

PANIMALAR ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND
COMMUNICATION ENGINEERING

QUESTION BANK
FOR EIGHTH SEMESTER

(2017- 2018)

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**PANIMALAR ENGINEERING COLLEGE
DEPARTMENT OF ECE**

VISION

To emerge as a centre of excellence in providing quality education and produce technically competent Electronics and Communication Engineers to meet the needs of the industry and society.

MISSION

M1: To Provide the best facilities, infrastructure and environment to our students, researchers and faculty members to meet the challenges in the field of Electronics and Communication Engineering.

M2: To provide quality education through effective teaching learning process for their future career, viz placement and higher education.

M3: To provide insight in to the core domains with industry interaction.

M4: To prepare graduates adaptable to the changing requirements of the society through lifelong learning.

PROGRAMME EDUCATIONAL OBJECTIVES

1. To prepare students to analyze, design and implement electronic circuits and systems using the knowledge acquired from basic science and mathematics.
2. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design and create novel products and solutions for real life problems.
3. To introduce the research world to the graduates not only in their own domain but also in multidisciplinary domain, so that they feel motivated for higher studies.
4. To prepare graduates to exhibit professionalism, ethical attitude, communication skills, team work and leadership qualities in their profession and adapt to current trends by engaging in lifelong learning.
5. To practice professionalism in a collaborative, team oriented manner that embraces the multicultural environment of today's business world.

PROGRAMME OUTCOMES

1. **Engineering Knowledge:** Able to apply the knowledge of Mathematics, Science, Engineering fundamentals and an Engineering specialization to the solution of complex Engineering problems.
2. **Problem Analysis:** Able to identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of Mathematics, Natural sciences, and Engineering sciences.
3. **Design / Development of solutions:** Able to design solution for complex Engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health and safety and the cultural, societal, and

environmental considerations.

4. Conduct investigations of complex problems: Able to use Research - based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Able to create, select and apply appropriate techniques, resources, and modern Engineering IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.

6. The Engineer and society: Able to apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.

7. Environment and sustainability: Able to understand the impact of the professional Engineering solutions in societal and environmental context, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Able to apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.

9. Individual and Team work: Able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Able to communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Able to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life – long learning: Able to recognize the needs for, and have the preparation and ability to engage in independent and life-long learning in the broadest contest of technological change.

PROGRAMME SPECIFIC OUTCOMES

1. Graduates should demonstrate an understanding of the basic concepts in the primary area of Electronics and Communication Engineering, including: analysis of circuits containing both active and passive components, electronic systems, control systems, electromagnetic systems, digital systems, computer applications and communications
2. Graduates should demonstrate the ability to utilize the mathematics and the fundamental knowledge of Electronics and Communication Engineering to design complex systems which may contain both software and hardware components to meet the desired needs.
3. The graduates are capable of excelling in Electronics and Communication Engineering industry/Academic/Software companies through professional careers.

BLOOM'S TAXONOMY LEVELS (BTL)

Level 1 – Remembering (R)

Level 2 – Understanding (U)

Level 3 – Applying (A)

Level 4 – Analyzing (AZ)

Level 5 – Evaluating (E)

Level 6 – Creating (C)

SUBJECT CODE: EC 6801

SUBJECT NAME: WIRELESS COMMUNICATION

UNIT -I
WIRELESS CHANNELS
Part – A

1. What is coherence time and coherence bandwidth? **(Remembering)**

Coherence time is the maximum duration for which the channel can be assumed to be approximately constant. Coherence time is defined as the time over which the time correlation function is above 0.5.

$$T_c = 0.423 / f_m \quad f_m = \text{maximum Doppler shift.}$$

Coherence bandwidth is defined as the bandwidth over which the frequency correlation function is above 0.9.

$$B_c = 0.15 / \sigma_\tau \quad \sigma_\tau = \text{rms delay spread}$$

2. How would you recall fading and Doppler spread? **(Remembering)**

Fading is nothing but reduction in radio signal strength, usually caused by reflection or absorption of the signal.

Doppler spread is as the range of frequencies over which the received Doppler spectrum is essentially non-zero.

3. State Snell's law. **(Remembering)**

Snell's law states that the ratio of the sines of the angles of incidence and refraction is equivalent to the ratio of phase velocities in the two media, or equivalent to the reciprocal of the ratio of the indices of refraction:

$$\frac{\sin \theta_1}{\sin \theta_2} = \frac{v_1}{v_2} = \frac{n_2}{n_1}$$

with each θ as the angle measured from the normal of the boundary, v as the velocity of light in the respective medium (SI units are meters per second, or m/s) and n as the refractive index (which is unitless) of the respective medium.

4. Define EIRP.

(Remembering)

EIRP of a transmitting system in a given direction as the transmitter power that would be needed, with an isotropic radiator, to produce the same power density in the given direction $EIRP = P_t G_t$.

Where P_t -transmitted power in w

G_t -transmitting antenna gain.

5. Find the factors influencing small scale fading?

(Remembering)

- (i) Speed of surrounding objects.
- (ii) Multipath propagation
- (iii) Speed of the mobile
- (iv) Transmission bandwidth of the signal

6. Can you recall frequency selective fading?

(Remembering)

If the channel possesses a constant gain & linear phase response over a bandwidth that is smaller than the bandwidth of the transmitted signal, then the channel creates frequency selective fading on the received signal.

7. Relate fast fading and slow fading.

(Understanding)

The channel impulse response changes rapidly within the symbol duration. This type of a channel is called **fast fading channel**.

The channel impulse response changes at a rate much slower than the transmitted Baseband signal. This type of a channel is called **slow fading channel**.

8. Illustrate the Friis free space equation.

(Understanding)

$$P_{RX}(d) = P_{TX} G_{TX} G_{RX} \left(\frac{\lambda}{4\pi d} \right)^2$$

Friis law seems to indicate that the attenuation in free space increases with

frequency.

9. Summarize the different types of wireless channels. **(Understanding)**

Types of Channel	Defining Characteristic
fast fading	$T_c \ll$ delay requirement
slow fading	$T_c \gg$ delay requirement
flat fading	$W \ll W_c$
frequency-selective fading	$W \gg W_c$
underspread	$T_d \ll T_c$

10. Compare small scale fading and large scale fading. **(Understanding)**

Small scale fading is used to describe the rapid fluctuations of the amplitudes, phases, or multipath delays of a radio signal over a short period of time or travel distance.

Large scale fading used to describe the Long term variation in the mean signal level caused by the mobile unit moving into the shadow of surrounding objects.

11. Solve the far field distance for an antenna with maximum dimension of 1m and operating frequency of 900 MHz. **(Applying)**

Largest dimension of antenna, $D = 1$ m

$$\text{Operating frequency } f = 900 \text{ MHz, } \lambda = c/f = \frac{3 \times 10^8 \text{ m/s}}{900 \times 10^6 \text{ Hz}} \text{ m}$$

Using equation (3.7.a), far-field distance is obtained as

$$d_f = \frac{2(1)^2}{0.33} = 6 \text{ m}$$

12. Solve the Brewster Angle for wave impinging on ground having a permittivity

$$\epsilon_r = 4.$$

(Applying)

$$\sin(\theta_B) = \frac{\sqrt{\epsilon_r - 1}}{\sqrt{\epsilon_r^2 - 1}}$$

$$\sin(\theta_i) = \frac{\sqrt{(4) - 1}}{\sqrt{(4)^2 - 1}} = \sqrt{\frac{3}{15}} = \sqrt{\frac{1}{5}}$$

$$\theta_i = \sin^{-1} \sqrt{\frac{1}{5}} = 26.56^\circ$$

Thus Brewster angle for $\epsilon_r = 4$ is equal to 26.56°

13. Explain about flat fading?

(Understanding)

If the mobile radio channel has a constant gain and linear phase response over a bandwidth which is greater than the bandwidth of the transmitted signal, then the bandwidth of the transmitted signal, then the receive signal will undergo flat fading.

14. Compare fading and Doppler spread?

(Understanding)

Fading: It is the rapid fluctuations of received signal strength over short time intervals and Travel distances.

Doppler Spread: Time varying fading due to the motion of a scatter or the motion of the transmitter or receiver or both results in Doppler spread.

15. State the differences between small-scale and large-scale fading.

(Understanding)

- (i) Small scale fading: The changing of the total signal amplitude due to interference of the different multipath components is called small scale fading.
- (ii) Large-scale fading: When MS moves behind the high-rise building the amplitude of the signal that propagates along the direct connection between BS and MS greatly decreases. This effect is called Shadowing.

The MS has to move over large distances. For this reason Shadowing gives rise to large scale fading.

16. What is Link Budget calculation? **(Remembering)**

A link budget is the clearest and most intuitive way of computing the required transmitter power. In this link Budget, we write all equations that connect the transmitted power to the received SNR in tabular form.

17. Distinguish between Narrowband and wideband systems. **(Analyzing)**

(i) Narrowband systems support low bit-rate transmission, whereas wideband systems support high bit-rate transmission.

(ii) Systems operating with channels substantially narrower than the coherence bandwidth are known as Narrowband systems.

(iii) Wideband systems operate with channels substantially wider than the coherence bandwidth.

(iv) In Narrowband systems all the components of the signals are equally influenced by multipath propagation.

(v) In wideband systems the various frequency components of the signal may be differently affected by fading.

18. List out any two properties of wideband channel. **(Remembering)**

(i) Space time frequency correlation function

(ii) Power space delay spectral density.

19. What is propagation model? **(Remembering)**

Propagation models that predict the mean signal strength for an arbitrary transmitter –receiver separation distance are useful in estimating the radio coverage area of a transmitter.

20. Define large scale propagation model. **(Remembering)**

The propagation models that characterize the signal strength over large T-R separation distances (several hundreds or thousands of meters.)

21. What is small scale model? **(Remembering)**

The propagation models that characterize the rapid fluctuations of the received signal strength over very short travel distances (a few wavelengths) or short time duration.

22. What is free space propagation model? **(Remembering)**

The free space propagation model is used to predict received signal strength, when unobstructed line-of-sight path between transmitter & receiver.

23. Explain path loss. **(Understanding)**

The path loss is defined as the difference (in dB) between the effective transmitted power & the received power, & may or may not include the effect of the antenna gains.

24. What is intrinsic impedance & Brewster angle? **(Remembering)**

It is defined by the ratio of electric to magnetic field for a uniform plane wave in the particular medium. The Brewster angle is the angle at which no reflection occurs in the origin.

25. What is scattering? **(Remembering)**

When a radio wave impinges on a rough surface, the reflected energy is spread out in all directions due to scattering.

26. Define radar cross section. **(Remembering)**

Radar Cross Section of a scattering object is defined as the ratio of the power density of the signal scattered in the direction of the receiver to the power density of the radio wave Incident upon the scattering object & has units of squares meters.

27. Name some of the outdoor propagation models. **(Remembering)**

Some of the commonly used outdoor propagation models are

1. Longely-Rice model
2. Durkin's model
3. Okumura model.

28. Define indoor propagation models. **(Remembering)**

The indoor propagation models are used to characterizing radio propagation inside the buildings.

29. Mention some indoor propagation models **(Remembering)**

Some indoor propagation models are

1. Long –distance path loss model
2. Ericession multiple break point model
3. Attenuation factor model.

30. Explain small scale fading. **(Understanding)**

Small scale fading is used to describe the rapid fluctuations of the amplitudes, phases, or multipath delays of a radio signal over a short period of time or travel distance.

31. What are the factors influencing small scale fading? **(Remembering)**

Factors influencing small scale fading are

1. Speed of surrounding objects
2. Multipath propagation
3. Speed of the mobile
4. Transmission bandwidth of the signal.

32. Define slow fading channel. **(Remembering)**

The channel impulse response changes at a rate much slower than the transmitted Baseband signal. This type of a channel is called slow fading channel.

33. Define fast fading channel.

(Remembering)

The channel impulse response changes rapidly within the symbol duration. This type of a channel is called fast fading channel.

34. State the difference between Narrowband and wideband systems.
(Remembering)

(i) Narrowband systems support low bit-rate transmission, whereas wideband Systems support high bit-rate transmission.

(ii) Systems operating with channels substantially narrower than the coherence Bandwidth are known as Narrowband systems.

(iii) Wideband systems operate with channels substantially wider than the coherence bandwidth.

(iv) In Narrowband systems all the components of the signals are equally influenced by multipath propagation.

(v) In wideband systems the various frequency components of the signal may be differently affected by fading.

35. What is the function of outdoor propagation models?

(Remembering)

The outdoor propagation models aim to predict signal strength at a particular receiving point or in a specific local area.

36. Define Doppler shift.

(Remembering)

The shift in received signal frequency due to motion is called the Doppler shift.

37. What is frequency selective fading?

(Remembering)

If the channel possesses a constant gain & linear phase response over a bandwidth that is smaller than the bandwidth of the transmitted signal , then the channel creates frequency selective fading on the received signal.

PART - B

1. What do you mean by path loss model? Explain in detail about large scale path loss. **(Remembering)**

2. What is the need for link calculation? Explain with suitable example. **(Remembering)**

3. Derive the final expression for **(Remembering)**
(a) The free space path loss model, and derive the gain expression.
(b) Two Ray Model propagation mechanisms.

4. Write short notes on the following concepts **(Remembering)**
(a) With system theoretic description, explain the characteristics of time dispersive Channels.
(b) Frequency selective fading.

5. How would you explain fading due to multipath delay spread? **(Remembering)**

6. Explain in detail about the free space propagation and describe how the signals are affected by reflection, diffraction and scattering. **(Understanding)**

7. Summarize the following **(Understanding)**
(i) Doppler shift
(ii) Doppler spread
(iii) Coherence time
(iv) Calculate the Doppler spread if the carrier frequency is 1900 MHz and Velocity is 50 m/s.

8. Illustrate fading due to Doppler spread and coherence time in detail? **(Understanding)**

9. Build the impulse response model of a multipath channel and also obtain the relationship between bandwidth and received power. **(Applying)**

10. Identify the various parameters involved in mobile multipath channels and explain in detail. **(Applying)**

11. (a) Examine the advantages and disadvantages of the two-ray ground reflection model in the Analysis of path loss. **(Analyzing)**

(b) Analyze the following cases tell whether the two-ray model could be applied, and justify Why or why not:

Case (i) $h_1 = 35\text{m}, h_r = 3\text{m}, d = 250\text{ m}$

Case (ii) $h_1 = 30\text{m}, h_r = 1.5\text{m}, d = 450\text{ m}$

Case (iii) Prove that in the two-ray ground reflected model

$$\Delta = d'' - d' = 2h_t h_r / d.$$

12. Distinguish fast fading and slow fading in wireless channel and explain in detail. **(Analyzing)**

13. Categorize what are the factors that influence small-scale fading. **(Analyzing)**

14. Assume if a transmitter produces 50W of power, express the transmit power in units of dBm and dBW. If 50W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100m from the antenna. What is P_r = (10km?) Assume unity gain for the receiver antenna. **(Analyzing)**

15. Explain in detail about the small scale fading and, what are the factors affecting the small scale fading. **(Evaluating)**

16. Briefly explain the factors that influence small-scale fading. **(Understanding)**

17. Briefly explain the three basic propagation mechanisms which impact propagation in a mobile communication system. **(Understanding)**

18. What is Brewster angle? Calculate Brewster angle for a wave impinging on ground having a permittivity of $\epsilon_r = 4$. **(Remembering)**

19. Explain the time-variant two-path model of a wireless propagation channel. **(Understanding)**

20. Brief about the properties of Rayleigh distribution. **(Remembering)**

21. Explain the narrow band modeling methods for Short scale fading and Long scale fading. **(Understanding)**
22. Brief about the properties of Nakagami distribution.
23. How the received signal strength is predicted using the free space propagation model? Explain. **(Understanding)**
24. Find the far-field distance for an antenna with maximum dimension of 1m and operating frequency of 900 MHz. **(Understanding)**
25. With system theoretic description explain the characteristics of Time-Dispersive Channels. **(Understanding)**
26. Explain the three basic propagation mechanisms in a mobile communication system. **(Understanding)**
27. Describe any two methods of diffraction by multiple screens. **(Remembering)**
28. Discuss about ultra wide band channel. **(Remembering)**
29. Compare Coherence Bandwidth and Coherence time. **(Understanding)**
30. Discuss the mathematical formulation of narrowband and wideband system, with relevant figures. **(Understanding)**
31. Explain the free space propagation model. **(Understanding)**
32. What is reflection? Explain in detail the reflection from dielectric and conductors. **(Remembering)**
33. Write short notes on diffraction and scattering. **(Remembering)**
34. Explain in detail the indoor & outdoor propagation model. **(Understanding)**
35. Explain in detail the small scale multipath propagation and its different measurements **(Understanding)**
36. Explain about propagation mechanism for wireless channel. **(Understanding)**
37. Discuss about propagation effects with mobile radio. **(Remembering)**
38. Explain about channel classification. **(Understanding)**
39. Brief notes about link calculations for various applications.

40. What are narrow band models? Explain the significance of each model.

(Understanding)

41. Discuss on wide band models.

(Remembering)

42. Derive the equation of the Path loss using Two-Ray Model with neat diagrams.

(Understanding)

43. Explain knife Edge Diffraction Model.

(Understanding)

44. Explain Rayleigh fading and Rician fading effects with mobile radio.

(Understanding)

45. Determine the proper spatial sampling interval required to make small scale propagation measurements which assume that consecutive samples are highly correlated in time. How many samples will be required over 10m travel distance if $f_c = 1900\text{MHz}$ and $v=50\text{m/s}$. how long would it take to make these measurements, assuming they could be made in real time from a moving vehicle. What is the Doppler spread B_D for the channel. (Applying)

46. Compare and contrast fast fading and slow fading. “In practice fast fading only occurs for very low data rate (Communications)”. Why?

UNIT II CELLULAR ARCHITECTURE

Part – A

1. Define co-channel reuse ratio. (Remembering)

It is defined as the ratio between the distance between the centers of nearest co channel cells to the radius of the cell. $Q = D/R$.

2. How would you find Grade of Service? (Remembering)

It is defined as the measure of the ability of a user to access a trunked system during the busiest hour.

