampling, survey made among users • To assess results on product. **Humane touch:** • Engineering experiments involve human souls, their needs, views,& expectations, • Creative use as in case of social experimentation. • This view not agreed by many of engineers. • Quality engineers, managers fully realized this humane aspect. **Informed consent:** • Engineering experimentation viewed as Societal Experiment • Since subject, the beneficiary is human beings. **Informed consent consists of two main elements:** • Knowledge: Human subjects should be given all information to make a reasonable decision. • Voluntariness: Human subjects, show their willingness to be a human model voluntarily. The person should not be forced, deceived, fraud, etc.

	UNIT-IV **SAFETY, RESPONSIBILITIES AND RIGHTS**
	Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.
	PART * A
1	**Define conflict Interest?(MAY/JUNE 2012) (NOV-DEC 2018)** BTL1 A situation that has the potential to undermine the impartiality of a person because of the possibility of a clash between the person's self-interest and professional interest or public interest. Types of Conflicts of interest: Actual conflict of interest Potential conflict of interest Apparent conflict of interest
2	**List out the reasons for Risk-Benefit Analysis?(NOV/DEC 2011, NOV/DEC 2013) (MAY/JUNE 2016)** BTL1 A risk-benefit analysis is a comparison between the risks of a situation and its benefits. The goal is to figure out whether the risk or benefit is most significant. It's used often in medicine, because every medical procedure has risks associated with it, and some procedures that could be beneficial actually turn out to statistically cause more harm than good. That's how medical researchers figure out whether certain procedures are worth doing and what types of people will benefit. • Risk-benefit analysis is concerned with the advisability of undertaking a project. • It helps in deciding which design has greater advantages. • It assists the engineers to identify a particular designs core higher with that of the another**.**
3	**Give few steps to reduce risks. (MAY/JUNE 2009)** BTL1 The factors are: • The engineer must have the right data. • Engineer should satisfy with the present design. • Engineer must test the safety of a product. • Engineer must measure and weight he risks with benefits for a product.
4	**Give the reasons for the Three Mile Island disaster? ((MAY/JUNE 2014)**BTL1

	In adequate training to the operators. Use of B&W reactors.
5	**List the two types of Risk.((MAY/JUNE 2012)** BTL1 • Personal Risk: An individual, who is given sufficient information, will be in a position to decide whether to take part in a risky activity or not . They are more ready to take on voluntary risks than in voluntary risks. • Public Risks: Risks and benefits to the public are more easily determined than to individuals, as larger number of people is taken in to account .Involuntary risks are found here.
6	**Define "risk".(May/June 2011)(NOV/DEC2014) (NOV-DEC 2016)**BTL1 A risk is the potential that something unwanted and harmful may occur. Risk = Probability X Consequences.
7	**Define voluntary risk. (May/June 2010, May/June 2010)** BTL1 If a person knowingly takes any risk, then he feels it safe. In contrast, if the same risk is forced to him, then he feels it unsafe. In simple terms the voluntary risks are considered as safe and the involuntary risks are considered as unsafe.
8	**Differentiate safe risk and acceptability of risk? (IT Dec 2009,May 2010)** BTL1 Acceptability of risk: A risk is acceptable when those affected are generally no longer apprehensive about it. Apprehensiveness mainly depends on how the risk is perceived by the people. Safe Risk: If a person knowingly takes any risk then he feels it safe. In the same way voluntary risks are considered as safe risk
9	**List the methods that can be applied when testing is inappropriate. (May/June 2009)(NOV/DEC2014)** BTL1 • Scenario Analysis • Failure modes and effects analysis • Fault free analysis • Event free analysis
10	**List out the use of knowledge of risk acceptance to engineers?** BTL1 Though past experience and historical data give better information about safety of products designing there are still inadequate .The reasons are

	• The information is not freely shared among industries. • There also new applications of old technologies that provides available data, which are less useful. • So, in order to access the risk of a product, the engineers must share their knowledge and information with others in a free manner.
11	**List out the positive uncertainties in determining risks?** BTL1 • Purpose of designing • Application of the product • Materials and the skill used for producing the product
12	**Define Risk Transfer.** BTL1 It refers to the legal assignment of the cost of certain potential losses from one party to another. The most common way of affecting such transfer is by insurance.
13	**List out the steps involved in design for safety? ((MAY/JUNE 2014)** BTL1 • Define the problem • Generate alternate solutions • Analyses each solution • Test the solution • Select the best solution • Implement the chosen solution**.**
14	**State the industrial definition on safety .(MAY/JUNE 2014)** BTL1 • A ship in harbour is safe, but that is not what ships are built for‖ – John A. Shedd • A thing is safe if its risks are judged to be acceptable,, - William W. Lawrence • We buy an ill-designed Iron box in a sale- Underestimating risk • We judge fluoride in water can kill lots of people - Overestimating risk • We hire a taxi, without thinking about its safety - Not estimating risk
15	**Define Disaster? (MAY/JUNE 2014, NOV/DEC 2013)** BTL1 A DISASTER = A seriously disruptive event + A state of unpreparedness. E.g., Titanic collision with an iceberg, at night: Emergency Fewer lifeboats, inadequate training and warnings of icebergs unheeded ->Disaster
16	**Define informed consent? (MAY/JUNE 2011)(APR/MAY 2015)** BTL1 Informed consent is the process by which the treating health care provider discloses appropriate Information to a competent patient so that the patient may make a voluntary choice to accept or refuse treatment. It originates from the legal and ethical right the patient