3. What is multiple access technique? (Remembering)

Multiple access technique allows multiple users to talk to a BS simultaneously. It makes a provision to allow the simultaneous communications of as many users as possible within that band.

4. Recall soft handoff in mobile communication. (Remembering)

Soft handoff or “soft handover,” is one of the most important advantages of CDMA in which the spread spectrum mobiles share the same channel in every cell. By simultaneously evaluating the received signals from a single subscriber at several neighboring base stations, the MSC may actually decide which version of the user’s signal is best at any moment in time. This technique exploits the MSC to make a “soft” decision as to which version of the user’s signal to pass along to the PSTN at any instance. The ability to select between the instantaneous received signals from a variety of base stations is called Soft Handoff.

5. List the different types of multiple access schemes. (Remembering)

Frequency-division multiple access (FDMA)

Time division multiple access (TDMA)

Code division multiple access (CDMA)/Spread spectrum multiple access (SSMA)

Space division multiple access (SDMA)

Power division multiple access (PDMA)

6. Write short note on FDMA.

(Remembering)

Frequency division multiple access is a channel access method used in multiple-access protocols as a channelization protocol. FDMA gives users an individual allocation of one or several frequency bands, or channels. It is particularly commonplace in satellite communication. FDMA, like other multiple access systems, coordinates access between multiple users.

7. Demonstrate channel assignment? And how would you classify.

(Understanding)

Channel assignment is done for efficient utilization of radio spectrum a frequency reuse scheme with increasing capacity and minimizing interference is required. It can be classified as Fixed and Dynamic channel assignment. If the channels in each cell are allocated to the users within the cell, it will be called as fixed channel assignment. If all channels are occupied, the call will be blocked.

If the voice channels are not allocated permanently in a cell, it will be called as dynamic channel assignment. In this assignment, channels are dynamically allocated to users by the MSC.

8. Illustrate cell and cluster.

(Understanding)

The interference between adjacent channels is reduced by allocating different frequency bands or channels to adjacent cells so that their coverage can overlap slightly without causing interference. In this way cells can be grouped together in what is termed a cluster.

It is necessary to limit the interference between cells having the same

frequency. The topology of the cell configuration has a large impact on this. The larger the number of cells in the cluster, the greater the distance between cells sharing the same frequencies.

9. Compare co channel interference and adjacent channel interference. (Understanding)

The interference between the signals from co channel cells is called as co channel interference.

Interference resulting from signals which are adjacent in frequency to the desired signal is called adjacent channel interference.

10. How would you choose frequency reuse? (Applying)

Frequency reuse is the process of using the same radio frequencies on radio transmitter sites within a geographic area that are separated by sufficient distance to cause minimal interference with each other. Frequency reuse allows for a dramatic increase in the number of customers that can be served (capacity) within a geographic area on a limited amount of radio spectrum (limited number of radio channels).

11. Illustrate the importance of Cell splitting in networks. (Applying)

Cell splitting is the process of subdividing congested cells into smaller cells each with its own base stations and a corresponding reduction in antenna height and transmitter power. It increases the capacity of cellular system.

12. Develop cell sectoring in cellular networks. (Applying)

Sectoring is a technique for decreasing co-channel interference and thus increasing the system performance by using directional antennas.

13. What are the features of TDMA?

(Analyzing)

- Shares single carrier frequency with multiple users.
- Non-continuous transmission makes handoff simpler.
- Slots can be assigned on demand in dynamic TDMA.
- Less stringent power control than CDMA due to reduced intra cell interference.
- Higher synchronization overhead than CDMA.

14. Assess the theme of blocked call delay system.

(Analyzing)

If a channel is not available immediately, the call request may be delayed until a channel becomes available.

15. Analyze the function of CDMA.

(Analyzing)

- Soft capacity limit, hence system performance degrades for all users as number of users increase
- Wide frequency spectrum reduces fading, E.g., Rake receiver in which separate multipath signals of different delays by “chip” unit
- Cell frequency reuse, so no frequency planning required
- Soft Handover increases capacity therefore it is “make before break” vs. “break before make”
- Utilization of voice activity (talk spurts)

16. Interpret signal-interference ratio.

(Evaluating)

The signal-to-interference ratio (SIR or S/I), also known as the carrier-to-interference ratio (CIR or C/I), is the quotient between the average received

modulated carrier power S or C and the average received co-channel interference power I , i.e. cross-talk, from other transmitters than the useful signal.

The CIR resembles the carrier-to-noise ratio (CNR or C/N), which is the signal-to-noise ratio (SNR or S/N) of a modulated signal before demodulation. The interfering radio transmitters referred as I may be controlled by radio resource management, while N involves noise power from other sources, typically additive white gaussian noise (AWGN).

17. Mention the importance of frequency reuse in cellular networks. (Evaluating)

In the cellular concept, frequencies allocated to the service are re-used in a regular pattern of areas, called 'cells', each covered by one base station and these cells are usually hexagonal which are designed to achieve the desired coverage within the particular cell. By limiting the coverage area to within the boundaries of the cell, the same group of channels may be used to cover different cells that are separated from one another by distances large enough to keep interference levels within tolerable limits. The process of selecting and allocating channel groups for all cellular base stations within a system is called Frequency reuse or Frequency planning

18. How would you build microcell zone concept? (Creating)

The aim for creating microcells is for increasing the capacity of cellular network in areas where population is high. According to the Microcell Zone concept, large base station is replaced by several lower powered transmitters on the edge of the cell. The mobile retains the same channel and the base station simply switches the channel to a different zone site and the mobile moves from zone to zone. Since a given channel is active only in a particular zone in which mobile is traveling, base station radiation is localized and interference is reduced.

19. Discuss a few techniques used to improve the capacity of a cellular system. (Creating)

Increasing the amount of spectrum used
More efficient modulation formats and coding
Better source coding
Discontinuous Voice Transmission DTX:
Multiuser detection:
Adaptive modulation and coding
Reduction of cell radius
Use of sector cells
Use of an overlay structure:
Multiple antennas
Fractional loading
Partial frequency reuse

20. Differentiate Cellular telephony and cordless telephony. (Understanding)

The main difference from a cell phone is that the cordless telephone is associated with, and can communicate with, only a single Base Station.

21. What is base station? (Remembering)

A fixed station in mobile radio system used for radio communication with mobiles. It has transmitter and receiver section. It is located at the centre of coverage area.

22. What is MSC?

(Remembering)

Mobile switching centre coordinates the routing of calls in large service area. It connects the base station and mobiles to PSTN. It is also called as MTSO (Mobile telephone switching office).

23. What do you mean by forward and reverse channel? (Remembering)

Forward channel is a radio channel used for transmission of information from base station to mobile.

Reverse channel is a radio channel used for transmission from mobile to base station.

24. What is the function of control channel? What are the types? (Remembering)

Control channel is used for transmission of call setup, call request, call initiation & Control. Types are forward control channel, reverse control channel.

25. Define cell.

(Remembering)

Each cellular base station is allocated to a group of radio channels to be used within a small geographic area called as cell.

26. What is foot print?

(Remembering)

Actual radio coverage of a cell is called as footprint. It is determined from the field measurements or propagation prediction models.

27. What is hand off?

(Remembering)

When a mobile moves into a different cell while conversation in progress, the MSC automatically transfers the call from one cell to other cell without any interference. This is called as hand off.

28. Define dwell time.

(Remembering)

The time over which the call may be maintained within a cell without handoff is called as dwell time. This time is governed by factors such as propagation, interference, distance between subscribers and base station.

29. What is blocked call clear system (BCC)?

(Remembering)

In a system, a user is blocked without access by a system when no channels are available in the system. The call blocked by the system is cleared and the user should try again .This is called BCC system.

30. In a cellular network, among a handoff call and a new call, which one is given priority? Why?

(Understanding)

In a cellular network, among a handoff call and a new call, priority is given to Handoff call, to provide continuous service to the existing call.

Part – B

1. What is Handoff and interference systems and explain with neat diagram.
(Remembering)
2. Can you recall interference and system capacity of cellular system?
(Remembering)
3. Write short note on (i) Trunking, (ii) Grade of service of cell system.
(Remembering)
4. How to select various methods to improve coverage and channel capacity in cellular systems? **(Remembering)**
5. Summarize the features of various multiple access technique used in wireless mobile communication and State the advantages and disadvantages of each technique. **(Understanding)**
6. Explain in detail about the following (i) Cellular network architecture (ii) Any one type of multiple access schemes. **(Understanding)**
7. Illustrate multiple access techniques (i) TDMA (ii) FDMA (iii) CDMA (iv) Compare various multiple access techniques with each other. **(Understanding)**
8. (i) How would you apply frequency reuse? **(Applying)**
(ii) Explain in detail about channel assignment strategies. **(Applying)**
9. Identify the channel capacity of TDMA in cell system. **(Applying)**
10. Analyze what approaches are used to calculate channel capacity of CDMA in cell system. **(Analyzing)**
11. Categorize the techniques to improve coverage and capacity. **(Analyzing)**
12. Examine the concept of (i) Repeaters for range extension (ii) Microcell zone concept. **(Analyzing)**
13. If signal-to-interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that Should be used for maximum capacity if the path loss exponent is (1) $n=4$ (2) $n=3$? **(Creating)**
14. Describe in detail about the effects of multipath propagation in wireless environment. **(Remembering)**

15. Discuss the principle of cellular networks. **(Remembering)**
16. Write short notes on frequency reuse & channel assignment. **(Remembering)**
17. Discuss different techniques used for improving coverage and capacity in cellular systems. **(Remembering)**
18. Explain the various types of Handoff processes available. **(Understanding)**
19. If a total of 33MHz bandwidth is allocated to a particular FDD cellular telephone system which uses two 25KHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (1) 4 cell reuse (2) 7 cell reuse and (3) 12 cell reuse. If 1 MHz of the allocated spectrums is dedicated to control channels, determine the equitable distribution of control channels and voice channels in each cell of each of the three systems. **(Analyzing)**
20. Consider global system for mobile which is a TDMA/FDD system that uses 25MHz for the forward link, which is broken into radio channels of 200MHz. If 8 speech signals are supported on a single radio channel and if no guard band is assumed, find the number of simultaneous users that can be accommodated in GSM. **(Applying)**
21. If GSM uses a frame structure where each frame consists of 8 time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 Kbps, in the channel, find (1) the time duration of a bit (2) the time duration of a slot (3) the time duration of a frame and (4) how long must a user occupying a single time slot wait between two successive transmissions. **(Analyzing)**
22. Describe channel assignment strategies and Handoff strategies. **(Understanding)**

UNIT-III DIGITAL SIGNALLING FOR FADING CHANNELS

Part – A

1. List the advantages of digital modulation.(Remembering)

- i) Immunity to channel noise and external interference.
- ii) Flexibility operation of the system.
- iii) Security of information.
- iv) Reliability of digital circuits used.
- v) Multiplexing of various sources of information into a common format is possible.
- vi) Error detection correction is easy.

2. Define the concept of windowing. (Remembering)

Windowing is a popular method of reducing the spectral sidelobes of OFDM. A popular window usually used for this purpose in the raised cosine (RC) window, because of its tapered and smooth edges.: "windowing a time domain OFDM signal is equivalent to every subcarrier being individually windowed by the window function (RC for example), basically the sinc sidelobes of every subcarrier will be reduced". when the window function is applied to a non-contiguous OFDM signal (some subcarriers are deactivated somewhere in the middle of the spectrum), the spectrum is not only reduced at the edges of the band, but also in the in-band. This is not obtained when a filter is applied to the signal as with a filter, only the power spectrum reduction occurs in the edges but not in the band.

3. How would you explain non coherent detection? (Remembering)

Non coherent (envelope) detection is a type of detection which does not need receiver carrier to be phase locked with transmitter carrier.

4. List the advantages of OQPSK. (Remembering)

- OQPSK prevents phase transition from the origin by shifting one stream by a bit period and allowing only one bit to change between the transitions.
- Offset provides an advantage when non-rectangular data pulses are used.
- It supports more efficient RF amplification.

5. Identify bit error rate of GMSK. (Remembering)

$$P_e = Q \left\{ \sqrt{\frac{2\gamma E_b}{N_0}} \right\}$$

where γ is a constant related to BT by

$$\gamma \equiv \begin{cases} 0.68 & \text{for GMSK with } BT = 0.25 \\ 0.85 & \text{for simple MSK } (BT = \infty) \end{cases}$$

6. Differentiate between MSK and GMSK.(Understanding)

MSK: It has smooth waveforms than QPSK scheme, constant envelope, main lobe is wider and contains 99% signal energy and good Spectral efficiency.

GMSK: Simple binary modulation scheme, Premodulation is done by Gaussian pulse shaping filter so sidelobe levels are much reduced, Excellent power efficiency and spectral efficiency.

7. Interpret the term PAPR with necessary equations. (Understanding)

OFDM systems are known to have a high peak-to-average power ratio (PAPR) when compared to single-carrier systems. In fact, the high PAPR is one of the most detrimental aspects in an OFDM system as it decreases the signal-

to-quantization noise ratio (SQNR) of the analog-digital convertor (ADC) and digital-analog convertor (DAC) while degrading the efficiency of the power amplifier in the transmitter. As a side note, the PAPR problem is more of a concern in the uplink since the efficiency of the power amplifier is critical due to the limited battery power in a mobile terminal.

The PAPR of a signal is expressed by the following formula:

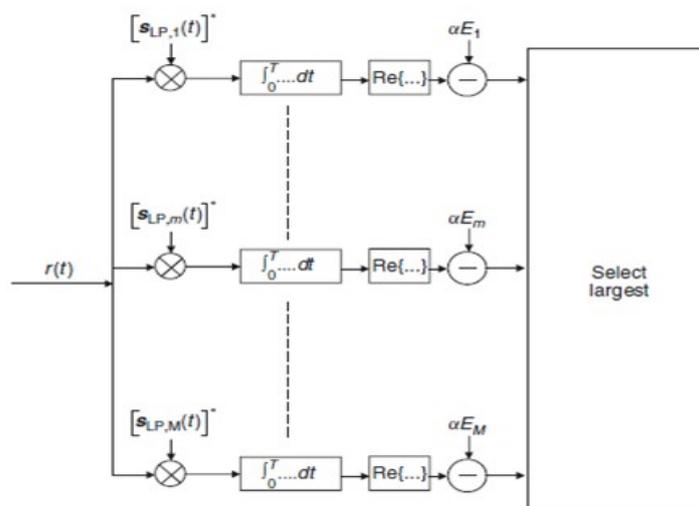
$$PAPR_{dB} = 10 \log \left(\frac{\max[x(t)x^*(t)]}{E[x(t)x^*(t)]} \right)$$

Where $()^*$ corresponds to the conjugate operator.

8. What is meant by OFDM? (Understanding)

Orthogonal frequency division multiplexing (OFDM) is a technique, method or scheme for digital multi-carrier modulation using many closely spaced subcarriers - a previously modulated signal modulated into another signal of higher **frequency** and bandwidth.

9. How would you summarize the structure of a generic optimum receiver with neat diagram? (Understanding)



10. Why is MSK referred to as fast FSK? (Applying)

MSK is sometimes referred to as fast FSK, as the frequency spacing used for only half as much as that used in conventional non-coherent FSK.

11. Find the 3-dB bandwidth for a Gaussian low pass filter used to produce 0.25 GMSK With a channel data rate of $R_b = 270\text{ kbp}$. What is the 90% power bandwidth in the RF channel? (Applying)

12. Illustrate the key features of GMSK. (Applying)

- Simple binary modulation scheme,
- Premodulation is done by Gaussian pulse shaping filter so sidelobe levels are much reduced,
- Excellent power efficiency and spectral efficiency.

13. List any two criteria for choosing a modulation technique for a specific wireless communication. (Analyzing)

Power efficiency, bandwidth efficiency, and system complexity

14. Examine the term Bandwidth efficiency. (Analyzing)

Bandwidth efficiency is defined as the ratio of the data (bit) rate to the occupied bandwidth

$$\frac{C}{B} = \log_2 \left(1 + \frac{E_b R_b}{N_0 B} \right)$$

15. Analyze the importance of constellation diagram? What do you infer from it? (Analyzing)

A signal constellation is the physical diagram used to describe all possible symbols used by a signaling system to transmit data and is an aid to designing better communication systems. The analysis of a constellation map allows the development of error detection and error correction schemes that can detect transmission problems.

16. Perceive the importance of a Gaussian filter in GMSK. (Evaluating)

GMSK uses a pre-modulation Gaussian filter which makes the output power spectrum more compact. The pre-modulation Gaussian filter has narrow bandwidth and sharp cutoff properties which are required to suppress the high-frequency components. Moreover, it has a lower overshoot impulse response which allows to protect against excessive instantaneous deviation.

17.A 880 MHz carrier signal is frequency modulated using a 100 kHz sinusoidal modulating waveform. The peak deviation of the FM signal is 500 kHz. If this FM signal is received by a super heterodyne receiver having an IF frequency of 5MHz, determine the IF bandwidth necessary to pass the signal. (Creating)

Given:

Modulating frequency, $f_m = 100 \text{ kHz}$

Frequency deviation, $\Delta f = 500 \text{ kHz}$

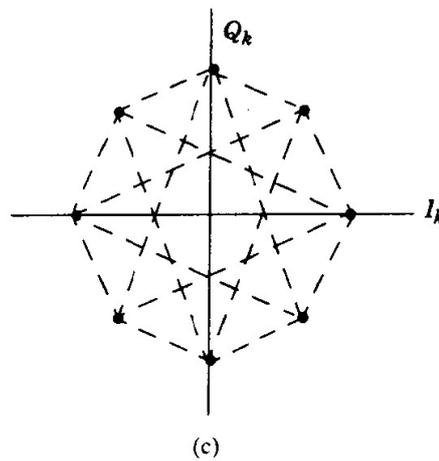
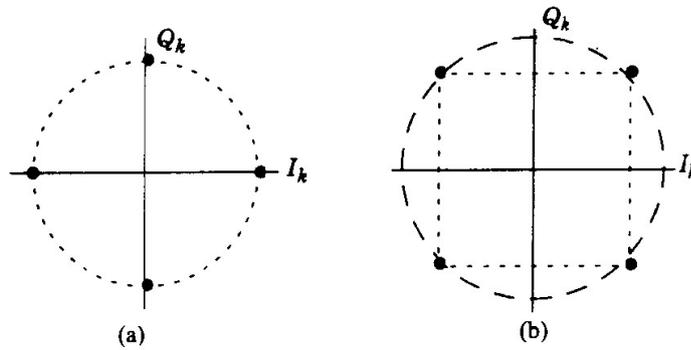
Therefore modulation index, $\beta_f = \Delta f / f_m = 500 / 100 = 5$

Using Carson's rule, the bandwidth occupied by the FM signal is given by

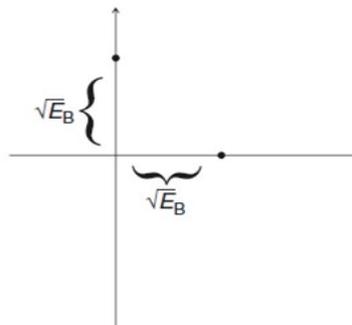
$$B_T = 2(\beta_f + 1)f_m = 2(5 + 1)100 \text{ kHz} = 1200 \text{ kHz}$$

The IF filter at the receiver needs to pass all the components in this bandwidth, hence the IF filter should be designed for a bandwidth of 1200 kHz.