	has to direct what happens to her body and from the ethical duty of the physician to involve the patient in her health care.
17	**List out use of risk analysis?(APR/MAY 2015) (MAY/JUNE 2016) (APR/MAY 2017)**BTL1 Risk analysis is the process of defining and analyzing the dangers to individuals, businesses and government agencies posed by potential natural and human-caused adverse events.
18	**List the two types of authority given by Martin and Schinzinger. (May/June2011,NOV/DEC 2014),(APR/MAY2015)** BTL1 **Martin and Schinzinger define two types of authority** Institutional authority • Associated with administrative position Expert Authority • Accrues from specialized knowledge
19	**List out the elements of collegiality? (May/June 2010, NOV/DEC 2014)(Nov/Dec 2013) (MAY/JUNE 2014)** BTL1 • Respect • Commitment • Connectedness • Cooperation
20	**Define employee rights and lists its categories. (Nov/Dec 2012)** BTL1 Employee rights are rights, moral or legal, that involve the status of being an employee. They include some professional rights that apply to the employer-employee relationship. Categories: • workplace safety • Civil rights • Family and medical leave • Workers compensation • Labor relations laws.
21	**What is the Basic Right of Professional Conscience? (MAY/JUNE 2011)** BTL1 The right to do what everyone agrees it is obligatory for the professional engineers to do the basic professional right is an entitlement giving one the moral authority to act without interference from others.
22	**Define Institutional authority. (NOV/DEC 2011)** BTL1 • Associated with administrative position.

	• Those with authority have the right to administer their duties and the freedom to actually achieve organizational goals by expending the resources available to them. This type of authority usually goes with the position: • Managers • Administrators • Project Engineers
23	**Define the term safety. How is it related to risk? (NOV-DEC 2018)** BTL1 Safety is a concept that includes all measures and practices taken to preserve the life, health, and bodily integrity of individuals. In the workplace, safety is measured through a series of metrics that track the rate of near misses, injuries, illnesses, and fatalities. In order to improve these metrics, employers and safety officials must also conduct investigations following any incident to ensure that all safety protocols and measures are being followed or to implement new ones if needed. **Safety relation with risk:** • Identifying a hazard • Collecting information and analyzing risk associated with it • Determining how to remove or reduce its effect by completely eliminating the process or equipment • Replacement with a better equipment or process • Using advanced technology or design and physically isolating processes or direct contact of user by the use of appropriate collective or personal protective equipment.
24	**Define term collective bargaining. (MAY/JUNE 2014)(NOV-DEC 2016) (APR/MAY 2017) (MAY/JUNE 2016)**BTL1 • There is a limit of one representative for each unit of employees • All representatives must promote the practice, and follow all procedures, of collective bargaining • Employers must bargain with the employees' representatives • Employees and their representatives have the right to discuss wage issues
25	**Define IPR. (APR/MAY 2017)** BTL1 Intellectual property rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time.
26	**Differentiate between bribe and gifts? (Nov/Dec 2014)**BTL1 Gift: Something of value given without the expectation of return

	Bribe: Something of value given with the hope of a future influence or benefit
	PART * B
1	**Describe risk benefit analysis. Explain the procedure in Risk Benefit Analysis. Discuss its roles in reducing risks. (13M) (Nov/Dec 2010, May/June2011) (NOV/DEC 2014) (APR/MAY 2017) (NOV-DEC 2016) (NOV/DEC 2018)** BTL2 **Answer: page: 128to 133T - Mike W. Martin** **Introduction: (2 M)** A risk-benefit analysis is a comparison between the risks of a situation and its benefits. The goal is to figure out whether the risk or benefit is most significant. • Uncertainties in design • Personal risk • Public risk and public acceptance **Various procedure in adopting risk benefit analysis: (8M)** • Identify the risks early on in your project. • Communicate about risks • Consider opportunities as well as threats when assessing risks. • Prioritize the risks • Fully understand the reason and impact of the risks. • Develop responses to the risks • Develop the preventative measure tasks for each risk. • Develop the contingency plan for each risk. • Record and register project risks. • Track risks and their associated tasks. **Role in reducing risks: (3 M)** • Application of inherent safety concept in design. • Use of redundancy principle in the instrument protection • Regular inspection • Training and operating personnel • Conducting regular safety audits • Development of well-designed emergency evacuation plan and regular rehearsal.
2	**Define the term risk and safety. Explain how an engineer assesses the risk? (13M) (NOV/DEC 2014) (Nov/Dec 2013) (NOV-DEC 2016)** BTL2 **Answer: Page: 121 - Mike W. Martin (2 M)**

	Define risk: "Potential for the realization of unwanted consequences from impending events." **Define safety:** "A thing is safe if its risks are judged to be acceptable." **(2 M)** **Definition** **(2 M)** A safety risk assessment is a systematic procedure for identifying and managing hazards. It encompasses thorough examination of the entire work environment, processes and equipment to determine any hazard to the health of the employees in the short or long term and implementing remedies. **Risk assessment:** **(3 M)** ▪ Risk assessments are recorded retained for significant hazards. ▪ Risk assessments are suitable, sufficient. ▪ Staffs are aware of, understand relevant risk assessments. ▪ Risk assessments are reviewed periodically **Risk assessment process:** **(4 M)** • Identify the hazards associated with a procedure • Consider who may be exposed and what is the maximum possible exposure • Include storage waste, disposal and cleaning, if appropriate. • List existing control measures. • Consider emergency procedures. • If further control measures required, list and set actions
3	**Describe the concept of Occupational crime with examples. (13M) (Nov/Dec 2013)(Apr/May 2015) (Nov/Dec 2015)** BTL2 **Answer: Page: 128 M - Mike W. Martin** **Block and Geis (Man, Crime and Society, 1970: 307) have classified occupational offenders into five groups on the basis of the nature of victim involved: (4 M)** • Persons acting as individuals against other individuals (e.g., fraudulent lawyers, doctors), • Those committing crimes against business concerns that employ them (embezzlers), • Those in policy-making positions who commit crimes for their organizations (anti-trust violators), • Agents of an organisation who victimize the general public (advertising fraud), and • Merchants victimizing their customers (short-weighing). • This method is simple. The victim could be employer, employee, public concern, government organisation, and so forth. **Types of occupation crime:** **(9 M)** • Price fixing • Endangering lives • Industrial espionage
4	**Explain in detail about** (i) **Whistle blowing (ii) Discrimination (13M) (APRIL/ MAY 2015)**BTL2