18. Draw possible state of (a) θ_k when $\theta_{k-1} = n\pi/2$, (b) θ_k when $\theta_{k-1} = n\pi/4$ and (c) all possible states in $\pi/4$ QPSK signal. (Evaluating)



19. Develop the constellation diagram of binary frequency shift keying system. (Creating)



20. Mention any two criteria for choosing a modulation technique for a specific wireless application. (Understanding)

Bandwidth, Capacity, Peak to average power ratio.

21. What is OQPSK? (Remembering)

Offset Quadrature phase shift keying. It is another way of improving the peak-to-average ratio in QPSK is to make sure that bit transitions for the in-phase and the Quadrature phase components occur at different time instants.

21. Write the advantages of MSK over QPSK. (Remembering)

(i). In QPSK the phase changes by 90 degree or 180 degree. This creates abrupt amplitude variations in the waveform, Therefore bandwidth requirement of QPSK is more filters of other methods overcome these problems, but they have other side effects.

(ii). MSK overcomes those problems. In MSK the output waveform is continuous in phase hence there are no abrupt changes in amplitude.

22. What is quadrature modulation? (Remembering)

Sometimes two or more quadrature carriers are used for modulation. It is called quadrature modulation.

23. What is QAM? (Remembering)

At high bit rates a combination of ASK and PSK is employed in order to minimize the errors in the received data. This method is known as "Quadrature Amplitude Modulation".

24. Define QPSK.

(Remembering)

QPSK is a multilevel modulation in which four phase shifts are used for representing four different symbols.

25. What is linear modulation?

(Remembering)

In linear modulation technique the amplitude of the transmitted signal varies linearly with the modulating digital signal.

In general, linear modulation does not have a constant envelope.

26. Define non linear modulation.

(Remembering)

In the non linear modulation the amplitude of the carrier is constant, regardless of the variation in the modulating signals.

Non-linear modulations may have either linear or constant envelopes depending on whether or not the baseband waveform is pulse shaped.

27. What is the need of Gaussian filter?

(Remembering)

Gaussian filter is used before the modulator to reduce the transmitted bandwidth of the signal. It uses less bandwidth than conventional FSK.

28. Mention some merits of MSK.

(Remembering)

- i) Constant envelope
- ii) Spectral efficiency
- iii) Good BER performance
- iv) Self-synchronizing capability
- v) MSK is a spectrally efficient modulation scheme and is particularly attractive for use in mobile radio communication systems.

29. Give some examples of linear modulation.

(Remembering)

- i) Pulse shaped QPSK
- ii) OQPSK

30. Define digital modulation.

(Remembering)

Modulation is the process of encoding information from a message source in a manner suitable for transmission.

31. What are the types of digital modulation techniques. (Remembering)

- i) ASK : Amplitude shift keying
- ii) FSK : Frequency shift keying
- iii) PSK : Phase shift keying

32. Define constellation diagram. What do you infer from it? (Remembering)

The collection of M message points in N dimensional Euclidean space is called signal constellation diagram. It helps to find P_e – Probability of error, Euclidean distance between signaling points.

33. What is meant by MSK?

(Remembering)

A Continuous phase FSK signal with a deviation ratio of one half is referred to as MSK. It is a spectrally efficient modulation scheme.

34. Why GMSK is preferred for multiuser, Cellular communications?

(Remembering)

- i) It is a simple binary modulation scheme.
- ii) Premodulation is done by Gaussian pulse shaping filter,so side lobe levels are much reduced.
- iii) GMSK has excellent power efficiency and spectral efficiency than FSK.

35. How can we improve the performance of digital modulation under fading channels?

(Understanding)

By the use of:

- i) Diversity technique.
- ii) Error control coding techniques.
- iii)Equalization technique.

36. Define digital modulation.

(Remembering)

Modulation is the process of encoding information from a message source in a manner suitable for transmission.

Part –B

1. Describe with neat diagram and the modulation technique of QPSK.
(Remembering)
2. List the advantages and applications of BFSK. **(Remembering)**
3. What is flat fading channels? Derive the expression for probability of error in flat fading channels. **(Remembering)**
4. Discuss the expression for MSK signal as a special type of continuous phase FSK Signal. **(Understanding)**
5. What is the concept of GMSK and mention its advantages. **(Understanding)**
6. Demonstrate the generation, deduction and bit error probability of QPSK scheme. **(Applying)**
7. Examine the principle of MSK modulation and derive the expression for power spectral density. **(Applying)**
8. Calculate the average BER in flat fading channels. **(Applying)**
9. Analyze the performance of digital modulation in slow flat fading channels. **(Analyzing)**
10. Point out the function of PAPR in OFDM systems. **(Analyzing)**
11. Explain the principle of OFDM systems and its operation with neat block diagram. **(Analyzing)**
12. Differentiate windowing and PAPR. **(Analyzing)**
13. Explain the Nyquist criterion for ISI cancellation. **(Understanding)**
14. With transfer function, explain the raised cosine roll off filter. **(Understanding)**
15. Explain the QPSK transmission and detection techniques. **(Understanding)**
16. Explain the performance of Digital modulation in slow flat-fading Channels. **(Understanding)**

17. Explain the principle of $\pi/4$ Differential Quadrature-Phase Shift Keying from a signal space diagram. **(Understanding)**

18. Derive the expression for probability of error in Flat-Fading Channels.

(Remembering)

19. Explain the principle of Minimum Shift Keying (MSK) modulation and derive the expression for power spectral density.

(Understanding)

20. Derive the expression for probability of error in Frequency-Dispersive Fading channels.

(Remembering)

21. Briefly explain the structure of a Wireless communication link.

(Understanding)

22. With block diagram, explain the MSK transmitter and receiver. Derive an expression for MSK and its power spectrum.

(Understanding)

23. Derive an expression for :

(Remembering)

(i) M-ary phase shift keying and

(ii) M-ary Quadrature amplitude modulation

also derive an expression for their bit error probability.

24. Discuss in detail any two demodulation techniques of minimum shift keying method.

(Understanding)

25. Explain in detail about optimum receiver structure for non Coherent detection.

(Understanding)

26. Explain in detail the generation & detection of MSK technique.

(Understanding)

27. Explain in detail the generation & detection of GMSK modulation.

(Understanding)

28. Explain the performance of digital modulation in slow flat fading channel.

(Understanding)

29. Draw and explain the structure of a wireless communication link.

(Understanding)

30. Explain the generation, detection and bit error probability of QPSK

technique.

(Understanding)

31. What is Offset QPSK? What is its advantage? Describe the offset QPSK scheme and its salient features.

(Understanding)

32. Explain the principle and operation of differential QPSK transmission and reception.

(Understanding)

33. What is BPSK? Derive the bit error probability of BPSK and also explain the constellation diagram of it.

(Understanding)

34. Explain Gaussian MSK. Why we prefer it for wireless communication?

(Understanding)

35. Discuss about the error performance of various modulation techniques in fading channels.

(Understanding)

UNIT- IV Multipath Mitigation Techniques

Part – A

1. What is the need of equalization? **(Remembering)**

Equalization can be used to compensate the Inter Symbol Interference created by multipath within time dispersion channel.

2. Can you recall the principle of diversity? **(Remembering)**

The principle of diversity is to ensure that the same information reaches the receiver on Statistically independent channels.

3. Define zero forcing equalizer. **(Remembering)**

In a zero Forcing Equalizer, the equalizer coefficients C_n are chosen to force the samples of the combined channel and equalizer impulse response to zero at all but one of the NT spaced sample points in the tapped delay line filter.

4. How least mean square algorithm used in equalization techniques?

(Remembering)

The LMS equalizer maximizes the signal to distortion at its output within the constraints of the equalizer filter length.

5. List the techniques used to improve the received signal quality.

(Remembering)

Equalization, Diversity and Channel coding.

6. Relate the factors used in adaptive algorithms. **(Understanding)**

- i) Rate of convergence
- ii) Misadjustments
- iii) computational complexity

7. Differentiate between macro and micro diversity. **(Understanding)**

S.No	Micro diversity	Macro diversity
1.	Used to reduce small scale fading effects.	Used to reduce large scale fading effects.
2.	Multiple reflections causes deep fading. This effect is reduced.	Deep shadow causes fading. This effect is reduced.
3.	BS-MS are separated by a small distance.	BS-MS are separated by a Large distance.

8. Give the advantages of LMS algorithm. **(Remembering)**

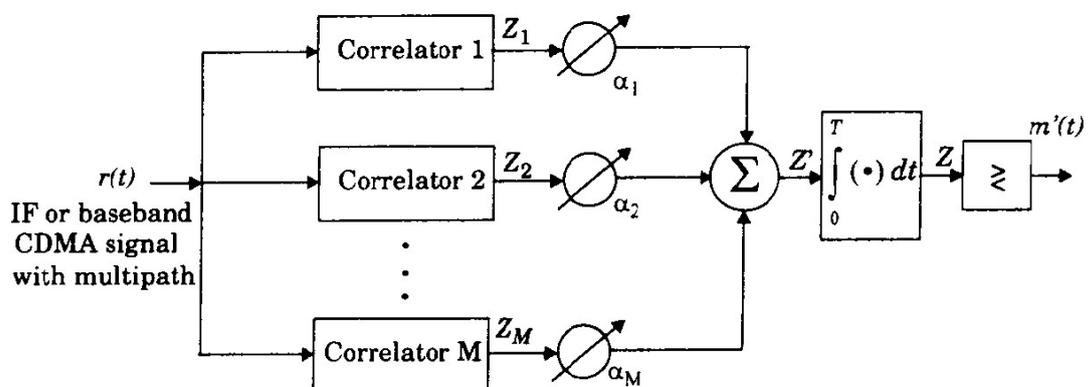
- i) The LMS equalizer maximizes the signal to distortion at its output within the constraints of the equalizer filter length.
- ii) Low computational complexity'.
- iii) Simple program.

9. Express the correlation coefficient of diversity. **(Remembering)**

The correlation coefficient ρ can be written as

$$\rho = \left(\frac{\tan^2(\alpha) \cos^2(\beta) - \Gamma}{\tan^2(\alpha) \cos^2(\beta) + \Gamma} \right)^2$$

10. Draw the block diagram of a RAKE receiver. **(Remembering)**



11. Classify the diversity and its combining techniques. **(Remembering)**

Micro Diversity and Macro Diversity. Combining Techniques-Selection Combining, Switched Combining, Equal gain combining and Maximum ratio combining.

12. Compare and contrast linear equalizers and non linear equalizers.

(Remembering)

Linear equalizers:

1. In linear equalizer, the current and past values of the received signal are linearly weighted by the filter coefficients and summed to produce the output. No feedback path is used.
2. Simple, easy to implement.
3. Not suitable for severely distorted channel, noise power signal is enhanced.

Non Linear equalizers:

1. If the past decisions are correct, then the ISI contributed by present symbol can be cancelled exactly, feedback path is used.
2. Suitable for severely distorted channel, also noise power is not enhanced.
3. Complex in structure, Channels with low SNR, the DFE suffers from error propagation.

13. Write about MMSE decision feedback equalizer. **(Remembering)**

MMSE decision feedback equalizer is a non linear equalization technique, which operates on minimizing the mean square error.

14. Why non linear equalizers are preferred? Justify. **(Remembering)**

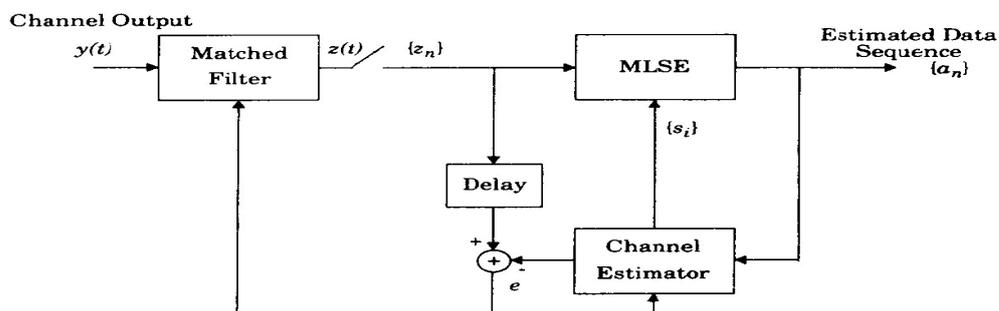
The linear equalizers are very effective in equalizing channels where ISI is not severe. The severity of ISI is directly related to the Spectral characteristics. In this case there are spectral nulls in the transfer function of the effective channel; the additive noise at the receiver input will be dramatically enhanced by the linear equalizer. To overcome this problem, non linear equalizers can be used.

15. State the significance of linear and decision feedback equalizer.

(Remembering)

Linear Equalizers are very effective in equalizing channels where ISI is not severe. The addition noise at the receiver input is dramatically enhanced by the linear equalizer. The basic idea of Decision Feedback equalization is that once an information symbol has been detected and decided, the ISI that it induces on future symbols can be estimated and subtracted out before detection of subsequent symbols.

16. Design the structure of maximum like hood sequence estimator (MLSE) in nonlinear equalizer. **(Creating)**



17. What is Diversity?

(Remembering)

Diversity is used to compensate for fading channel impairments and is usually implemented by using two or more receiving antennas. Diversity improves transmission performance by making use of more than one independently faded version of the transmitted signal.

18. What is Equalization?

(Remembering)

Equalization can be used to compensate the Inter Symbol Interference created by multipath within time dispersion channel.

19. State the principle of diversity.

(Remembering)

The principle of diversity is to ensure that the same information reaches the receiver on Statistically independent channels.

20. What is Transmit diversity?

(Remembering)

Diversity effect is achieved by transmitting signals from several transmitting antenna is known as transmit diversity.

21. What is an equalizer?

(Remembering)

Equalizer is a linear pulse shaping filter, used to reduce the effect of ISI.

22. Write a short note on linear equalizers and non linear equalizers?

(Remembering)

Linear equalizers: If the output $d(t)$ is not used in the feedback path to adapt the equalizer. his type of equalizers is called linear equalizer.

Nonlinear equalizers: If the output $d(t)$ is fed back to change the subsequent outputs of the equalizers is called non linear equalizers.

23. Define spatial diversity.

(Remembering)

The most common diversity technique is spatial diversity, whereby multiple antennas are strategically spaced and connected to a common receiving system. While one antenna sees a signal null, one of the other antenna may sees a signal peak, and the receiver is able to select the antenna with the best signals at any time.

24. Define STCM.

(Remembering)

Channel coding can also be combined with diversity a technique called Space-Time Coded Modulation. The space-time coding is a bandwidth and power efficient method for wireless communication.

25. Define adaptive equalization.

(Remembering)

To combine Inter Symbol Interference, the equalizer coefficients should change according to the channel status so as to break channel variations. Such an equalizer is called an adaptive equalizer since it adapts to the channel variations.

26. Define training mode in an adaptive equalizer.

(Remembering)

First , a known fixed length training sequence is sent by the transmitter then the receivers equalizers may adapt to a proper setting of minimum bit error detection where the training sequence is a pseudo random binary signal or a fixed and prescribed bit pattern.

27. What is tracking mode in an adaptive equalizer?

(Remembering)

Immediately following this training sequence the user data is sent and the adaptive equalizer at the receiver utilizes a recursive algorithm to evaluate the channel and estimate filter coefficients to compensate for the distortion created by multipath in the channel.

28. What are the nonlinear equalization methods used?

(Remembering)

- i) Decision feedback equalization
- ii) Maximum likelihood symbol detection
- iii) Maximum likelihood sequence estimation.

29. What are the advantages of RLS algorithm?

(Remembering)

- 1. Fast convergence.
- 2. Good tracking ability. If smaller value of weighting coefficient The equalizer has better tracking ability.

30. Define diversity concept.

(Remembering)

If one radio path undergoes a deep fade, another independent path may have a strong signal. By having more than one path to select from, both the instantaneous and average SNRs at the receiver may be improved often by as much as 20dB to 30dB.

Part –B

1. Describe Linear in detail about **(Remembering)**
 - (i) Equalizers, (ii) Non-linear equalizers
2. (i) Derive the mean square error for a generic adaptive equalizer.
(Remembering)
 - (ii) Define zero forcing equalizer and derive the mean square error criteria.
3. (i) With a neat block diagram, state and explain the principle of diversity.
(ii) Describe in detail, Decision feedback equalizer. **(Remembering)**
4. What is linear and decision feedback equalizer and derive an expression for its minimum mean square error. **(Remembering)**
5. (i) Describe about space diversity with necessary diagrams. **(Understanding)**
 - (ii) Express the LMS algorithm for an adaptive equalizer.
6. Illustrate the following **(Understanding)**
 - (i) Spatial Diversity
 - (ii) Temporal Diversity
 - (iii) Polarization Diversity
 - (iv) Macro Diversity
7. With a neat block diagram, discuss the principle of macro diversity.
(Remembering)
8. Discuss the operation of an adaptive equalizer at the receiver side.
(Remembering)
9. Examine the different types of diversity techniques and Explain Frequency, Angular and Polarization diversity techniques.
(Analyzing)
10. Analyze various diversity techniques used in wireless communication.
(Analyzing)
11. Compare the performance of signal combining techniques. **(Understanding)**
12. Describe the following **(Remembering)**
 - (i) Error probability in flat-fading channels
 - (ii) Symbol error rate in frequency selective fading channel.