	Answer: Page: 172-173 - Mike W. Martin **Whistle blowing (6 M)** • A whistleblower is a person who exposes any kind of information • Exposes activity that is deemed illegal, unethical. • Exposes, which is not correct within an organization that is either private or public. Types of whistle blowing: • Internal Whistle Blowing • External Whistle Blowing • Open Whistle Blowing • Anonymous Whistle Blowing **Discrimination (7 M)** **Definition** It is referred to prejudice resulting from denial of an opportunity, unfair treatment in the job selection, promotion and transfer is called discrimination. **Types of Discrimination** • Direct discrimination • Indirect discrimination • Pregnancy and maternity discrimination • Absence from work because of gender reassignment • Discrimination connected to your disability • Duty to make reasonable adjustments for disabled people • Sexual harassment • Victimization
5	**Explain the types and advantages of Intellectual property rights. (13M) (Nov/Dec 2015) (APRIL/ MAY 2013,NOV/DEC 2013) (NOV/DEC 2014) (MAY/JUNE 2016) (APRIL/ MAY 2015)** BTL2 **Answer Refer Notes** **Intellectual property rights: (2 M)** Intellectual property rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time. **Types of Intellectual Property Rights: (8 M)** Intellectual Property Rights can be further classified into the following categories −

	• Copyright • Patent • Trade mark • Trade Secrets, etc. **Advantages of Intellectual Property Rights (3 M)** • Provides exclusive rights to the creators or inventors. • Encourages individuals to distribute and share information and data instead of keeping it confidential. • Provides legal defence and offers the creators the incentive of their work. • Helps in social and financial development.
6	**Explain the concept of Confidentiality in detail. (13M) (NOV/DEC 2011)** BTL2 **Answer: Page: 146 to 148 -Mike W. Martin** **Introduction: (2 M)** • Any information that is desirable to keep secret. Usually has some exploitable value for business purposes **Types of information (8 M)** – Public (available to anyone) – Private (restricted/conditional availability) • Confidential • Privileged • Proprietary • Trade secrets (and ~patents) How companies might handle you changing jobs when confidentiality is at risk: **(3 M)** • Employee sign employment contracts that place constraints on future employment • Company give positive benefits to those leaving such as special pension considerations, the opportunity to do consulting etc. • Company works with employees to show the damage that can be done if information is passed on.
7	**Explain a detailed note about collective bargaining. (13M) (APRIL/ MAY 2010), (NOV/DEC 2013) (NOV/DEC 2014) (APRIL/ MAY 2015)** BTL2 **Answer: Page: -5.8 - V.Jayakumar** **collective bargaining: (3 M)** • There is a limit of one representative for each unit of employees

	• All representatives promote practice, and follow all procedures, of collective bargaining • Employers must bargain with the employees' representatives • Employees and their representatives have the right to discuss wage issues **Collective Bargaining Process** Preparation : **(10 M)** Choosing a negotiation team and representatives of both the union and employer. Discussion: Parties meet to set ground rules for collective bargaining negotiation process. Proposal: Representatives make opening statements, outlining options, possible solutions to issue at hand. Bargaining: Following proposals, parties discuss potential compromises, bargaining to create an agreement that is acceptable to both parties. A "draft" agreement, which is not legally binding, but a stepping stone to coming to a final collective bargaining agreement. Final Agreement: Once an agreement is made between the parties, it must be put in writing, signed by the parties, and put into effect.
8	**Discuss on Respect for authority and Conflict of interest. (13M) (MAY/JUNE 2014) (NOV/DEC 2014)** BTL2 **Answer: page: 150 to 151 - Mike W. Martin** **Respect for authority: (2 M)** • Authority is the "potential and resources" to accomplish tasks. • Power is the capability to do so • Authority gives the right to control decisions affecting the company's interests • Engineers must respect the authority of their employers **Martin and Schinzinger define two types of authority (5 M)** • Institutional authority Associated with administrative position • Expert Authority Accrues from specialized knowledge • Morally Justified Authority Institutions can try to direct engineers to do things that are not "morally justified"

	• Obliged to respect legitimate authority Does not give right to ignore legitimate directives Respecting authority comes second when: Lives are threatened Financial corruption is involved Grave economic loss may result **Conflict of interest: (2 M)** • "Professional conflicts of interest are situations where professionals have an interest which, if pursued, might keep them from meeting their obligations to their employers or clients."(M&S) • Three types of conflict of interest (Harris, Pritchard and Rabins, 2000) **(4 M)** • Actual • Potential • Apparent
9	**Explain the concept of Human rights and employee rights. And its role in organisation (13M) (MAY/JUNE 2014) (Nov/Dec 2013) (NOV/DEC 2014) (APRIL/ MAY 2015) (APR/MAY 2017)** BTL2 **Answers refer notes.** **Human rights: (3 M)** □ Based on the principle of respect for the individual. □ Each person morally, rationally treated who deserves to be treated with dignity. □ Rights to which everyone is entitled—no matter who they are, where they live—simply because they are alive. **Employee rights. (2 M)** □ An employee right can be any right, moral or legal, that involves status of being an employee. □ They involve some professional rights also, such as the right to be paid according to the salary mentioned in one's contract. □ Privacy and equal opportunity can be considered essential rights too. **Employee rights (4 M)** All employees have basic rights in the workplace -- including □ The right to privacy □ Fair compensation □ Freedom from discrimination. □ Equal Opportunity – Non-discrimination □ Equal opportunity – Affirmative Action

Rights of an Employee: (4 M)

An employee is, at the very least, entitled to the following rights at his workplace −

- No discrimination at work, especially on the basis of gender, nationality, religion, medical condition, and political affiliation.
- Healthy work-life balance, which means no long hours at work. Employees can also report if their employer makes unnecessary delays in delegating work.
- Protection of job for people with disabilities and medical conditions.
- Complete protection against sexual harassment of any kind and immunity from being forced to exchange favors for benefits.
- Freedom to discuss the terms and conditions of the employment with other employees and negotiating wages to suit lifestyle as per changing times.
- Right to ask for safe working conditions and reservation to answering questions on age, religion, nationality, and medical condition.
- Demanding certain changes and modifications regarding the working conditions to accommodate situations that might crop up due to their prevailing medical conditions.
- Right to form or participate a union that aims to improve the wages, lifestyle, working environment, and emphasizes on employee rights at the workplaces.