13. Explain combining techniques using combination of signal **(Understanding)**

- (i) Maximum ratio combining
- (ii) Equal gain combining
- (iii) optimum combining
- (iv) Hybrid selection -maximum ratio combining

14. Draw the block diagram and explain the operation of a RAKE Receiver.

(Understanding)

15. Explain in detail about: (i) Polarization diversity. (ii) Time diversity. (iii) Frequency diversity.

(Understanding)

16. Explain the basic idea about linear and behind decision feedback Equalizers and derive an expression for its minimum mean square error.

(Understanding)

17. With a neat block diagram discuss the structure of a decision feedback equalizer.

(Understanding)

18. Explain about micro diversity.

(Understanding)

19. Explain about macro diversity.

(Understanding)

20. Discuss on transmit diversity.

(Remembering)

21. Compare the performance of signal combining techniques.

(Understanding)

22. Describe the role played by equalization and diversity as multipath mitigation techniques. Compare and contrast these two techniques.

23. Consider the design of the US digital cellular equalizer, where $f=900\text{MHz}$ and the mobile velocity $v=80\text{Km/hr}$, determine the maximum Doppler shift, the coherence time of the channel and the maximum number of symbols that could be transmitted without updating the equalizer assuming that the symbol rate is $24.3\text{ k symbols/sec}$.

24. Assume four branch diversity is used, where each branch receives an independent Rayleigh fading signal. If the average SNR is 20dB , determine the probability that the SNR will drop below 10dB . Compare this with the case of single receiver without diversity.

UNIT-V MULTIPLE ANTENNA TECHNIQUES

Part – A

1. What are smart antenna systems? **(Remembering)**

Smart Antenna is systems which are equipped with multiple antenna elements. In Smart antennas signals from different elements are combined by an adaptive algorithm. Intelligence is not in the antenna but rather in signal processing.

2. Define MIMO Systems. **(Remembering)**

Multi-input-multi-output (MIMO) systems are modern wireless systems with multiple antenna elements at both ends of the link.

3. List the different approaches of improving capacity gains. **(Remembering)**

- (i).Spatial filtering for Interference Reduction (SFIR), used in TDMA/FDMA systems.Space Division Multiple Access.(SDMA).
- (ii) Capacity Increase in CDMA systems.
- (iii)Capacity increase in third-generation CDMA systems.

4. Define Precoding. **(Remembering)**

Precoding is a technique which exploits transmit diversity by the weighting information stream. The transmitter sends the coded information to the receiver in order to have the pre-knowledge of the channel. The receiver is a simple detector such as matched filter ,and does not have to know the channel side information.

5. What are the requirements of beam forming? **(Remembering)**

To perform beamforming for a particular user, the base station needs to know the individual channel amplitude and phase responses from all the antennas which require more information to feedback than the overall signal to noise ratio.

- 6.** What does it mean by spatial multiplexing? **(Remembering)**

The objective of MIMO spatial multiplexing is the increase of the system capacity, While spatial diversity is adopted to reduce the Bit Error Rate (BER).

- 7.** Distinguish Transmit beam forming and receive beam forming.

(Remembering)

Transmit beamforming is aligning the transmit signal in the direction of transmit antenna array pattern. Transmit beamforming is defined as the process to allocate more power to the stronger antennas and arrange the signals from different antennas to align in phase at the receiver.

In the point-to-point and uplink scenarios, a decorrelating receiver is the optimal linear filter at high Signal to Noise Ratio(SNR) when the interference from other streams dominates over the additive noise. For general SNR, the linear MMSE receiver is used to optimally balance between interference and noise suppression. This is also called as receive beamforming.

- 8.** Describe about capacity in non fading channels. **(Remembering)**

Capacity of a wireless channel refers to an information theoretic bound, which provides maximum amount of information which can be transmitted into a wireless channel.

- 9.** Define ergodic capacity and give its expression. **(Remembering)**

This is the expected value of capacity taken over all realizations of the channel.

- 10.** Discuss Transmit precoding. **(Remembering)**

Transmit precoding is used in multicarrier systems, where it converts the ISI Channel into a set of noninterfering, orthogonal subcarriers each experiencing narrowband flat fading.

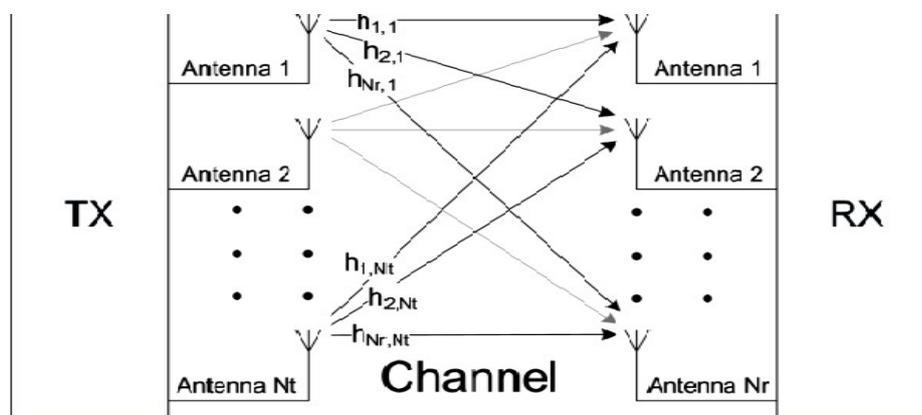
11. How would you explain the capacity of a fading channel?

(Remembering)

The capacity of a fading channel is given as $C = \log_2 (1 + \gamma |H|^2)$; where γ is the signal to noise ratio at the receiver. H is normalized transfer function from the transmitter to the receiver.

12. Draw the structure of a MIMO system model.

(Remembering)



13. What was the main idea behind linear precoding with full CSI.

(Remembering)

In wireless communications, Channel state information refers to known channel properties of a communication link. CSI describes how a signal propagates from the transmitter to the receiver and represents the combined effect of reflection, diffraction and scattering.

14. State the point of view of CSI at the transmitter and receiver side.

(Understanding)

Channel State Information at Transmitter refers to the channel values known at the transmitter. Channel State Information refers to the wireless channel magnitude and phase values. Channel State Information at Receiver (CSIR) refers to the channel values known at receiver.

- 15.** Classify beamforming and explain opportunistic beamforming.
(Understanding)

Opportunistic beamforming is one in which channel fluctuation can be induced in situations when the natural fading has small dynamic range and is slow. From the cellular system point of view, this technique also increases the fluctuations of the interference imparted on adjacent cells, and presents an opposing philosophy to the notion of interference averaging in CDMA systems.

- 16.** Distinguish CSI, CSIT, and CSIR. **(Understanding)**

In wireless communications, Channel state information (**CSI**) refers to known channel properties of a communication link. Channel State Information at Transmitter (**CSIT**) refers to the channel values known at the transmitter. Channel State Information refers to the wireless channel magnitude and phase values. Channel State Information at Receiver (**CSIR**) refers to the channel values known at receiver.

- 17.** Compare transmit and receive diversity. **(Understanding)**

Transmit diversity involves using multiple antennas at the transmitter, whereby information is transmitted in different antennas under the presumption that if one the antennas surfaces a deep fade the others will receive a quality signal.

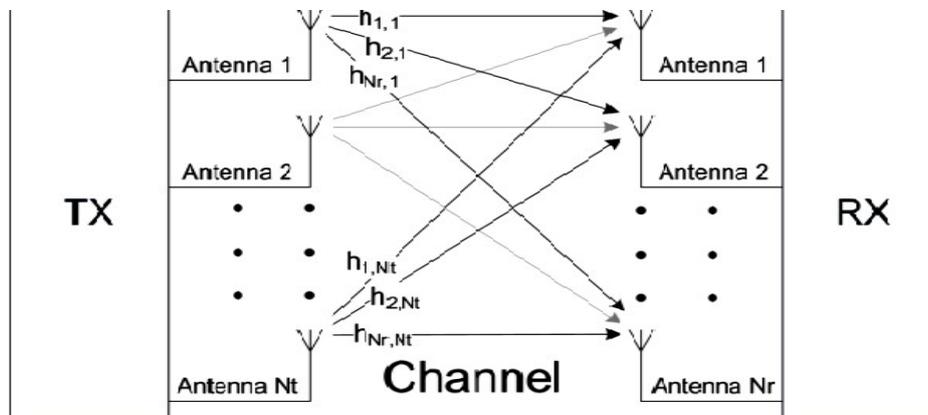
Receive diversity involves using multiple antennas at the receiver, whereby information is received in different antennas and one of the antennas receives a good quality signal.

- 18.** Explain the methods to increase the capacity of wireless. **(Understanding)**

MAC Aggregation-Reduce overhead by Multiple packet Transmissions and reduce the acknowledgement packets, Channel width- Increase the width of the RF channel , Modulation and coding-, MIMO techniques- Multiple Transmitters and Receivers.

19. Develop multi user MIMO systems.

(Applying)



20. Define transmit diversity.

(Remembering)

Transmit diversity involves using multiple antennas at the transmitter, whereby information is transmitted in different antennas under the presumption that if one the antennas surfaces a deep fade the others will receive a quality signal.

PART- B

1. What is meant by MIMO systems? Explain the system model with necessary diagrams. **(Remembering)**
2. Describe the operation of spatial multiplexing. **(Remembering)**
3. Define precoding and explain the operation of transmit precoding. **(Remembering)**
4. Why beamforming is important for wireless systems, explain transmit beamforming, receive beamforming and opportunistic beamforming. **(Remembering)**
5. What is diversity? Explain the operation of transmit diversity. **(Remembering)**
6. Compare transmit diversity and receive diversity. **(Remembering)**
7. Describe the capacity of a fading channel for information transmitted from a wireless system. **(Remembering)**
8. Give some advantages and applications of MIMO systems. **(Remembering)**
9. Describe the capacity of a Non fading channel for information transmitted from a wireless system. **(Understanding)**
10. Discuss the different approaches used to increase the capacity gains in smart antennas. **(Understanding)**
11. State channel state information? Explain the different kinds of channel state information. **(Understanding)**
12. Can you illustrate about multi user diversity and random beamforming. **(Understanding)**
13. Write a brief outline about the impact of channel in MIMO systems. **(Applying)**
14. Explain the BLAST architectures used in MIMO systems. **(Applying)**

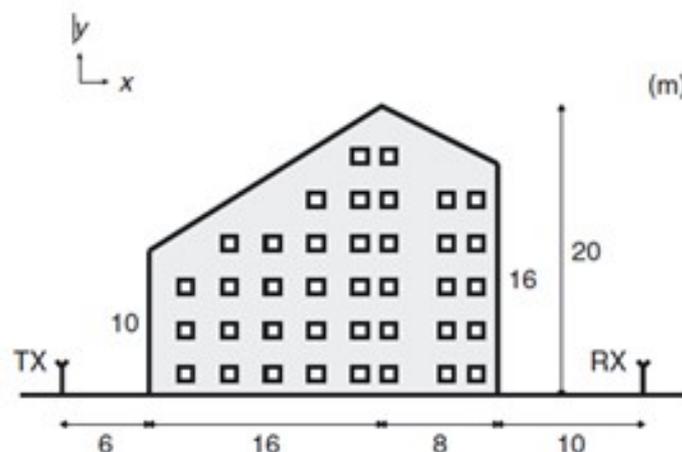
15. Compare the capacity of a fading and a non fading channel for information transmitted from a wireless system. **(Analyzing)**
16. What is the function of smart antennas and explain the various purposes of it. **(Analyzing)**
17. Can you distinguish between different beamforming techniques. **(Analyzing)**
18. Classify precoding schemes based on channel state information at transmitter and receiver sides . **(Analyzing)**
19. Explain precoding and precoding for multi-user MIMO systems. **(Evaluating)**
20. Design the capacity for MIMO systems in flat fading channels and compare it with fading and non-fading channels. **(Creating)**
21. Describe MIMO systems with emphasis on their requirement in a wireless communication environment.

Assignment Topics

Unit -I

- 1) Communication is to take place from one side of a building to the other as depicted in

Figure below, using 2-m-tall antennas. Convert the building into a series of semi-infinite screens and determine the field strength at the receive antenna caused by diffraction using Bullington's method for (a) $f = 900$ MHz, (b) $f = 1,800$ MHz, and (c) $f = 2.4$ GHz. (**Analyzing**)



- 2) A radio system is usually specified in such a way that an RX should be able to handle a certain amount of Doppler spread in the received signal, without losing too much in performance. Assume that only the mobile RX is moving and that the maximal Doppler spread is measured as twice the maximal Doppler shift. Further, assume that you are designing a mobile communication system that should be able to operate at both 900MHz and 1,800 MHz. (**Evaluating**)

(a) If you aim at making the system capable of communicating when the terminal is moving at 200 km/h, which maximal Doppler spread should it be able to handle?

(b) If you design the system to be able to operate at 200 km/h when using the 900-MHz band, at what maximal speed can you communicate if the 1,800-MHz band is used (assuming the same Doppler spread is the limitation)?

Unit -II

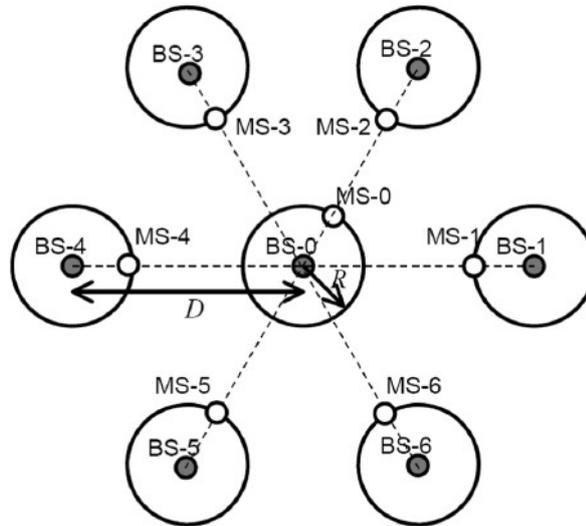
1) Consider a cellular system of hexagonal structure and a reuse distance D (distance to the closest co-channel BS), a cell radius of R , and a propagation exponent η . It is assumed that all six co-channel BSs transmit independent signals with the same power as the BS in the studied cell. (**Analyzing**)

(a) Show that the downlink-carrier-to-interference ratio is bounded

$$\left(\frac{C}{I}\right) > \frac{1}{6} \left(\frac{R}{D-R}\right)^{-\eta}$$

by

(b) Figure below shows an illustration of the worst case uplink scenario, where communication from MS 0 to BS 0 is affected by interference from other co-channel mobiles in first-tier co-channel cells. The worst interference scenario is when co-channel mobiles (MS 1 to MS 6) communicating with their respective BSs (BS 1 to BS 6) are at their respective cell boundaries, in the direction of BS 0. Calculate the C/I at BS 0, given that all mobiles transmit with the same power, and compare your expression with the one above. (**Evaluating**)



2) TDMA requires a temporal guard interval.

(Evaluating)

(a) The cell radius of a mobile system is specified as 3,000m and the longest impulse response in the cell is measured as 10 μ s. What is the minimum temporal guard interval needed to avoid overlapping transmissions?

(b) Justify the temporal guard interval reduced in GSM?

Unit -III

1) A system should transmit as high a data rate as possible within a 1-MHz bandwidth, where out-of-band emissions of -50 dBm are admissible. The transmit power used is 20 W. Is it better to use MSK or BPSK with root-raised cosine filters with $a = 0.35$? **(Analyzing)**

2) consider a point-to-point radio link between two highly directional antennas in a stationary environment. The antennas have antenna gains of 30 dB, distance attenuation is 150 dB, and the RX has a noise figure of 7 dB. The symbol rate is 20 Msymb/s and Nyquist signaling is used. It can be assumed that the radio link

can be treated as an AWGN channel without fading. How much transmit power is required (disregarding power losses at TX and RX ends) for a maximum BER of 10^{-5} :

- (a) When using coherently detected BPSK, FSK, differentially detected BPSK, or non coherently detected FSK?
- (b) Derive the exact bit and symbol error probability expressions for coherently detected Gray coded QPSK. Start by showing that the QPSK signal can be viewed as two antipodal signals in quadrature.
- (c) What is the required transmit power if Gray-coded QPSK is used?
- (d) What is the penalty in increased BER for using differential detection of Gray-coded QPSK in (c)? **(Evaluating)**

Unit -IV

- 1) In a wideband CDMA system, the Rake RX can take advantage of the multipath diversity arising from the delay dispersion of the channel. Under certain assumptions, the Rake RX acts as a maximal ratio combiner where branches correspond to the delay bins of the CDMA system. Assume a rectangular PDP and that the number of Rake fingers is equal to the number of resolvable multipaths. Furthermore, assume that each MPC is Rayleigh fading. We require that the instantaneous BER exceeds 10^{-3} only 1% of the time when using BPSK on a channel with an average SNR of 15 dB. How many resolvable multipaths must the channel consist of in order for the BER requirement to be fulfilled? **(Creating)**

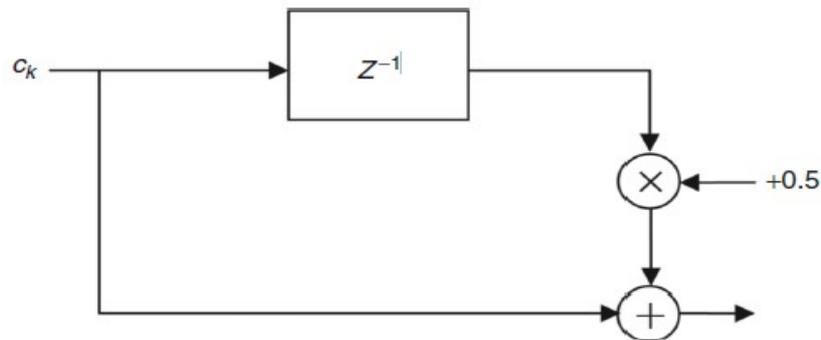
- 2) When transmitting 2-Amplitude Shift Keying (2-ASK) (with alternatives -1 and $+1$ representing "0" and "1," respectively) over an AWGN channel, ISI is experienced as a discrete time equivalent channel $F(z) = 1 + 0.5z^{-1}$ (see below Figure for the block diagram of channel $F(z) = 1 + 0.5z^{-1}$). When transmitting over this channel, we assume that the initial channel state is -1 , and the

following noisy sequence is received when transmitting 5 consecutive bits. Transmission continues after this, but we only have the following information at this stage:

0.66 1.59 -0.59 0.86 -0.79

- (a) What would the equalizer filter be if we apply a ZF linear equalizer?
- (b) What is the memory of this channel?
- (c) Draw one trellis stage with states, input symbols, and output symbols shown.
- (d) Draw a full trellis for this case and apply the Viterbi algorithm to find the maximum likelihood sequence estimate of the transmitted 5-bit sequence.

(Evaluating)



Unit-V

- 1) Design the capacity for MIMO systems in flat fading channels and compare it with fading and non-fading channels. **(Analyzing)**
- 2) Compare the capacity of a fading and a non fading channel for information transmitted from a wireless system. **(Analyzing)**

SUBJECT CODE: EC 6802

SUBJECT NAME: WIRELESS NETWORKS

UNIT I - WIRELESS LAN

PART - A

1. What are the goals of HIPERLAN?(R)

1. Quality Of Service
2. Strong Security.
3. Handoff when moving between local area and wide area.
4. Increased throughput.
5. Ease of use, deployment and maintenance.
6. Affordability.
7. Scalability.

2. What are the versions of HIPERLAN?(R)

- HIPERLAN-1
- HIPERLAN-2
- HIPER Access
- HIPERLINK

3. List the protocols used in HIPERLAN-2.(R)

- Radio Link Control protocol.
- DLC Connection Control
- Radio Resource Control
- Association Control Function.

4. What are the advantages of wireless LAN? (R)

- Flexibility
- Planning
- Robustness
- Design
- Cost

5. Define HIPERLAN-2. (R)

It is a mobile short-range access network specified in the Broadband Radio Access Networks (BRAN) project chartered by the European Telecommunications Standards Institute (ETSI). HIPERLAN-2, a competes directly with IEEE 802.11g/n, aka Wi-Fi.

6. What is Bluetooth? (R)

It is an open specification for short range wireless voice and data communications that was originally developed forcible replacement in PAN.

7. How is interference between Bluetooth and 802.11 handled? [AU April/May 2012] (R)

Bluetooth – CVSD Continuously Variable Slope Modulation.
IEEE 802.11 – CSMA/CA

8. Write some of the characteristics of Bluetooth. (May /June 2012)(U)

Frequency band	2.5GHz
Technology	Spread spectrum
Transmission method	Hybrid direct sequence and frequency hopping
Transmitting power	1 mill watt
Data speed	Asymmetric- 721+57.6 Kbps, symmetric link – 432.6Kbps
Range	10ms

9. What are the layers in IEEE 802.11 architecture? (R)

Physical Layer

- Physical layer convergence procedure(PLCP)
- Physical Medium dependent Sublayer(PMD).

Data link layer

- Logical Link Control Layer.(LLC)
- Medium Access Control (MAC).

10. What are the functions of Physical Layer? (R)

On transmission, assemble data into a frame with address and error detection fields.

On, reception, disassemble frame, and perform address and error detection.

Govern access to the LAN transmission medium.

Provide an interface to higher layers and perform flow and error control.

11. Draw the MAC frame format.(U)

MAC control	Destination MAC address	Source MAC address	Data	CRC
-------------	-------------------------	--------------------	------	-----

Data:

DSAP	SSAP	LLC control	Information
------	------	-------------	-------------

DSAP:

I/G	DSAP value
-----	------------

I/G – Individual / Group

DSAP – Destination Service Access Point

SSAP:

C / R	SSAP value
-------	------------

C / R – Command / Response

SSAP --Source Service Access Point

12. Define MANET. (R)

A MANET consists of a number of mobile devices that come together to form a network as needed, without any support from any existing Internet infrastructure or any other kind of fixed stations.

13. What are the characteristics of MANET? (May / Jun '12) (R)

- Dynamic topologies.
- Bandwidth constrained and variable capacity links.
- Energy constrained operations.
- Limited physical security

14. What are the applications of MANET? (R)

- Defense applications
- Crisis management applications.
- Telemedicine applications.
- Tele geo processing applications.
- Virtual navigation.
- Education via the Internet.

15. What are the building blocks of IEEE 802.11 architecture? (R)

- Basic Service SET. (BSS)
- Distribution System (DS)

- Access Point (AP).

16. What are the other IEEE.802.11 protocols? (R)

- 802.11a High speed physical layer in 5 GHz band
- 802.11b higher speed physical layer extension of wireless in 2.4 GHz band
- 802.11d Local and metropolitan area wireless 802.11g Broadband wireless

17. List out the IEEE 802.11 Services. (R)

- a. Distribution of Messages within a DS.
 - Distribution
 - Integration.
- b. Association Related Services
 - No Transition.
 - BSS Transition.
 - ESS transition.
- c. Access and Privacy Services.
 - Authentication.
 - DE authentication.
 - Privacy.

18. Define WIMAX(R)

WiMAX (Worldwide Interoperability for Microwave Access) is a wireless industry coalition dedicated to the advancement of IEEE 802.16 standards for broadband wireless access (BWA) networks. WiMax is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies (such as Cable Modems, DSL and T1/E1 links) to provide broadband access to customer premises.

19. List Some of the salient features supported by WiMAX are: (R)

i. High data rates: - WiMAX can typically support data rates from 500 Kbps to 2 Mbps. - The inclusion of multi-input multi-output(MIMO) antenna techniques along with flexible sub-channelization schemes, advanced coding and modulation all enable mobile to support peak downlink data rates of 63 Mbps per sector and peak uplink data rates of up to 28 Mbps per sector in a 10 MHz channel.

ii. Quality of service (QoS):

- WiMAX has clearly defined QoS classes for applications with different requirements such as VoIP, real time video streaming, file transfer and web traffic.

iii. Scalability:

- Mobile WiMAX is designed to be able to work in different channelization from 1.25 to 20 MHz to comply with varied world-wide requirements.

iv. Security:

- There is support for diverse set of user credentials like SIM/USIM cards, smart cards, digital certificates, username/password schemes.
- All this is based on relevant 'extensible authentication protocol (EAP)' methods for credential type.

v. Mobility:

- Mobile WiMAX supports optimized handoff schemes with latencies less than 50ms to ensure that real time applications such as VoIP can be performed without service degradation.
- Flexible key management schemes assume that security is maintained during handoff.

20. Define the Spectrum Allocation for WiMAX? (R)

- i. The biggest spectrum segment for WiMAX is around 2.5GHz.
- ii. The other bands are around 3.5HZ, 2.3/2.5GHz, or 5GHz, with 2.3/2.5GHz.

21. Compare between Wi-Fi and WiMAX. (A)

Sr.No	Wi-Fi	WiMAX
1.	Wi-Fi technology is based on IEEE 802.11 standards.	WiMAX technology is based on IEEE 802.16 standards.
2.	802.11a-OFDM,maximum rate=54Mbps.,802.11b-DSSS,maximum rate=11Mbps.,802.11g-OFDM,maximum rate=54Mbps.	802.16-OFDM, maximum rate=50Mbps.,802.16e-OFDM, maximum rate~30Mbps.
3.	The stations gain access to media based on CSMA/CA and back off algorithm schemes.	There is time slot for each station and there is scheduling algorithm used by base station.
4.	Range is less than 100 meters.	A kilometer non-line-of-sight, more with line-of-sight.
5.	Indoor Environment.	Outdoor Environment.
6.	No Quality of Service.	Five Quality of service enforced by base station.

22. What are the differences between the 802.11a and HIPER LAN-2?(R)

The HIPER LAN-2 standard uses the same physical layer as 802.11a with a MAC that supports the needs of the cellular telephone industry is supporting mechanisms for tariff, integration with existing cellular systems and providing QOS. IEEE 802.11camp is a connectionless WLAN camp that evolved from data oriented computer communications. HIPER LAN-2 camp is connection based WLANs addressing the needs of voice oriented cellular telephone.

23. State the relationship between HYPER LAN-2 and WATM. (R)

HIPER LAN-2 aims at higher data rates and intends to accommodate ATM as well as IP type access.

24. How many transport channels and logical channels are implemented in the HIPERLAN-2 DLC layer? (R)

HIPERLAN-2 DLC layer has four transport channels and five logical channels.

25. What is meant by wireless ATM? (R)

Wireless ATM is sometimes called as mobile ATM or WATM. It does not only describe a transmission technology, but specify a complete communication system. It develops a set of specifications that extends the use of ATM technology to wireless network.

26. Define MAC layer of WIMAX? (R)

The IEEE 802.16 MAC was designed for point-to-multipoint broadband wireless access applications. The primary task of the WiMAX MAC layer is to provide an interface between the higher transport layers and the physical layer.

27. State the Significance of radio transmission over infrared. (R)

Long Range Communication and High bandwidth are two main factors of radio transmission as compared to infrared.

PART-B

1. What are the basic differences between wireless WANs and WLANs, and what are the common features? (R)
2. What are the problems of WLANs? What level of security can WLANs provide, what is needed additionally and how far do the standards go? (R)
3. Compare IEEE 802.11, HiperLAN2, and Bluetooth with regard to their ad-hoc Capabilities. (U)
4. What are the reasons for the use of infra-red transmission for WLANs? (R)
5. Why is the PHY layer in IEEE 802.11 subdivided? What about HiperLAN2 and Bluetooth? (R)
6. How do IEEE 802.11, HiperLAN2 and Bluetooth, respectively, solve the hidden terminal problem? (R)
7. What are advantages and problems of forwarding mechanisms in Bluetooth networks regarding security, power saving, and network stability? (R)
8. Why did WATM not succeed as stand-alone technology, what parts of WATM succeeded? (R)
9. Discuss the methods by which data services get integrated with voice oriented networks.(AZ) [AUMay/June 2012]
10. Explain in detail about security and privacy in wireless networks(E) (Nov/Dec 2014)
11. Write a note on security issues in wireless networks (Apr/May 2015)

12. Distinguish between collisions on PHY and MAC layer. How do the three wireless networks, try to solve the collisions or minimize the probability of collisions?(E)
13. Compare the power saving mechanisms in all three LANs. What are the negative effects of the power saving mechanisms, what are the trade-offs between power consumption and transmission QoS?(E)
14. Compare the QoS offered in all three LANs in ad-hoc mode. What advantages does an additional infrastructure offer? How is QoS provided in Bluetooth? (E)
15. Explain and compare the medium access mechanism of DCF methods adopted in IEEE 802.11 WLAN. (U)
16. Describe the user scenario architecture and protocol stack of Bluetooth technology (U)

UNIT II MOBILE NETWORK LAYER

PART – A

1. What is Dynamic source Routing? (R)

Dynamic Source Routing eliminates all periodic routing updates. If a node needs to discover a route, it broadcast a route request with a unique identifier and the destination address as parameters. Any node that receives a route request gives a list of addresses representing a possible path on its way toward the destination.

2. Explain Mobile ad-hoc routing protocol in detail.(E)

Destination-Sequenced Distance-Vector (DSDV) Routing protocol. Ad-hoc on demand distance vector routing protocol. Dynamic source routing protocol.

3. What is mobile routing?(R)

Even if the location of a terminal is known to the system, it still has to route the traffic through the network to the access point currently responsible for the wireless terminal. Each time a user moves to a new access point, the system must reroute traffic. This is known as mobile routing.

4. List the major goals when selecting a routing protocol. (R)

Possible reliability by selecting alternative routes if node connectivity fails. minimizing the actual length between the source and destination through the least number of intermediate nodes. Especially important for interactive sessions between user applications.

5. What is a Mobile IP address? (R)

Mobile IP (or MIP) is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining a permanent IP address.

6. Define IPv6? (R)

Internet Protocol Version 6 (IPv6) is an Internet Protocol (IP) used for carrying data in packets from a source to a destination over various networks. IPv6 is the enhanced version of IPv4 and can support very large numbers of nodes as compared to IPv4. It allows for 2¹²⁸ possible node, or address, combinations.

7. What is DHCP? (R)

Dynamic Host Configuration Protocol (DHCP) is a network protocol that enables a server to automatically assign an IP address to a computer from a defined range of numbers (i.e., a scope) configured for a given network

8. Name the entities of DHCP? (R)

The entities acquired via DHCP are, e.g., DHCP relay, DHCP server etc.

9. How can DHCP be used for mobility and support of mobile IP? (R)

DHCP is a good candidate for support the acquisition of COA for mobile nodes. The same holds for all other parameters needed, such as address of the default router, DNS servers etc. A DHCP server should be located in the subnet of the access point of the mobile node, or at least a DHCP relay should provide forwarding of the messages.

10. What advantages does the use of IPv6 offer for mobility? (R)

Many mobility supporting function are already integrated in IPv6. An explicit FA is not needed any more, all routers are capable of agent advertisements, tunnelling, forwarding of data, setting up security associations. Authentication is built-in as well as optimisation functions.

11. Name the main differences between multi-hop ad hoc networks? (R)

Ad-hoc networks in general do not require an infrastructure to operate (they can be connected to an infrastructure). Multi-hop ad-hoc networks additionally do not require that all nodes can receive each other. Nodes may forward transmissions for other nodes.

12. What are general problems of mobile IP regarding security? (R)

Mobile IP does not increase security compared to IP, on the contrary. The only additional security related function is the authentication of MN and HA. However, if MN and HA, together, want to attack an FA, nothing can prevent them.

13. What are the classifications of Table Driven routing protocols? (R)

Destination sequenced distance vector Routing.

Cluster Head Gateway switch routing.

Wireless routing protocols

14. Define Adhoc Networks? (R)

Adhoc network is an autonomous system node connected with wireless link. The node in the ad hoc network communicates with other node without any physical representation. The nodes in the ad hoc organization instantly form the network whenever the communication is

established.

15. Write the advantages of Adhoc Networks?(U)

- Ease of deployment
- Speed of deployment
- Decreased dependence on infrastructure

16. List the issues of MANET? (R)

- Lack of a centralized entity.
- Network topology changes frequently and unpredictably
- Channel access/bandwidth availability
- Hidden/exposed station problem

17. List the disadvantages of Dynamic source routing? (R)

- Packet header size grows with route length due to source routing.
- Flood of route requests may potentially reach all nodes in the network

18. What are the features of IPv6? (R)

- Larger Address Space
- Simplified Header
- End-to-end Connectivity
- Auto-configuration
- Faster Forwarding/Routing
- IP Security
- No Broadcast
- Any cast Support
- Mobility
- Enhanced Priority Support
- Smooth Transition

- Extensibility

19. What are the advantages of IPv6 over IPv4? (R)

Advantages of IPv6 compared to IPv4:

- IPv6 in addition to offering a significantly larger address space, has many other advantages over IPv4:
- The IPv6 protocol has built in support for multicast 1 transmission, while with IPv4 this feature is optional.
- IPv6 devices allocate also an only locally accessible and valid IPv6 address for a client connected, which allows communication between endpoints on the same sub-network regardless of the presence of a router. 2
- As for security features, the IPsec support (authentication and encryption) is a mandatory component of the IPv6 protocol, while in case of IPv4 this feature is optional.
- Contrary to the Mobile IPv4 protocol, the Mobile IPv6 (MIPv6) helps avoid triangular routing experienced earlier, and makes it possible for mobile (WiFi) clients to select a new router without renumbering, which results in a more reliable and faster connection with less network interruption.
- In case of IPv4, data packages have an upper size limit of 64 kB (kilobytes), while with IPv6 this may be extended up to 4GB (gigabytes), significantly increasing the transmission rate.

20. Write the differences between IPv4 and IPv6?(U)

	IPv4	IPv6
Address	<ul style="list-style-type: none"> • 32 bits (4 bytes) 12:34:56:78 	<ul style="list-style-type: none"> • 128 bits (16 bytes) • 1234:5678:9abc:def0: • 1234:5678:9abc:def0
Packet size	<ul style="list-style-type: none"> • 576 bytes required, fragmentation optional 	<ul style="list-style-type: none"> • 1280 bytes required without fragmentation
Packet fragmentation	<ul style="list-style-type: none"> • Routers and sending hosts 	<ul style="list-style-type: none"> • Sending hosts only
Packet header	<ul style="list-style-type: none"> • Does not identify packet flow for QoS handling 	<ul style="list-style-type: none"> • Contains Flow Label field that specifies packet flow for QoS handling
	<ul style="list-style-type: none"> • Includes a checksum 	<ul style="list-style-type: none"> • Does not include a checksum
	<ul style="list-style-type: none"> • Includes options up to 40 bytes 	<ul style="list-style-type: none"> • Extension headers used for optional data
DNS records	<ul style="list-style-type: none"> • Address (A) records, maps host names 	<ul style="list-style-type: none"> • Address (AAAA) records, maps host names
	<ul style="list-style-type: none"> • Pointer (PTR) records, IN-ADDR.ARPA DNS domain 	<ul style="list-style-type: none"> • Pointer (PTR) records, IP6.ARPA DNS domain
Address configuration	<ul style="list-style-type: none"> • Manual or via DHCP 	<ul style="list-style-type: none"> • Stateless address auto configuration (SLAAC) using Internet Control Message Protocol version 6 (ICMPv6) or DHCPv6
IP to MAC resolution	<ul style="list-style-type: none"> • broadcast ARP 	<ul style="list-style-type: none"> • Multicast Neighbour Solicitation
Local subnet group management	<ul style="list-style-type: none"> • Internet Group Management Protocol (IGMP) 	<ul style="list-style-type: none"> • Multicast Listener Discovery (MLD)
Broadcast	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • No
Multicast	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes
IPSec	<ul style="list-style-type: none"> • optional, external 	<ul style="list-style-type: none"> • required

21. What is the care of address in mobile IP? (R)

Used in Internet routing, a care-of address (usually referred to as CoA) is a temporary IP address for a mobile device. This allows a home agent to forward messages to the mobile device.