10

Discuss professional rights in an engineer field.(13M) (APRIL/ MAY 2015) (MAY/JUNE 2014) (NOV/DEC 2014) (Nov/Dec 2013) BTL2

Answer: Page: 163 - Mike W. Martin

Professional Rights (3 M)

The rights that engineers have as professionals are called Professional Rights. These professional rights include :

- The basic right of professional conscience.
- The right of conscientious refusal.
- The right of professional recognition

Professional rights set by professional societies (10 M)

- Guided in all their relations by the highest standards of honesty and integrity.
- Engineers shall at all times strive to serve the public interest.
- Engineers shall avoid all conduct or practice that deceives the public.
- Not disclose, without consent, confidential information concerning business affairs.

	Engineers shall not influence in their professional duties by conflicting interests. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly. Guilty of unethical, illegal practice shall present information to proper authority for action. Credit for engineering work to those to whom credit is due, recognize proprietary interests of others.
11	**Discuss the 'faithful agent argument' and 'public service argument' of collective with suitable examples. (13M) (NOV-DEC 2018)** BTL2 Answer Refer notes: Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest or the appearance of conflicts of interest. (7 M) a. Engineers shall avoid all known conflicts of interest with their employers which could influence their judgment or the quality of their services. b. Engineers shall not undertake any assignments which would knowingly create a potential conflict of interest between themselves and their clients or their employers. c. Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project. d. Engineers shall not solicit or accept financial or other valuable considerations, for specifying products without disclosure to their clients or employers. e. Engineers shall not solicit or accept gratuities, directly or indirectly, from contractors, their agents, or employers in connection with work for which they are responsible. f. Engineers shall not participate in considerations or actions with respect to services provided by them or their organization(s) in private or product engineering practice. g. Engineers shall not solicit an engineering contract from a governmental body or other entity on which a principal, officer. h. Engineers shall exercise careful judgment in their determinations to ensure a balanced viewpoint, and avoid a conflict of interest. i. When, as a result of their studies, Engineers believe a project(s) will not be successful, they shall so advise their employer or client. j. Engineers shall treat information coming to them in the course of their assignments as confidential, and shall not use such information as a means of making personal profit. (1) They will not disclose confidential information concerning the business

affairs or technical processes

(2) Not reveal confidential information or finding of any commission or board of which they are members unless required by law or court order.

(3) Designs supplied to Engineers by clients shall not be duplicated by the Engineers for others without the express permission of the client(s).

k. Engineers shall act with fairness and justice to all parties when administering a construction (or other) contract.

l. Before undertaking work for others in which Engineers may make improvements, plans, designs, inventions, Engineers shall enter into positive agreements regarding the rights of respective parties.

m. Engineers shall admit their own errors when proven wrong and refrain from distorting or altering the facts to justify their mistakes or decisions.

n. Engineers shall not accept professional employment or assignments outside of their regular work without the knowledge of their employers.

o. Engineers shall not attempt to attract an employee from other employers or from the marketplace by false or misleading representations.

'PUBLIC SERVICE ARGUMENT' (6 M)

Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.

a. Engineers shall recognize that the lives, safety, health and welfare of the general public are dependent upon engineering judgments.

b. Engineers shall not approve nor seal plans and/or specifications that do not conform with accepted engineering standards.

c. Should the Engineers' professional judgment be over ruled under circumstances where the safety, health, and welfare of the public are endangered.

(c.1) Engineers shall do whatever possible to provide published standards, test codes and quality control procedures that will enable the public to understand the degree of safety.

(c.2) Engineers will conduct reviews of the safety and reliability of the design, products or systems for which they are responsible before giving their approval to the plans for the design.

(c.3) Should Engineers observe conditions, which they believe, will endanger public safety or Health.

d. Should Engineers have knowledge or reason to believe that another person or firm may be in violation of any of the provisions of the Guidelines?

(d.1) They shall advise proper authority if an adequate review of the safety and reliability of the

	Products or a system has not been made. (d.2) They shall withhold approval of products of systems when changes or modifications are made which would adversely affect its performance insofar as safety and reliability are concerned. e. Engineers should seek opportunities to be of constructive service in civic affairs and work for the advancement of the safety, health and well being of their communities. f. Engineers should be committed to improving the environment to enhance the quality of life.
12	**Explain the factors that affect Risk Acceptability? And the knowledge required to assess the risk by engineer.(13M) (MAY- JUN 2016) (Nov/Dec 2013)** BTL2 **The Factors That Affect Risk Acceptability (6 M)** • Voluntarism and control • Effect of information on risk assessment • Job related pressures • Magnitude and proximity of the people facing risk **The knowledge required to assess the risk by engineer (7M)** • Data in design • Uncertainties in design • Testing for safety • Analytical testing • Risk-benefit analysis
	PART * C
1	**Discuss the significance of intellectual property rights. Also Explain the legislations covering intellectual property rights in India. (15M) (NOV/DEC 2013) (MAY-JUN 2016) (MAY/JUNE 2014) (NOV/DEC2014)** BTL2 **Answers refer notes.** **SIGNIFICANCE: (4 M)** • Clear identification of the IP. • Unambiguous title to the asset. • Qualitative and quantitative characteristics of the IP. • Earnings capacity and profitability relating to the IP. • Market share supported by, or as a result of, the IP. • Legal rights restrictions, competition, barriers to entry, risks associated with the IP. • Product life cycles and positioning.