22. What is encapsulation in mobile IP? (R)

The default encapsulation process used in Mobile IP is called IP Encapsulation Within IP, defined in RFC 2003 and commonly abbreviated IP-in-IP. It is a relatively simple method that describes how to take an IP datagram and make it the payload of another IP datagram.

PART – B

1. Name the consequences and problems of using IP together with the standard routing protocols for mobile communications. (R)
2. What could be quick 'solutions' and why don't they work? (R)
3. Name the requirements for a mobile IP and justify them. Does mobile IP fulfill them all? (R)
4. List the entities of mobile IP and describe data transfer from a mobile node to a fixed node and vice versa. Why and where is encapsulation needed? (R)
5. How does registration on layer 3 of a mobile node work? (R)
6. Show the steps required for a handover from one foreign agent to another foreign agent including layer 2 and layer 3.(A)
7. Explain packet flow if two mobile nodes communicate and both are in foreign networks.(U)
What additional routes do packets take if reverse tunneling is required?
8. Explain how tunneling works in general and especially for mobile IP using IP-in-IP, minimal, and generic routing encapsulation, respectively. Discuss the advantages and disadvantages of these three methods.(U)
9. Name the inefficiencies of mobile IP regarding data forwarding from a correspondent node to a mobile node. What are optimizations and what

additional problems do they cause? (R)

10. What advantages does the use of IPv6 offer for mobility? Where are the entities of mobile IP now? (R)

11. What are general problems of mobile IP regarding security and support of quality of service? (R)

12. What is the basic purpose of DHCP? Name the entities of DHCP. (R)

13. How can DHCP be used for mobility and support of mobile IP? (R)

14. Name the main differences between multi-hop ad-hoc networks and other networks. What advantages do these ad-hoc networks offer? (R)

15. Why is routing in multi-hop ad-hoc networks complicated, what are the special challenges? (R)

16. Recall the distance vector and link state routing algorithms for fixed networks. Why are both difficult to use in multi-hop ad-hoc networks? (U)

17. State the entities and terminologies used in mobile IP along with tunneling and also explain the three types of encapsulation mechanisms used in mobile IP. (U)

18. Explain and compare the working mechanism of both destination sequence distance vector and dynamic source routing protocol when applied on a mobile adhoc network scenario. (U)

3. What is a TCP packet? (R)

Most networks use TCP/IP as the network protocol, or set of rules for communication between devices, and the rules of TCP/IP require information to be split into packets that contain both a segment of data to be transferred and the address where the data is to be sent.

4. What are the three most common TCP/IP protocols(R)

- HTTP - Used between a web client and a web server, for non-secure data transmissions. A web client (i.e. Internet browser on a computer) sends a request to a web server to view a web page. The web server receives that request and sends the web page information back to the web client.
- HTTPS - Used between a web client and a web server, for secure data transmissions. Often used for sending credit card transaction data or other private data from a web client (i.e. Internet browser on a computer) to a web server.
- FTP - Used between two or more computers. One computer sends data to or receives data from another computer directly.

5. What do you mean by congestion control? (R)

Congestion control Congestion control controls traffic entry into a telecommunications network, to avoid congestive collapse by avoiding oversubscription by reducing the rate of packets. It should not be confused with flow control, which prevents the sender from overwhelming the receiver.

6. What do you mean by congestion window? (R)

The congestion window is a sender imposed window that was implemented to avoid overrunning some routers in the middle of the network path. The sender, with each segment sent, increases the congestion window slightly, i.e. the sender will allow itself more outstanding sent data.

7. What is fast retransmit in TCP? (R)

Fast Retransmit is an enhancement to TCP which reduces the time a sender waits before retransmitting a lost segment. A TCP sender uses a timer to recognize lost segments.

8. What is fast recovery in TCP? (R)

This step is congestion avoidance, since TCP is down to one-half the rate it was at when the packet was lost. The fast retransmit algorithm first appeared in the 4.3BSD Tahoe release, and it was followed by slow start.

9. What are the major responsibilities of TCP ? (R)

- Provide reliable in-order transport of data: to not allow losses of data.
- Control congestions in the networks: to not allow degradation of the network performance,
- Control a packet flow between the transmitter and the receiver: to not exceed the receiver's capacity.

10. Define fast retransmit in TCP? (R)

The congestion threshold can be reduced because of two reasons. First one is if the sender receives continuous acknowledgements for the same packet. It informs the sender that the receiver has got all the packets up to the acknowledged packet in the sequence and also the receiver is receiving something continuously from the sender. The gap in the packet stream is not due to congestion, but a simple packet loss due to a transmission error. The sender can now retransmit the missing packet(s) before the timer expires. This behaviour is called fast retransmit.

11. Define fast recovery in TCP? (R)

It is an early enhancement for preventing slow-start to trigger on losses not caused by congestion. The receipt of acknowledgements shows that there is no congestion to justify a slow start. The sender can continue with the current congestion window. The sender performs a fast recovery from the packet loss.

12. What is indirect TCP?(R)

Indirect TCP segments the TCP connection in to a fixed part and a wireless part. Standard PC is used between the fixed computer and the access point. No computer in the internet recognizes any changes to TCP. Instead of the mobile host the access point now terminates the standard TCP connection, acting as a proxy.

13. Enumerates the advantages of indirect TCP?(R)

- No changes in the fixed network necessary, no changes for the host necessary.
- Simple to control
- Transmission errors on wireless links do not propagate in to the fixed network.
- Fast retransmission of packets is possible.
- It is easy to use different protocols for wired and wireless networks.

14. List the disadvantages of indirect TCP?(R)

- Loss of end to end semantics
- Higher latency possible
- Security issues will arise.

17. What is snooping TCP?(R)

It is the new enhancement which leaves the TCP connection intact and is completely transparent. The main function is to buffer data close to the mobile host to perform fast local retransmission in case of packet loss.

18. List the advantages of snooping TCP?(R)

- The end to end TCP semantics is preserved.
- Handover of state is not required
- Most of the enhancements are done in the foreign agent itself.

19. Define Mobile TCP? (R)

The M – TCP has the same goals as that of I – TCP and snooping TCP to prevent the sender window from shrinking if bit errors or disconnection but not congestion cause current problems. The M – TCP improves the overall throughput, to lower the delay, to maintain end to end semantics of TCP to provide more efficient handover.

20. Write the advantages of M – TCP? (R)

- It maintains the TCP end to end semantics.
- It avoids useless retransmission, slow starts or breaking connections by simply shrinking the sender's window to 0.
- No buffering is required

21. Write the disadvantages of M – TCP? (R)

- M – TCP assumes low bit error rates which are not always a valid assumption.
- A modified TCP on the wireless link requires modification to the MH protocol software but also new network elements like bandwidth manager.

22. Write about 3G system. (R)

It is to provide fairly high speed wireless communications to support multimedia, data and video in addition to voice.

23. Write the applications of 3G? (R)

Applications of 3G

The bandwidth and location information available to 3G devices gives rise to applications not previously available to mobile phone users. Some of the applications are:

- Global Positioning System (GPS)
- Location-based services
- Mobile TV
- Telemedicine
- Video Conferencing
- Video on demand

24. What is the speed of 3g network? (R)

The operators talk about 3G speeds of 3.6 mbps to 21 mbps on their network, but the actual speed is much lower. Last year, telecom regulator TRAI proposed to set a minimum of one mbps download speed for 3G networks. In fact, the difference between the speeds of 2G and 3G is hardly visible.

25. List out the disadvantages of Indirect TCP (R)

- Loss of TCP's end-to-end semantics
- Handoff overhead can be significant
- Overhead at the proxy for per packet processing (up to TCP and back down)
- TCP proxy must be trusted

26. Mention the advantages of mobile TCP. (R)

1. Maintains semantics
2. Supports disconnection
3. No buffer forwarding

PART – B

1. (a) Write brief notes on congestion control in traditional TCP.
(b) Compare several enhancements to TCP for mobility giving their relative advantages and disadvantages(R)
2. (a) Describe transaction oriented TCP. (b) Explain Mobile TCP. How does a supervisory host send TCP packets to the mobile node and to a fixed TCP connection?
3. (a) How does selective transmission improve the transmission efficiency? What are the modifications required in the TCP receiver to implement the selective retransmission protocol.(b)Explain snooping TCP. What are it's advantages and disadvantages? (R)
4. Describe indirect TCP. Explain the modifications of indirect TCP as the selective repeat protocol and mobile - end transport protocol. What are the advantages and disadvantages of indirect TCP?
5. (a) Why mobility results in packet loss?(b) Compare the error rate in wired networks and mobile networks.(c) Why we cannot change TCP completely just to support mobile users? What are the consequences of it? (R)
6. (a) What are the applications in which packet delayed is equivalent to packet lost? Explain.(b) What are the applications for which packet loss can create severe problems? (R)
7. (a) Why Access point maintains buffers in Indirect TCP?(b) How Indirect TCP hides the problems of wireless links from fixed host?(c) The foreign agent

can act as a gateway to translate between the different protocols in Indirect TCP. (R)

- 8.** Compare the different types of transmission errors that can occur in wireless and wired networks. What additional role does mobility play?(A)
- 9.** What is the reaction of standard TCP in case of packet loss? In what situation does this reaction make sense and why is it quite often problematic in the case of wireless networks and mobility? (R)
- 10.** Can the problems using TCP be solved by replacing TCP with UDP? Where could this be useful and why is it quite often dangerous for network stability?(A)
- 11.** How and why does I-TCP isolate problems on the wireless link? What are the main drawbacks of this solution? (R)
- 12.** Show the interaction of mobile IP with standard TCP. Draw the packet flow from a fixed host to a mobile host via a foreign agent. Then a handover takes place. What are the following actions of mobile IP and how does TCP react?
- 13.** Now show the required steps during handover for a solution with a PEP. What are the state and function of foreign agents, home agents, correspondent host, mobile host, PEP and care-of-address before, during, and after handover? What information has to be transferred to which entity to maintain consistency for the TCP connection?(A)
- 14.** What are the influences of encryption on the proposed schemes? Consider for example IP security that can encrypt the payload, i.e., the TCP packet. (R)
- 15.** Name further optimizations of TCP regarding the protocol overhead which are important especially for narrow band connections. Which problems may occur?
- 16.** Describe the working mechanism of traditional TCP.(U)
- 17.** Write your understanding on indirect TCP, Snooping TCP, Mobile TCP and transaction oriented TCP. (A)

UNIT – IV WIRELESS WIDE AREA NETWORK]

PART – A

1. What is UMTS? (R)

The Universal Mobile Telecommunications System (UMTS) is a third generation mobile cellular system for networks based on the GSM standard. Developed and maintained by the 3GPP (3rd Generation Partnership Project), UMTS is a component of the International Telecommunications Union IMT-2000 standard set and compares with the CDMA2000 standard set for networks based on the competing cdma One technology. UMTS uses wideband code division multiple access (W-CDMA) radio access technology to offer greater spectral efficiency and bandwidth to mobile network operators.

2. What are the features of UMTS? (R)

UMTS supports maximum theoretical data transfer rates of 42 Mbit/s when Evolved HSPA (HSPA+) is implemented in the network.[2] Users in deployed networks can expect a transfer rate of up to 384 kbit/s for Release '99 (R99) handsets (the original UMTS release), and 7.2 Mbit/s for High-Speed Downlink Packet Access (HSDPA) handsets in the downlink connection. These speeds are significantly faster than the 9.6 kbit/s of a single GSM error-corrected circuit switched data channel, multiple 9.6 kbit/s channels in High-Speed Circuit-Switched Data (HSCSD) and 14.4 kbit/s for CDMAOne channels.

3. What is meant by UMTS network? (R)

UMTS, short for Universal Mobile Telecommunications System, is a 3G networking standard used throughout much of the world as an upgrade to existing GSM mobile networks. UMTS makes use of WCDMA, a technology that shares much with CDMA networks used throughout the world, though it is not compatible with them.

4. What are the QoS classes in the UMTS? (R)

- Conversational class (voice, video telephony, video gaming)
- Streaming class (multimedia, video on demand, webcast)
- Interactive class (web browsing, network gaming, database access)
- Background class (email, SMS, downloading)

5. Write about the UMTS architecture?

A UMTS network consist of three interacting domains; Core Network (CN), UMTS Terrestrial Radio Access Network (UTRAN) and User Equipment (UE). The main function of the core network is to provide switching, routing and transit for user traffic. Core network also contains the databases and network management functions.

6. Define radio access network? (R)

Wide band CDMA technology was selected to for UTRAN air interface. UMTS WCDMA is a Direct Sequence CDMA system where user data is multiplied with quasi-random bits derived from WCDMA Spreading codes. In UMTS, in addition to channelization, Codes are used for synchronization and scrambling. WCDMA has two basic modes of operation: Frequency Division Duplex (FDD) and Time Division Duplex (TDD).

7. Write the functions of Node – B? (R)

The functions of Node-B are:

- Air interface Transmission / Reception
- Modulation / Demodulation
- CDMA Physical Channel coding
- Micro Diversity
- Error Handing
- Closed loop power control

8. What is SGSN? (R)

The SGSN or Serving GPRS Support Node element of the GPRS network provides a number of tasks focussed on the IP elements of the overall system.

9. What are the services of SGSN? (R)

- Packet routing and transfer
- Mobility management
- Attach/detach
- Logical link management
- Authentication
- Charging data

10. What is GGSN? (R)

- The GGSN, Gateway GPRS Support Node is one of the most important entities within the GPRS network architecture.
- The GGSN organizes the interworking between the GPRS network and external packet switched networks to which the mobiles may be connected. These may include both Internet and X.25 networks.

11. What is the GMSC? (R)

The Gateway Mobile Switching Centre (GMSC) is a special kind of MSC that is used to route calls outside the mobile network. Whenever a call for a mobile subscriber comes from outside the mobile network or the subscriber wants to make a call to somebody outside the mobile network the call is routed through the GMSC.

12. What is SMS – GMSC? (R)

The SMS – GMSC interfaces with the MSC/VLR and or the SGSN to deliver a short message, stored in the SM –SC to the recipient mobile subscriber.

13. Define DHCP? (R)

Dynamic Host Configuration Protocol (DHCP) is a client/server protocol that automatically provides an Internet Protocol (IP) host with its IP address and other related configuration information such as the subnet mask and default gateway.

14. Is DHCP over TCP or UDP?(U)

DHCP is a UDP service. So there are no connections and there is no "listening". So different source ports are needed to identify whether the packet comes from a server or a client. With a TCP service there are also two ports.

15. Which transport layer protocol is used by DHCP?(U)

The DHCP employs a connectionless service model, using the User Datagram Protocol (UDP). It is implemented with two UDP port numbers for its operations which are the same as for the BOOTP protocol. UDP port number 67 is the destination port of a server, and UDP port number 68 is used by the client.

16. What is DNS? (R)

The Domain Name System (DNS) is a hierarchical decentralized naming system for computers, services, or any resource connected to the Internet or a private network. It associates various information with domain names assigned to each of the participating entities.

17. What is DNS protocol? (R)

Domain Name Servers (DNS) are the Internet's equivalent of a phone book. They maintain a directory of domain names and translate

them to Internet Protocol (IP) addresses. This is necessary because, although domain names are easy for people to remember, computers or machines, access websites based on IP addresses.

18. What do you mean by DNS server? (R)

This means that a resolving name server must issue another DNS request to find out the IP address of the server to which it has been referred. If the name given in the delegation is a subdomain of the domain for which the delegation is being provided, there is a circular dependency.

19. What is the HSDPA? (R)

High-Speed Downlink Packet Access (HSDPA) is an enhanced 3G (third-generation) mobile-telephone communications protocol in the High-Speed Packet Access (HSPA) family, also dubbed 3.5G, 3G+, or Turbo 3G, which allows networks based on Universal Mobile Telecommunications System (UMTS) to have higher data speed.

20. Is the EDGE network 2g or 3g?(Az)

Letter E stands for EDGE (Enhanced Data Rates for GSM Evolution). It is also called Enhanced GPRS. This technology lies somewhere in between 2G and 3G technology. So, some people refer to it as 2.5G.

21. Write the functions of SMS-GSC? (R)

The SMS-GMSC provides the following functions:

Reception of short message packet data unit (PDU)

Interrogation of HLR for routing information

Forwarding of the short message PDU to the MSC or SGSN using the routing information

22. What is the purpose of firewall in UMTS network? (U)

To provide Access Control and network security to the input and output side of a network.

23. Name the 3G radio access schemes identified to support different spectrum scenario. (R)

CDMA, TDMA, FDMA, MSC, GMSC, GGSN and SGSN

PART - B

1. Discuss two evolution paths for the GSM to offer 3G services. (AZ)
2. What is the high-speed circuit switched data (HSCSD) in the GSM? (R)
3. What is the role of the general packet radio service (GPRS) in the GSM? (R)
4. What are the QoS classes in the UMTS? (R)
5. Define roles of two new network entities in the GPRS. (R)
6. Name the physical channels of the GPRS and discuss their functions.
7. What are some of the point-to-point (PTP) and point-to-multipoint (PTM) applications of the GPRS? (R)
8. How are higher data rates achieved in the enhanced data rates for GSM enhancement (EDGE)? Discuss. (R)
9. What are the modulation and coding schemes that are used for the packet mode in the EDGE? (R)
10. Discuss the roles of 3G systems. (AZ)
11. What is the UMTS? List important features of the UMTS air interface. (R)
12. What are three channel types that are used in the UMTS? Discuss the role of each channel type. (R)
13. What are the three main entities of the UMTS network? Discuss their functions. (R)
14. Discuss the responsibilities of the RNC in the UMTS network. (AZ)
15. What are the responsibilities of Node B in the UMTS network? (R)
16. Discuss the role of the access link control application part (ALCAP) in the

UMTS.