	Historical growth and prospects for the future. **Firms of all sizes and purpose are motivated by similar goals in the creation of such programs:** To identify what constitutes a risk sensitive intangible asset; **(4 M)** To address new and emerging threats to IP; To properly allocate available risk resources given limited funds; and To achieve compliance within the legal and regulatory environment in which they operate. The TRIPS Agreement came into effect on 1st January 1995, is considered till date most complete multilateral agreement on intellectual property. The areas of intellectual property, it covers are as following: **(7 M)** Trademarks which include service marks as well. Industrial designs. Copyright and related rights (i.e. producers of broadcasting organisation, the rights of performers) Geographical indications which include appellations of origin. The lay-out designs (topographies) of assimilated circuits. The information which are not closed which includes test data and trade secrets. Patents which include protection of new varieties of plants.
2	**(i) Discuss the significance of loyalty and collegiality in team work.(15M)(MAY-JUN 2014) (NOV/DEC2014) (APRIL/ MAY 2015)** **(ii) Explain the different types of collective bargaining.(APRIL/ MAY 2015)** BTL2 **Answer: Page: 150-151 - Mike W. Martin.** • **Loyalty** **(4 M)** Loyalty is the faithful adherence to an organization, employer. **Loyalty to an employer can be either of the two types:** • **Agency-loyalty:** Acting to fulfill one's contractual duties to an employer. • **Attitude-loyalty :** A lot to do with attitudes, emotions A sense of personal identity as it does with actions. **Collegiality** **(3 M)** • To improve the respect in work place • To help to maintain the better relation in the organisation • To increase the value of relationship

	• To maximise the method of communication • Motivates unity in the workplace. • Offers differing perspectives and feedback • Improved efficiency and productivity • Provides great learning opportunities • Promotes workplace synergy **Definiton:** Collective Bargaining. **(2 M)** The Collective Bargaining is the process wherein the unions (representatives of employees or workers), and the employer meet to discuss the issues related to wage, the number of working hours, work environment and the other terms of the employment **Types of collective bargaining:** **(6 M)** • Conjunctive or Distributive Bargaining • Co-operative or Integrative Bargaining • Productivity Bargaining • Composite Bargaining
3	**Discuss the features of whistle blowing. (15M) (NOV/DEC2014) (15M)** BTL2 **Answer : Page: 177 to 178 - Mike W. Martin** **The features of whistle blowing:** • Evidence A whistleblower must have evidence that someone, usually a corporation or government contractor • Documentation The whistleblower needs to have more than just suspicions; he or she needs to collect concrete and legitimate documentation of the wrongdoing • Information Gathering Names and contact information of the parties involved in the wrongdoing, laws that he or she believes are being violated by said parties • Confidentiality The whistleblower should keep the information and the case absolutely confidential and avoid discussing it with anyone. • Settle in for the Long Haul Since cases like these often take a long time to settle, the whistleblower should prepare for a long process • Prepare for Backlash It's not uncommon for a whistleblower to be accused of being privy to the wrongdoing or even

	participating in it. • Look for New Employment Whistleblowers can get a bad reputation, which can affect finding a new job, so getting a new one before that happens is important • Be a Model Citizen Being a model citizen and not doing anything that can be used against them is important for whistleblowers. • Get Support In addition to finding an attorney for legal help, whistleblowers should look into resources like the National Whistleblowers Canter
4.	**Justify "Safety in a commodity comes with a price".Explain and discuss how the knowledge of risk is always better for safety with suitable examples. (15M) (NOV-DEC 2018)** BTL2 **Answer refer notes:** **Safety in a commodity comes with a price' (8 M)** • Absolute safety is never possible to attain and safety can be improved in an engineering product only with an increase in cost. • On the other hand, unsafe products incur secondary costs to the producer beyond the primary (production) costs, like warranty costs loss of goodwill, loss of customers, litigation costs, downtime costs in manufacturing, etc. • Figure indicates that P-Primary costs are high for a highly safe (low risk) product and S-Secondary costs are high for a highly risky (low safe) product. • If we draw a curve T=P+S as shown, there is a point at which costs are minimum below which the cost cannot be reduced. If the risk at Minimum Total Cost Point is not acceptable, then the producer has to choose a lower acceptable risk value in which case the total cost will be higher than M and the product designed accordingly. • It should now be clear that safety comes with a price only. **"Knowledge of risk for better safety".(7 M)** • Robert Stephenson writes that all the accidents, the harms caused and the means used to repair the damage should be recorded for the benefit of the younger Members of Profession. • A faithful account of those accidents and the damage containment was really more valuable than the description of successful work. • Hence it is imperative that knowledge of risks will definitely help to attain better safety.

	But it should be borne in mind, that still gaps remain, because i) There are some industries where information is not freely shared ii) There are always new applications of old technology that render the available information less useful.

	UNIT V GLOBAL ISSUES
	Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.
	PART * A
1	**Define embezzlement. (APRIL/ MAY 2011)** BTL1 Embezzlement is a form of white-collar crime wherein a person or entity misappropriates the assets entrusted to him or her. In this type of fraud the assets are attained lawfully and the embezzler has the right to possess them, but the assets are then used for unintended purposes. Embezzlement is a breach of the fiduciary responsibilities placed upon a person.
2	**Define technology transfer? (APRIL/ MAY 2010)** BTL1 Technology transfer is a process of changing the technology to a new setting and implementing it. Technology includes hardware such as machines and installations as well as techniques such as technical, organizational and managerial skills and procedures**.**
3	**Define moral leadership. APRIL/MAY2010) (NOV/DEC 2014)** BTL1 Whenever the goals of a leader become permissible and also morally valuable, it is known as moral leadership. Moral leadership also means that employing morally acceptable ways to motivate the groups to move towards morally desirable ways. The ways are depending on the situations.
4	**State the most important ethical mistake made by the multinational corporation which caused Bhopal gas plant disaster. (NOV/DEC 2010)** BTL1 • The tanks used to store Methyl Iso-cyanate were overloaded to a tune of 75%. • The emergency plant was also filled with a large amount of chemicals. • The entire refrigeration unit had been shut down as a measure to reduce the cost and this Led to increase of temperatures to a higher level. • One of the disappointed workers unscrewed a pressure gauge on a tank and inserted a hosepipe into it, knowing that it would cause damage, but not to this extent. • Scrubber has also been shut down. • Flare tower was also not in an operating condition. • Unfortunately there were no emergency drills or evacuation plants available.
5	**Define Conflict resolution. (APRIL/ MAY 2010)** BTL1 Conflict resolution means a process of resolving dispute or disagreement. It mainly aims at