17. Discuss Iu, Iur, and Iub interfaces in the UMTS.
18. The core network of the UMTS is divided into three different functional areas. Name these areas and discuss their roles.
19. What is adaptive multi-rate (AMR) codec? (R)
20. Discuss the UMTS bearer service layered architecture.
21. How is isolation between users in the downlink accomplished in a WCDMA system? (R)
22. Explain the UMTS network architecture with GSM, 3G and also explain the reference architecture. (U)
23. Explain the UMTS core network architecture (U)

UNIT – V 4G NETWORKS

PART – A

1. What is 4 g? (R)

4G is the fourth generation of mobile phone technology and follows on from 2G and 3G. 2G technologies was suitable for making calls and sending text messages while 3G makes it possible to access the internet more effectively through your mobile phone.

2. What is the difference between 4Gand 4GLTE? (R)

While the difference between slower 3G networks and new 4G or LTE networks is certainly noticeably faster, most of the 4G and “true 4G” networks have upload and download speeds that are almost identical. For now, LTE is the fastest connection available for wireless networks.

3. What is the difference between 3G and 4G? (R)

On the surface, the difference between 3G and 4G is pretty simple. The “G” is short for generation, so 3G and 4G represent the third and fourth generations of mobile broadband Internet. As a rule, provided that you're on the same carrier, a 4Gconnection will be faster than a 3G one.

4. How fast is the 3g network? (R)

The average mobile broadband download speed on 4G (15.1Mbit/s) was more than twice as fast as 3G (6.1Mbit/s) across all the networks. The research found that performance varied by operator. EE and O2 offered faster than average 4G download speeds at 18.4 Mbit/s and 15.6Mbit/s respectively.

5. What is the data transmission speed of 4g network? (R)

Ultra Mobile Broadband (UMB), also known as CDMA2000 EV-DO, is an expected path to 4G for legacy CDMA network providers. It's an IP-based technology that is said to support 100Mbps through 1Gbps data-transmission speeds.

6. Compare 4G with 3G?(A)

Comparing Key Parameters of 4G with 3G

	3G (including 2.5G, sub3G)	4G
Major Requirement Driving Architecture	Predominantly voice driven - data was always add on	Converged data and voice over IP
Network Architecture	Wide area cell-based	Hybrid - Integration of Wireless LAN (WiFi, Bluetooth) and wide area
Speeds	384 Kbps to 2 Mbps	20 to 100 Mbps in mobile mode
Frequency Band	Dependent on country or continent (1800-2400 MHz)	Higher frequency bands (2-8 GHz)
Bandwidth	5-20 MHz	100 MHz (or more)
Switching Design Basis	Circuit and Packet	All digital with packetized voice
Access Technologies	W-CDMA, 1xRTT, Edge	OFDM and MC-CDMA (Multi Carrier CDMA)
Forward Error Correction	Convolutional rate 1/2, 1/3	Concatenated coding scheme
Component Design	Optimized antenna design, multi-band adapters	Smarter Antennas, software multiband and wideband radios
IP	A number of air link protocols, including IP 5.0	All IP (IP6.0)

7. Write the advantages and limitations of 4G? (R)

ADVANTAGES OF 4G:-

1. Support for interactive multimedia services like teleconferencing and wireless Internet.
2. Wider bandwidths and higher bitrates.
3. Global mobility and service portability.
4. Scalability of mobile network.
5. Entirely Packet-Switched networks.
6. Digital network elements.
7. Higher band widths to provide multimedia services at lower cost(up to 100 Mbps).
8. Tight network security [4]

LIMITATIONS:-

Although the concept of 4G communications shows much promise, there are still limitations that must be addressed. A major concern is interoperability between the signaling techniques that are planned for use in 4G (3XRTT and WCDMA).

Cost is another factor that could hamper the progress of 4G technology. The equipment required to implement the next-generation network are still very expensive.

A Key challenge facing deployment of 4G technologies is how to make the network architectures compatible with each other. This was one of the unmet goals of 3G.

AS regards the operating area, rural areas and many buildings in metropolitan areas are not being served well by existing wireless networks.

8. List the challenges of 4G? (R)

- High usability: anytime, anywhere, and with any technology
- Support for multimedia services at low transmission cost
- Personalization
- Integrated services

9. Write the applications of 4G? (R)

- Virtual presence — 4G will provide user services at all times, even if the user is off-site.

- Virtual navigation — 4G will provide users with virtual navigation through which a user can access a database of streets, buildings, etc., of a large city.
- This requires high speed transmission.
- Tele-medicine — 4G will support the remote health monitoring of patients via video conference assistance for a doctor at anytime and anywhere.
- Tele-geo-processing applications — 4G will combine geographical information systems (GIS) and global positioning systems (GPS) in which a user will get location querying.

10. What is multi carrier modulation? (R)

Multicarrier modulation (MCM) is a derivative of frequency-division multiplexing. Forms of multicarrier systems are currently used in DSL modems and digital audio/video broadcast (DAB/DVB). MCM is a baseband process that uses parallel equal bandwidth sub channels to transmit information and is normally implemented with fast Fourier transform (FFT) techniques.

11. Define OFDM? (R)

OFDM is possibly the most widely used form of multicarrier modulation. It uses multiple closely spaced carriers and as a result of their orthogonality, mutual interference between them is avoided.

12. What is the number of subcarrier in OFDM? (R)

An 802.11a OFDM carrier signal (burst type) is the sum of one or more OFDM symbols each comprised of 52 orthogonal subcarriers, with baseband data on each subcarrier being independently modulated using quadrature amplitude modulation (available formats: BPSK, QPSK, 16-QAM, or 64-QAM).

13. List the OFDM advantages(R)

- OFDM has been used in many high data rate wireless systems because of the many advantages it provides.
- Immunity to selective fading
- Resilience to interference
- Spectrum efficiency
- Resilient to ISI
- Resilient to narrow-band effects
- Simpler channel equalization

14. Write the OFDM disadvantages(U)

- High peak to average power ratio
- Sensitive to carrier offset and drift

15. What is MIMO technology? (R)

MIMO (multiple input, multiple output) is an antenna technology for wireless communications in which multiple antennas are used at both the source (transmitter) and the destination (receiver). The antennas at each end of the communications circuit are combined to minimize errors and optimize data speed.

16. What is MIMO support? (R)

Multiple-Input Multiple-Output (MIMO) technology is a wireless technology that uses multiple transmitters and receivers to transfer more data at the same time. All wireless products with 802.11n support MIMO, which is part of the technology that allows 802.11n to reach much higher speeds than products without 802.11n.

17. Define cognitive radio? (R)

Cognitive radio (CR) is a form of wireless communication in which a transceiver can intelligently detect which communication channels are in use and which are not, and instantly move into vacant channels while avoiding occupied ones.

18. What is the meaning of cognitive network? (R)

In communication networks, cognitive network (CN) is a new type of data network that makes use of cutting edge technology from several research areas (i.e. machine learning, knowledge representation, computer network, network management) to solve some problems current networks are faced with.

19. What is meant by dynamic spectrum access? (R)

Dynamic spectrum access is a new spectrum sharing paradigm that allows secondary users to access the abundant spectrum holes or white spaces in the licensed spectrum bands. DSA is a promising technology to alleviate the spectrum scarcity problem and increase spectrum utilization.

20. What do you mean by adaptive modulation or coding? (R)

Link adaptation, or adaptive modulation and coding (AMC), is a term used in wireless communications to denote the matching of the modulation, coding and other signal and protocol parameters to the conditions on the radio link. For example, WiMAX uses a rate adaptation algorithm that adapts the modulation and coding scheme (MCS) according to the quality of the radio channel, and thus the bit rate and robustness of data transmission.

21. Mention the features and challenges of 4G. (R)

High usability, anytime, anywhere support for multimedia services, Personalization and integrated services.

22. Define multi carrier modulation. (R)

The process of splitting the carrier into several frequency components allowed to modulate.

PART – B

1. Define the role of the 4G system. (R)
2. Compare the 3G and 4G systems.(AZ)
3. Discuss multicarrier modulation (MCM). (AZ)
4. What is a multi-input multi-output (MIMO) system? Explain. (R)
5. How are higher spectral efficiency and increased throughput achieved in the OFDM-MIMO system? (R)
6. What is the BLAST system? Explain. (R)
7. Explain in detail about software-defined radio system? (R)
8. Discuss briefly about cognitive radio? (AZ)
9. List some of the new technologies that will be used in the 4G system. (R)
10. Write your understanding on behaviour of smart antenna techniques. (A)
11. Explain adaptive modulation and coding with time-slot scheduler along with cognitive radio concept. (U)

ASSIGNMENT QUESTIONS

Questions	
UNIT - 1	<p>1. Compare IEEE 802.11, HiperLAN2, and Bluetooth with regard to their ad-hoc Capabilities (E)</p> <p>2. How do IEEE 802.11, HiperLAN2 and Bluetooth, respectively, solve the hidden terminal problem? (R)</p> <p>3. Name reasons for the development of wireless ATM. What is one of the main difference to Internet technologies from this point of view? Why did WATM not succeed as stand-alone technology, what parts of WATM succeeded? (R)</p> <p>4. In what situations can collisions occur in all three networks? Distinguish between collisions on PHY and MAC layer. How do the three wireless networks try to solve the collisions or minimise the probability of collisions? (AZ)</p>

<p>UNIT - 2</p>	<p>Questions</p> <p>1. Think of ad-hoc networks with fast moving nodes, e.g., cars in a city. What problems arise even for the routing algorithms adapted to ad-hoc networks? What is the situation on highways? (R)</p> <p>2. What are the differences between AODV and the standard distance vector algorithm? Why are extensions needed?</p> <p>3. What are general problems of mobile IP regarding security and support of quality of service? (R)</p> <p>4. Explain how tunneling works in general and especially for mobile IP using IP-in-IP, minimal, and generic routing encapsulation, respectively. Discuss the advantages and disadvantages of these three methods. (U)</p>
<p>UNIT - 3</p>	<p>Questions</p> <p>1. Assume a fixed internet connection with a round trip time of 20 ms and an error rate of 10^{-10}. Calculate the upper bound on TCP's bandwidth for a maximum segment size of 1,000 byte. Now two different wireless access networks are added. A WLAN with 2 ms additional one-way delay and an error rate of 10^{-3}, and a GPRS network with an additional RTT of 2 s and an error rate of 10^{-7}. Redo the calculation ignoring the fixed network's error rate. Compare these results with the ones derived from the second formula (use $RTO = 5 RTT$). Why are some results not realistic? (A)</p> <p>2. Now show the required steps during handover for a solution with a PEP. What are the state and function of foreign agents, home agents, correspondent host, mobile host, PEP and care-of-</p>

	<p>address before, during, and after handover? What information has to be transferred to which entity to maintain consistency for the TCP connection? (R)</p> <p>3.Show the interaction of mobile IP with standard TCP. Outline the packet flow from a fixed host to a mobile host via a foreign agent. Then a handover takes place. What are the following actions of mobile IP and how does TCP react? (U)</p>
UNIT - 4	<p>Questions</p> <p>1.Applications of the GPRS? Using the following data for a GSM1800 network, calculate i). average busy hour traffic per subscriber, (ii) traffic capacity per cell, (iii) required number of base stations per zone, and (iv) the hexagonal cell radius for the zone. Subscriber usage per month= 150 minutes, Days per month= 24, Busy hours per day= 6 Allocated spectrum= 4.8 MHz, Frequency reuse plan =4/12, RF channel width= 200 kHz (full rate), Present number of subscribers in the zone =50,000 ,Subscriber growth= 5% per year, Area of the zone= 500 km² ,Initial installation based on a four-year design Capacity of a base station transceiver (BTS)= 30 Erlangs (C)</p> <p>2.Using the following data for a GSM network, estimate the voice and data traffic per subscriber. If there are 40 BTS sites, calculate voice and data traffic per cell.</p>

	<p>Subscriber usage per month: 150 ,minutes Days per month: 24 ,Busy hours per day: 6 ,Allocated spectrum: 4.8 MHz ,Frequency reuse plan: 4/12 ,RF channel width: 200 kHz (full rate) ,Present number of subscribers in a zone: 50,000, Subscriber growth per year: 5%, Network roll-over period: 4 years, Number of packet calls per session (NPCS): 5 (see Figure 17.1) ,Number of packets within a packet call (NPP): 25, Reading time between packet calls (Tr): 120 s ,Packet size (NBP): 480 bytes, Time interval between two packets inside a packet call (Tint): 0.01 s, Total packet service holding time during one hour (Ttot): 3000 s, Busy hour packet sessions per subscriber: 0.15. (C)</p>
<p>UNIT- 5</p>	<p>Questions</p> <ol style="list-style-type: none"> 1. Discuss to Improving TCP/IP performance over Wireless Network. (C) 2. Explain Some fundamental limits on cognitive radio. (U) 3.Explain Adaptive modulation and scheduling of IP traffic over fading channels (U) 4.Analyse Hybrid type-II ARQ schemes with adaptive modulation systems for wireless channels (AZ)

SUBJECT CODE: GE 6075

**SUBJECT NAME: PROFESSIONAL ETHICS IN
ENGINEERING**

Unit – I
Human Values
Part – A

1. What are human values? (R)

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. What are ethical values? (R)

Trustworthiness, respect, responsibility, fairness, caring is ethical values

3. Distinguish values from ethics and culture. (AZ)

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? (R)

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. Define work ethics. (R)

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.

6. What is service learning? (R)

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.

7. List some civic virtues? (R)

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.

8. Explain caring and sharing. (U)

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.

9. Explain honesty. (U)

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 bedifficult to follow some times.

10. What is courage as a value? (E)

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 make-up of an individual in taking bold decisions even under adverse situations.

11. Define co-operation.(R)

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.(R)

Empathy means putting self in a position of someone else and thinking as the later and reasoning suitable action.

13. Define spirituality.(R)

Spirituality raises a man above the materialistic world into a realm where he seeks peace and real happiness.

14. Define Integrity.(R)

Integrity is the bridge between responsibility in private and professional life.

15. Define Compromise.(R)

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.

16. List the two aspects of Honesty. (U)

Truthfulness – meeting responsibilities concerning truth-telling.

Trustworthiness – Meeting responsibilities concerning trust.

17. Compare Self-respect and Self-esteem. (AZ)

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.

18. What is Yoga?(R)

A Hindu spiritual and ascetic discipline, a part of which, including breath control, simple meditation, and the adoption of specific bodily postures, is widely practiced for health and relaxation

19. What is Meditation?(R)

Focus one's mind for a period of time, in silence or with the aid of chanting, for religious or spiritual purposes or as a method of relaxation.

20. What is Stress?(R)

A state of mental or emotional strain or tension resulting from adverse or demanding circumstances.

21. What is Stress Management?(R)

Stress management refers to the wide spectrum of techniques and psychotherapies aimed at controlling a person's levels of stress, especially chronic stress, usually for the purpose of improving everyday functioning.

22. Explain various actions of an engineer leading to dishonesty. (AZ)

1. Lying: Honesty implies avoidance of lying. Engineer may communicate wrong or distorted test results intentionally or otherwise. It is giving wrong information to the right people.
2. Deliberate deception: Engineer judges or decides on matters which he is not familiar with or with insufficient data or proof, to impress upon the customer or employer. It is self-deceit.
3. Withholding the information: Hiding the facts during communication to one's superior or subordinate, intentionally or otherwise.
4. Not seeking the truth: Engineers accept the information or data, without applying their mind and seeking the truth.
5. Not maintaining confidentiality: It is giving right information to wrong people.
6. Giving professional judgment under the influence of extraneous factors such as personal benefits and prejudice. The laws, experience, social welfare, and even conscience are given a go-bye.

Part - B

1. Briefly discuss honesty as a value. (C)
2. Write short notes on courage, co-operation. (U)
3. Elaborate on service learning? (R)
4. Distinguish values from ethics and culture. (AZ)

5. What do you understand by the term spirituality? Explain in detail. **(U)**
6. Briefly write about the terms Values, Morals & Ethics? **(R)**
7. Write about Human Values?**(U)**
8. 'Yoga and Meditation aids in Professional Excellence'. Comment.**(C)**
9. What is Stress? Write about Stress Management in detail.**(R)**

Assignment Questions

1. Robert is a third-year engineering student who has been placed on probation for a low grade point average, even though he knows he is doing the best work he can. A concerned friend offers to help him by sitting next to him and "sharing" his answers during the next exam. Robert has never cheated on an exam before, but this time he is desperate. What should he do? **(A)**
2. A student gives Elaine a copy of a professor's midterm exam from last year. (a) Is it all right for her to accept the exam, without asking any questions? (b) Elaine decides to ask about how the exam was obtained. She learns that the professor had required all copies of the exam sheet to be returned but had inadvertently missed this copy, which a student then circulated to select other students. She decides to decline the exam, but does she have any additional responsibilities?**(A)**
3. The use of Agent Orange defoliants in Vietnam has only recently been officially recognized by the United States as a health hazard as former U.S. soldiers began to show symptoms of ill effects, long after scientists warned of its effects on farmers and their animals in the war zones of Vietnam. When, if ever, does a war justify exposing soldiers and noncombatants to substances that can affect humans in ways that can have long term effects?**(A)**

Unit – II
Engineering Ethics
Part – A

1. Define Ethics.(R)

Moral principles that govern a person's behavior or the conducting of an activity. Study of right or wrong, good and evil, obligations and rights, justice, social & political deals.

2. Define Engineering Ethics.(R)

- 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.

3. What is the need to study Ethics? (U)

- To responsibly confront moral issues raised by technological activity.
- To recognize and resolve moral dilemma.
- To achieve moral autonomy.

4. Differentiate Moral and Ethics. (AZ)

Moral:

- Refers only to personal behavior.
- 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 behavior.
- Critical reflection on what one does and why one does it.
- Refers only to professional behavior.

5. What are the moral aspects of an engineer? (U)

- Respect colleagues, customers and bosses
- Keeping promises --not robbing the credit of others
- Avoid cheating --Honesty.

6. What are the Senses of Engineering Ethics? (R)

- An activity and area of inquiry.
- Ethical problems, issues and controversies.
- Particular set of beliefs, attitudes and habits.
- Morally correct.