	reconciling opposing arguments in a manner that promotes and protects the human rights of all parties concerned.
6	**Define contextualizing. (APRIL/MAY 2010)** BTL1 In accordance to Gilligan women try hard to preserve personal relationship with all people. This context-oriented emphasis on maintaining personal relationship is called as ethics of care in contrast With ethics of rules and rights.
7	**Give a short note on ethical pluralism and ethical relativism. (APRIL/MAY 2010)** BTL1 Ethical pluralism: According to this view there may be alternative moral perspectives that are reasonable, but no one of which must be accepted completely by all rational and morally concerned persons. Ethical relativism: Actions are morally right when they are approved by law or custom they are wrong when they violate laws or customers.
8	**What should an ethical expert witness, even though hired by a company, expected to do? (APRIL/MAY 2010)** BTL1 Engineers should not become the hired-guns to their clients, but instead remain as objective as humanly possible in their investigations and the conclusions they reach .They should avoid biases resulting from money ego, and sympathy.
9	**List down the international rights listed by Donaldson. (NOV/DEC 2014)** BTL1 Thomas Donaldson in his book _The ethics of International Business,, has listed the following as the International rights: • The right to freedom of physical movement • The right to ownership of property • The right to freedom from torture • The right to a fair trial • The right to non discriminatory treatment • The right to physical security • The right to freedom of speech and association • The right to minimal education • The right to political participation • The right to subsistence.
10	**Define appropriate technology. (Nov 2008)** BTL1 Appropriate technology refers to the identification, transfer and implementation of the most suitable technology for a new set of conditions.

11	**List out four examples for Multinational Corporation.(Nov 2010)** BTL1 Large corporations having investment and business in number of countries are known as Multinational or Transnational corporation. Some of them are : Hindustan Lever, Ford, Toyota, Sony, LG, Smith Kline Beecham, ITC, Ponds etc.
12	**Define computer ethics. (DEC/NOV2010) (NOV/DEC 2016)** BTL1 Ethics is a set of moral principles that govern the behaviour of a group or individual. Therefore, computer ethics is set of moral principles that regulate the use of computers. Some common issues of computer ethics include intellectual property rights (such as copyrighted electronic content), privacy concerns, and how computers affect society.
13	**Define globalization. (MAY/JUN2016)**BTL1 Our lives are increasingly dependent upon the goods/services produced over the world and are influenced by the business from around all the corners of the world. In general world has become a global village and have a global economy. The increasing international flow of capital, technology, trade, and people have had the effects of changing the nature of local organizations governments and people of countries and have led to social changes and developments.
14	**List the three senses of relative values. (DEC/ NOV 2012)** BTL1 • Ethical Relativism The theory that holds that morality is relative to the norms of one's culture. • Descriptive Relativism The existence of moral disagreements between cultures or individuals. • Moral Relativism More easily understood in comparison to moral absolutism. Absolutism claims that morality relies on universal principles (natural law, conscience).
15	**List out the normal issues arise in Multinational Corporation?(MAY/JUNE 2014)** BTL1 Ethical dilemmas faced by certain companies may be specific to their industry or company; other types of ethical issues are common to all types of companies. Handling ethical decisions with wisdom is especially important for small businesses, given the potentially devastating effects these companies may face if such issues aren't handled correctly**.**
16	**Differentiate the Eye witness and expert witness in the legal system. (MAY/JUNE 2014)** BTL1 An eyewitness is one who testifies what they perceived through his or her senses (e.g. Seeing, hearing, smelling, touching). That perception might be either with the unaided human sense or

	with the aid of an instrument, e.g., microscope or stethoscope, or by other scientific means, e.g. a chemical reagent which changes color in the presence of a particular substance An expert witness is one who allegedly has specialized knowledge relevant to the matter of interest, which knowledge purportedly helps to either make sense of other evidence, including other testimony, documentary evidence or physical evidence (e.g., a fingerprint)
17	**Define Moral Leadership. (NOV/DEC 2013) (MAY/JUN 2016) (APRIL/ MAY2015) (NOV–DEC 2014)** BTL1 Moral Leadership is a very different kind of leadership. Rather than aspiring to being followed, Moral Leaders aim to serve. Instead of showcasing their own skills, Moral Leaders tend to develop the capacities of others.
18	**Define the term honesty and moral leadership.** BTL1 Honesty :A facet of moral character that connotes positive and virtuous attributes such as Integrity, truthfulness, and straightforwardness, along with the absence of lying, cheating, or theft "Moral Leadership": A process of social influence in which one person enlists the aid and support of others in accomplishing a common task.
19	**Define business ethics. (APRIL/ MAY2015)** BTL1 Business ethics (also corporate ethics) is a form of applied ethics or professional ethics that Examines ethical principles and moral or ethical problems that arise in a business environment. It applies to all aspects of business conduct and is relevant to the conduct of individuals and entire organizations**.**
20	**Define hired guns. (APRIL/ MAY 2011)** BTL1 Engineers are hired by attorneys to help them to establish the facts in away favourable to their clients. The hired guns violate the standards of honesty and also due care in conducting investigations.
21	**Define corporate social responsibility.(NOV-DEC 2018)(APR-MAY 2017)** BTL1 Corporate social responsibility (CSR) is how companies manage their business processes to produce an overall positive impact on society. It covers sustainability, social impact and ethics, and done correctly should be about core business - how companies make their money - not just add-on extras such as philanthropy.
22	**List out demerits of MNC'S to host country. (NOV-DEC 2018)** BTL1 (i) Danger for Domestic Industries (ii) Repatriation of Profits

	(iii) No Benefit to Poor People (iv) Danger to Independence (v) Disregard of the National Interests of the Host Country (vi) Misuse of Mighty Status (vii) Careless Exploitation of Natural Resources
	PART * B
1	**Explain the philosophical view of nature in environmental ethics. Discuss the approaches to resolve environmental problems.(APRIL/ MAY2011) (APRIL/ MAY2015) (MAY–JUN 2014) (NOV–DEC 2013) (NOV–DEC 2014) (13M)** BTL2 **Answer: page: Refer Notes** **The philosophical view of nature: (8 M)** • Sentient – centered ethics • Bio-centric- Ethics • Eco-centric – ethics • Human - centered environmental ethics **The approaches to resolve environmental problems: (5 M)** • Cost oblivious approach • Cost benefit analysis
2	**Describe the Bhopal Gas Tragedy and its effects.(APRIL/MAY 11) (13M)** BTL2 **Answer: Page: 245-248 - Mike W. Martin** **Introduction (5 M)** Bhopal disaster, also referred to as the Bhopal gas tragedy, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It was considered as of 2010 to be the world's worst industrial disaster **Explanation (8 M)** • Liquid MIC storage • Earlier leaks • Acute effects • Gas cloud composition • Immediate aftermath • Subsequent legal action • Post-settlement activity
3	**Explain the different code of ethics of professional engineering societies. (NOV/DEC**

	2012) (13M) BTL2 **Answer: Refer Notes** **Code of ethics Meaning:(2 M)** To provide basic framework for ethical judgment for a professional. **Code of ethics of professional engineering societies.(11M)** ▪ American society of mechanical engineers ▪ American society of civil engineers ▪ Institute of electrical and electronics engineers ▪ The institution of engineers ▪ National society of professional engineers ▪ American institute of chemical engineers ▪ Association of computer machinery ▪ Computer society of India
4	**Explain briefly on Engineer used as expert witness and advisers. (13 M) (APR-MAY2017) (MAY/JUNE 2013) (MAY/JUNE 2014) (NOV–DEC 2018) (NOV–DEC 2015) (MAY/JUN 2016) (NOV–DEC 2014)** BTL2 **Answer: Refer Notes** **Engineer used as expert witness. (2 M)** "An expert witness is a witness who has knowledge beyond that of the ordinary lay person enabling him/her to give testimony regarding an issue that requires expertise to understand." USLEGAL goes on to explain, "Experts are allowed to give opinion testimony which a non-expert witness may be prohibited from testifying to. In court, the party offering the expert must lay a foundation for the expert's testimony. Laying the foundation involves testifying about the expert's credentials and experience that qualifies him/her as an expert. Sometimes the opposing party will stipulate (agree to) to the expert's qualifications in the interests of judicial economy." **Abuses of engineers as expert witness: (5 M)** • Hired guns • Financial biases • Ego biases • Sympathy biases **Engineers as expert advisers: (6 M)** **Normative model of advisers:** • Hired guns • Value neutral analysts • Value guided advocates
5	**Discuss the roles and responsibilities of engineers and managers. (13 M) (MAY/JUNE 2014) (NOV–DEC 2014)** BTL2 **Answer : Refer Notes** **Roles of managers: (7 M)**

	• Interpersonal • Informational • Decisional **Responsibilities of engineers and managers: (6 M)** • Promoting ethical climate • Resolving the conflicts • Principles of conflict resolution
6	**Explain the engineers as consultants. (13 M) (MAY/JUNE 2014) (APR-MAY 2017 (NOV-DEC 2018) (NOV–DEC 2015)** BTL2 **Answer Refer notes.** **Introduction: (2M)** Engineers in consulting engineering companies come from virtually every discipline and specialty. These engineers are often referred to as consulting engineers and they participate in project teams to help the consulting engineering firm deliver services to its clients. **The responsibilities of consulting engineers: (11 M)** • Advertising • Competitive bidding • Contingency fees • Safety and client needs • Provision for resolution of disputes
7	**Discuss the following in detail Computer Ethics. (13M)(NOV/DEC2013) (NOV–DEC 2015) (APR-MAY 2017)(MAY/JUNE 2014) (NOV–DEC 2014)**BTL2 **Answer Mike W. Martin pg no 254 and 266** **Computer Ethics: (2 M)** Computer ethics deals with the procedures, values and practices that govern the process of consuming computing technology and its related disciplines without damaging or violating the moral values and beliefs of any individual, organization or entity. In 1991 the Computer Ethics Institute held its first National Computer Ethics Conference in Washington, D.C. The Ten Commandments of Computer Ethics were first presented in Dr. Ramon C. Barquin's paper prepared for the conference, "In Pursuit of a 'Ten Commandments' for Computer Ethics." **The Computer Ethics Institute published them as follows in 1992: (5 M)** • Not use a computer to harm other people. • Shall not interfere with other people's computer work.

	• Thou shall not snoop around in other people's computer files. • Not use a Computer to steal. • Should not use a computer to bear false witness. • Shall not copy or use proprietary software for which you have not paid. • Do not use other people's computer resources without authorization or proper compensation. • Not appropriate other people's intellectual output. • Do think about social consequences of program you are writing or system you are designing. • Shall always use a computer in ways, insure consideration and respect for your fellow humans. • ethics codes of conduct and resources Important unethical act under this categories: (6 M) • Bank robbery • Privacy • Hacking • Computer viruses
8	**Explain the characteristics of moral leader in detail**. **(13 M) (NOV/DEC2013) (MAY/JUNE 2014) (APR/MAY 2015) (NOV/DEC 2014)** BTL2 **Answer : Page: 39 - Mike W. Martin** **Moral Leadership (2 M)** Moral Leadership is a very different kind of leadership. Rather than aspiring to being followed, Moral Leaders aim to serve. Instead of showcasing their own skills, Moral Leaders tend to develop the capacities of others. **CHARACTERISTICS OF MORAL LEADER(11M)** ○ Justice ○ Respect others ○ Honesty ○ Humane ○ Focus on teambuilding ○ Value driven decision-making ○ Encourages initiative ○ Leadership by example ○ Values awareness

	o No tolerance for ethical violations
9	**Discuss the corporate social responsibility in detail. (MAY/JUNE 2014) (NOV/DEC 2016) (13M)**BTL2 **Answer : Refer notes** **CORPORATE SOCIAL RESPONSIBILITY: (2 M)** Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large. **TYPES OF CORPORATE SOCIAL RESPONSIBILITY: (5 M)** o Environmental Responsibility o Philanthropic Initiatives o Ethical Business Practices o Economic Responsibility **ADVANTAGES OF CSR: (6 M)** o The ability to have positive impact in the community o It supports public value outcomes: o It supports being an employer of choice: o It encourages both professional and personal development o It enhances relationships with clients
10	**Explain the problems of defence industry with examples. (13M) (MAY/JUNE 2014) (13M)**BTL2 **Answer: Refer Notes (13 M)** **1.Large military build-ups:** $2 billion cost overrun on the development of C5-A cargo plane reported to the public by Ernest Fitzgerald due to poor operating efficiencies in defence industry. He pointed out how large suppliers felt secure in not complying with cost-cutting plans but small contractors were willing.25% firms hold 50%of all defence contracts and 8 firms conduct 45% of defence research. **2. Technology creep:** The arms are not only growing in size, it is also becoming better. The development of a new missile or one that can target more accurately, by one country, can upset or destabilize a diplomatic negotiation. Sometimes this fad for modernization leads to undesirably consequences. The F15 fighter planes were supposed to be fastest and most manoeuvrable of its kind but most were not available for service due to repairs, defects and lack of spares.

	Engineers should be bewaring of such pitfalls. **3. Impact of secrecy:** Secrecy poses problems to engineers. Engineers should be aware of the answers to the following questions: Should discoveries of significance to military be informed to govt.? Can they be shared with other researchers, in other countries? Should they be withheld from the scientific and public community? **4. Effect on economy:** Every dollar spent on defence produces less jobs than what could be provided for by using the resource on other neglected sectors such as education and road development.
	PART * C
1	**Discuss the various features of multinational corporation. (15M) (APR/MAY2015) (NOV/DEC 2016)** BTL2 **Answer: Refer notes.** **MULTINATIONAL CORPORATION:** Definition: (2 M) A multinational company is a business that operates in many different countries at the same time. In other words, it's a company that has business activities in more than one country. Example: (2 M) The true definition of a multinational company isn't that it manufactures in other countries, however; the true meaning is that the business has operations in multiple countries. This can take form in many different ways besides manufacturing. Take McDonalds for example. They have almost 35,000 restaurants located in 119 countries around the world. This means that not only operate the physical restaurants, they also operate supply chains to deliver the beef and other products required to keep their locations working properly. **Features of Multinational Corporations (MNCs): (11 M)** **Following are the salient features of MNCs:** ▪ Huge Assets and Turnover ▪ International Operations Through a Network of Branches ▪ Unity of Control ▪ Mighty Economic Power ▪ Advanced and Sophisticated Technology ▪ Professional Management ▪ Aggressive Advertising and Marketing ▪ Better Quality of Products

2	**Discuss the ethical issues related to weapon development. (15M) (NOV/DEC2014) (MAY/JUNE 2014) (MAY/JUN 2016) (NOV – DEC 2018)** BTL2 **Answer: Refer notes.** **Introduction: (2 M)** • Military activities including world wars have stimulated growth of technology. • The growth of internet amply illustrates this fact. • The development of warfare and the involvement of engineers bring out many ethical issues concerned with engineers. **Role of Engineers in weapons development: (13 M)** • It gives one job with high salary. • One takes pride and honor in participating in the activities towards the defense of the nation. • Engineers are capable of innovating and developing new weapons. • Many of the rational engineers feel that they cannot work on designing weapons, which are ultimately used to kill human beings. Even though they are not ultimate users of those weapons, they find it morally unacceptable to work on such areas. • One believes the he fights a war on terrorism and thereby contribute to peace and stability of country. • Ironically, the wars have never won peace, only peace can win peace. • By research and development, engineer is reducing or eliminating risk from enemy weapons. • Savings ones country from disaster. • By building up arsenals, show of force, a country can force rough country, towards regulation. • Engineers can participate effectively in arms control negotiation for surrender or peace • Bombing of Nagasaki and Hiroshima led to surrender by the Japanese in 1945. • Many engineers had to fight and convince their personal conscience. • Engineers must have the potential judgments to serve in defense works that would jeopardize the human community.
3	**Explain the advantages and disadvantages of multinational corporation. (15M) (NOV/DEC 2016)**BTL2 **Answer: Page: 155 - Mike W. Martin** **Advantages of MNCs : (8 M)** ▪ Employment Generation:

- Automatic Inflow of Foreign Capital:
- Proper Use of Idle Resources:
- Improvement in Balance of Payment Position:
- Technical Development:
- Managerial Development:
- End of Local Monopolies:
- Improvement in Standard of Living:
- Promotion of international brotherhood and culture:

Limitations of MNCs : **(7 M)**

- Danger for Domestic Industries:
- Repatriation of Profits:
- No Benefit to Poor People:
- Danger to Independence:
- Disregard of the National Interests of the Host Country:
- Misuse of Mighty Status:
- Careless Exploitation of Natural Resources:
- Selfish Promotion of Alien Culture:
- Exploitation of People, in a Systematic Manner