7. Differentiate Micro-ethics and Macro-ethics. (AZ)

- Micro-ethics: Deals about some typical and everyday problems which play an important role in the field of engineering and in the profession of an engineer.
- Macro-ethics: Deals with all the societal problems which are unknown and suddenly burst out on a regional or national level.

8. Explain self-interest. (U)

It is nothing but one's personal good. It refers to the goodness of oneself in the long run.

9. Explain self-respect. (U)

It is a moral concept of valuing oneself in some morally suitable way.

10. What are the two forms of Self-respect? (R)

a. Recognition self-respect b. Appraisal self-respect

11. What are the senses of Responsibility? (R)

a) virtue; b) obligations; c) general moral capacities of people;d) liabilities and accountability for actions; e) blame worthiness or praiseworthiness.

12. Define Religion.(R)

A religion is any set of articles of faith together with the observances, attitudes, obligations and feelings tied up therewith, which, in so far as it is influential in a person, tends to perform two functions, one social and the other personal.

13. Explain the importance of Ethics in engineering profession. (U)

Mostly Engineering students receive inputs in basic engineering sciences, design, manufacture and drawing capabilities, laboratory equipment's, technical problems solving abilities etc., but generally receive less training in business practices, safety, environment protection and ethics. If an Engineer is technically sound but ethically weak, it is like, a person is physically o.k. but

mentally handicapped. Hence the study of engineering ethics is very essential requirement for an Engineer to become a real manager.

14. What are the basic goals of Engineering Ethics? (R)

- To identify and enlist the types of ethical issues that are likely to confront an engineer in his/her work life.
- To clarify the key concepts, related theories and standards involved.
- To help future engineers be prepared for confronting and resolving ethical dilemmas, such as knowingly designing an unsafe product.
- To stimulate critical and responsible reflection and discussion on these issues.

15. What are the applications of Engineering Ethics in decision making? (A)

It applies to the designs made by Engineers and others engaged in managing and controlling the technological enterprise, including production managers, scientists, workers and their supervisors, technicians, government officials, general public and lawyers.

16. What are the components of self-respect? (R)

- Having a proper estimation of one's worth.
- Suitable recognition for other.
- Clear ideas about his course of action in any given situation.
- Self-control and self-direction.

17. What are the technical functions of an engineer? (U)

- Designing safe products
- Should not make false claim regarding product performance
- Concealing product deficiencies
- Shifting blame on others.

18. What are the technical judgments? (U)

- Making product according to specification
- Capital budgeting
- Technological innovation
- Plant maintenance
- Develop, design and execute products.

19. What are the technical functions an Engineer require involving ethical decisions? (AZ)

Engineers may have technical functions which involve ethical decisions- designing a safe product, making false claim regarding product performance, concealing product deficiencies from customers, shifting the blame on others wrongfully, use of incorrect materials in product manufacture etc.

20. Explain how moral issues are related with (i) organization (ii) Environment and (iii) Society? (U)

Most of the Engineers are not self-employed; they are employees of some organization or other. As an employee, an Engineer should utilize his/her skills to the benefit of the organization and should take decisions in the interest of the organization.

- It is very essential to use the resources carefully without depleting them. An Engineer should take care of not to spoil the nature resources like air, land and water
- An Engineer is expected to have a certain amount of social responsibility in addition to his core activities. Thus his motive should not solely to earn profit, at the cost of society's interests

21. Explain how an engineer's morality is related with (i) Finance (H) Competitor and (iii) Government? (U)

- If a product is priced higher than optimum, it means that the engineers are charging his inefficiencies upon the innocent customers. For a long lasting business, a right price for the product is a very good indicator of ethics
- An engineer must An Engineer must do better than his competitors, by all means; but he should not practice cut-throat competition. He should not practice business strategies aim at finishing-off competitor practice honesty with government in all the areas.
- He should voluntarily comply with all Governmental regulations, pay taxes and duties regularly, try to save foreign exchange and must co-operate with enforcement agencies like police, customs, safety inspectors etc.

22. What are the models of professional roles? (R)

- Savior
- Guardian

- Bureaucratic servant
- Social servant
- Social enabler and catalyst
- Game player

23. What is the method used to solve an Ethical problem? (E)

- Recognizing a problem or its need.
- Gathering information and defining the problem to be solved or goal to be achieved.
- Generating alternative solutions or methods to achieve the goal.
- Evaluate benefits and costs of alternate solutions.
- Decision making & optimization.
- Implementing the best solution

24. What are the three types of Inquiry? (R)

- Normative Inquiry – Based on values. It aimed at identifying and justifying the morally desirable norms that ought to guide individuals or groups
- Conceptual Inquiry – it is meant for describing the meaning of concepts, principles and issues related to engineering ethics.
- Factual Inquiry – provide facts for understanding and finding solutions to value based issues

25. What do you mean by moral dilemmas? (U)

Complex ethical problems are professionally termed as dilemmas.

26. What are the types of moral dilemmas? (R)

a) Vagueness b) conflicting reasons c) Problems of disagreement

27. What are the sorts of complexity and murkiness that may be involved in moral situations? (AZ)

a) Vagueness b) conflicting reasons c) Problems of disagreement

28. Explain role conflict. (U)

This is a situation where two or more duties came into conflict with each other. Independently each one is good and correct, but when they come in contact with each other, they appear to pull in opposite direction.

29. What do you mean by problems of disagreement? (U)

In simple terms, even the most responsible people will have differing views on interpreting moral issues. If it happens in an organization with differing authority levels and boss-subordinate relationships, there could be severe disagreements indeed.

30. What are the steps in confronting Moral Dilemmas? (R)

- Identify the relevant moral factors and reasons.
- Gather all available facts that are pertinent to the moral factors involved.
- Rank the moral considerations in order of importance as they apply to the situation.
- Consider alternative courses of actions as ways of resolving dilemma, tracing the full implications of each.
- Get suggestions and alternative perspectives on the dilemma.
- By weighing all the relevant moral factors and reasons in light of the facts, produce a reasoned judgment.

31. Define Moral Autonomy.(R)

Moral Autonomy is the skill and habit of thinking rationally on ethical issues based on moral concern.

a) Self-determining b) Independent c) Personal Involvement d) Exercised based on the moral concern for other people and recognition of good moral reasons

32. What are the factors that influence the moral concern? (U)

- Early childhood atmosphere.
- Immediate neighborhood.
- Interactions with friends and relations.
- Type of family and family atmosphere.
- Influence of media like Television and newspapers.
- Emotional balance and intellectual capabilities of each individual.

33. What are the three levels of moral development in Kohlberg's theory? (R)

(i) Pre-conventional level (ii) Conventional level and (iii) Post-conventional level

34. What is conventional level of moral development? (U)

In the conventional level, moral behavior of the individual is determined by the standards of the family, community and society. Individuals at this level are

motivated by the desire to be approved by others and to meet the expectations of the social unit.

35. What are the difficulties in Kohlberg's theory? (U)

- How to judge?
- Whether an individual belongs to first or second or third level?
- What are the Criteria?
- What are the measurements?

The theory implies that the individual's moral level is pre-programmed and inborn, It cannot be changed, If at all, any level can be changed, it is not clear what are the factors that shape an individual from one level to another level of moral development.

36. Discuss briefly the Gilligan's theory.(U)

Gilligan said that males have an over-riding to moral rules and regulations (ethics of rules and rights), whereas females tend to approach moral dilemmas pre dominantly with a view to preserving the inter-personal relations of the people involved in the situation.

37. What are the concepts of pre-conventional & conventional level in Gilligan's theory? (R)

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.

38. List the importance of Lawrence Kohlberg's and Carol Gilligan's theory. (U)

Kohlberg gives greater emphasis to recognizing rights and abstract universal rules.

Gilligan stresses the importance of maintaining personal relationships based on mutual caring.

39. What is consensus and controversy? (U)

Consensus means agreement and controversy means disagreement. Both plays the vital roles while considering moral autonomy.

40. What is the relationship between moral autonomy and authority? (AZ)

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.

41. Explain the need for Authority. (U)

Authority provides the framework in which learning can take place

42. Explain profession and professionalism.(U)

- 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

43. Discuss the general criteria to become a Professional engineer. (U)

- Attaining standards of achievement in education, job performance or creativity in engineering that distinguish engineers from engineering technicians and technologists.
- Accepting as part of their professional obligations as least the most basic moral responsibilities to the public as well as to their employers, clients, colleagues and subordinates.

44. What are the obstacles to responsibility in profession? (U)

- Self-interest
- Fear
- Self-deception
- Eco centric tendencies
- Microscopic vision
- Ignorance

45. Explain professional organization. (U)

There is an association or organization to enlist the members practicing the profession, setting the standards for admitting them into the association, enforcing the standards of practice before the public and the Government.

46. Engineers as savior - Discuss. (U)

It is the generally believed technology and engineers hold the key for any improvement in society. Therefore, this group holds the engineer as savior, who will redeem the society of much ills-like poverty, low productivity, waste and the hardships of manual labor.

47. Explain virtues. (U)

Virtues means ideals of what is right and what is wrong

48. What are the theories about virtues? (R)

- Aristotle's theory of Golden mean
- Alasdair Mac Intyre's theory

49. What are the types of virtues? (R)

- Self-direction – commitment, self-discipline, courage
- Public spirited – justice, generosity
- Team work – cooperation, loyalty, respect for authority, leadership qualities
- Proficiency- technical skill, creativity

50. What are the Cardinal Virtues/ Chief Virtues? (R)

- Wisdom
- Courage
- Temperament
- Justice

51. What do you mean by Public Spirited Virtues? (U)

These are virtues dictated by needs of the community. There is an element of service in any profession and the engineer also owes to the society-to benefit the society with his specialized status in life.

52. Explain Moral Integrity. (U)

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.

53. What is Accountability? (R)

It is the highest form of responsibility. It means being responsible liable, answerable or obligated

54. Define Compromise.(R)

- 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.

55. Explain Ethical Egoism. (U)

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.

56. When will you tell an Act as an involuntary one? (AZ)

- Act done in ignorance
- Act performed under compulsion

57. What are the types of Theories about Morality/ Right action? (R)

- Virtue ethics – Virtues and vices
- Utilitarianism – Most good for the most people
- Duty ethics – Duties to respect people
- Rights ethics – Human rights

58. What is the real meaning of customs and Ethics? (R)

This is based on the concept of ethical pluralism which means there are many views of looking at ethical problems and it is difficult to peg down to one solution which is acceptable to all.

59. Write any three uses of ethical theories. (U)

- (i) Ethical theories are very useful in understanding and resolving moral dilemmas.
- (ii) In estimating the professional obligations and ideals.
- (iii) Determining to what extent, the obligations can be exercised in a given situation.

60. Discuss about Right ethics followers. (U)

Right ethics followers will examine the same issue in terms of rights of public vs. rights of the management.

61. Explain Utilitarianism. (Happiness theory) (U)

It emphasizes to maximize the well-being of the society as a whole (not individual).

62. Differentiate Hypothetical imperatives and Moral imperatives. (AZ)

Hypothetical imperatives are based on some conditions whereas Moral imperatives won't be based on some condition.

63. Recall Rawls's principles. (U)

- Each person is entitled to the most extensive amount of liberty compatible with an equal amount for others.
- Differences in social power and economic benefits are justified only when they are likely to benefit everyone, including members of the most disadvantaged groups.

64. List the various tests required to evaluate the Ethical Theories. (U)

Theory must be clear, and formulated with concepts that are coherent and applicable.

- It must be internally consistent in that none of its tenets contradicts any other.
- Neither the theory nor its defense can rely upon false information.
- It must be sufficiently comprehensive to provide guidance in specific situations of interests to us.
- It must be compatible with our most carefully considered moral convictions about concrete situations.

65. Discuss the drawbacks of Utilitarianism. (U)

- Sometimes what is best for the community as a whole is bad for certain individuals in the community.
- It is often impossible to know in advance which decision will lead to the most good.

66. Discuss the drawback of Duty Ethics. (U)

Duty ethics does not always lead to a solution which maximizes the public good.

67. List the drawbacks of Rights Ethics. (U)

- How do we prioritize the rights of different individuals?
- It often promotes the rights of individuals at the expense of large groups / society.

68. Differentiate Ethical Relativism and Ethical Egoism. (AZ)

- 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.

69. Define Ethical Pluralism.(R)

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.

70. Discuss the uses of Ethical Theories. (U)

- In understanding moral dilemmas
- Justifying professional obligations and ideals
- Relating ordinary and professional morality

71. List various principles of Duty Ethics.(R)

W.D. Ross, the British philosopher has listed the duties that reflect our moral convictions:

1. Fidelity: duty to keep promises.
2. Reparation: duty to compensate others when we harm them.
3. Gratitude: duty to thank those who help us.
4. Justice: duty to recognize merit.
5. Beneficence: duty to improve the condition of others.
6. Self-improvement: duty to improve virtue and intelligence.
7. Non-maleficence: duty not to injure others.

Part-B

1. What are the ethical theories? How can you classify them? **(R & U)**
2. What is meant by virtues? Do engineers need virtues?**(R & U)**
3. What is meant by professional responsibility? Also discuss the theories about virtues. **(R & U)**
4. Explain the various types of virtues.**(U)**

5. Illustrate the interconnectedness among the virtues of integrity and self-respect. **(U)**
6. Explain Gilligan's theory of moral development. **(U)**
7. Explain Kohlberg's model of moral development. **(U)**
8. Give the steps in confronting moral dilemmas. **(R)**
9. Explain the skills needed to handle problems about issues in engineering ethics. **(U)**
10. Discuss the different model of professional roles. **(U)**
11. What is the different ethical theory available for right action, self-interest, and duty ethics? **(R)**
12. Explain how Gilligan view the three levels of moral development initiated by Kohlberg. What is moral autonomy? **(U & R)**
13. Explain the skill needed to handle problems about moral issues in engineering ethics. **(E)**
14. Explain the scope of engineering ethics. **(U)**
15. Discuss the importance of duty ethics and virtue in engineering profession. **(U)**
16. Explain the ethical theories and how these theories are useful in justifying moral obligation to engineers. **(U)**
17. Discuss three types of inquiry. **(U)**

Assignment Questions

1. Identify the moral values, issues, and dilemmas, if any, involved in the following cases, and explain why you consider them moral values and dilemmas. **(A)**
 - a. An engineer notified his firm that for a relatively minor cost a flashlight could be made to last several years longer by using a more reliable bulb. The firm decides that it would be in its interests not to use the new bulb, both to keep costs lower and to have the added advantage of "built-in obsolescence" so that consumers would need to purchase new flashlights more often.
 - b. A linear electron accelerator for therapeutic use was built as a dual-mode system that could either produce X-rays or electron beams. It had been in successful use for some time, but every now and then some patients received high overdoses, resulting in painful after-effects and several deaths. One patient on a repeat visit experienced great pain, but the remotely located operator was unaware of any problem because of lack of communication between them: The intercom was broken, and the video monitor had been unplugged. There also was no way for the patient to exit the examination chamber without help from the outside, and hence the hospital was partly at fault. On cursory examination of the machine, the manufacturer insisted that the computerized and automatic control system could not possibly have malfunctioned and that no one should spread unproven and potentially libelous information about the design. It was the painstaking, day-and-night effort of the hospital's physicist that

finally traced the problem to a software error introduced by the manufacturer's efforts to make the machine more user-friendly.

2. Regarding the following example, comment on why you think simple human contact made such a large difference. What does it say about what motivated the engineers, both before and after the encounter? Is the case too unique to permit generalizations to other engineering products?(A)

A team of engineers are redesigning an artificial lung marketed by their company. They are working in a highly competitive market, with long hours and high stress. The engineers have little or no contact with the firm's customers, and they are focused on technical problems, not people. It occurs to the project engineer to invite recipients of artificial lungs and their families to the plant to talk about how their lives were affected by the artificial lung. The change is immediate and striking: "When families began to bring in their children who for the first time could breathe freely, relax, learn, and enjoy life because of the firm's product, it came as a revelation. The workers were energized by concrete evidence that their efforts really did improve people's lives, and the morale of the workplace was given a great lift."

3. With regard to each of the following cases, answer several questions. First, what is the moral dilemma (or dilemmas), if any? In stating the dilemma, make explicit the competing moral reasons involved. Second, are there any concepts (ideas) involved in dealing with the moral issues that it would be useful to clarify? Third, what factual inquiries do you think might be needed in making a reliable judgment about the case? Fourth, what are the options you see available for solving the dilemma? Fifth, which of these options is required (obligatory, all things considered) or permissible (all right)?(A)

Case 1. An inspector discovers faulty construction equipment and applies a violation tag, preventing its continued use. The inspector's supervisor, a construction manager, views the case as a minor infraction of safety regulations and orders the tag removed so the project will not be delayed. What should she do?

Case 2. A software engineer discovers that a colleague has been downloading restricted files that contain trade secrets about a new product that the colleague is not personally involved with. He knows the colleague has been having financial problems, and he fears the colleague is planning to sell the secrets or perhaps leave the company and use them in starting up his own company. Company policy requires him to inform his supervisor, but the colleague is a close friend. Should he first talk with the friend about what he is doing, or should he immediately inform his supervisor?

Case 3. An aerospace engineer is volunteering as a mentor for a high school team competing in a national contest to build a robot that straightens boxes. The plan was to help the students on weekends for at most eight to ten hours. As the national competition nears, the robot's motor overheats, and the engine burns out. He wants to help the dispirited students and believes his mentoring commitment requires he do more. But doing so would involve additional evening work that could potentially harm his work, if not his family.

Case 4. During an investigation of a bridge collapse, Engineer A investigates another similar bridge, and finds it to be only marginally safe. He contacts the governmental agency responsible for the bridge and informs them of his concern for the safety of the structure. He is told that the agency is aware of this situation and has planned to provide in next year's budget for its repair. Until then, the bridge must remain open to traffic. Without this bridge, emergency vehicles such as police and fire apparatus would have to use an alternate route that would increase their response time by approximately twenty minutes. Engineer A is thanked for his concern and asked to say nothing about the condition of the bridge. The agency is confident that the bridge will be safe.

Case 5. A cafeteria in an office building has comfortable tables and chairs, indeed too comfortable: They invite people to linger longer than the management desires. You are asked to design uncomfortable ones to discourage such lingering.

4. Apply act-utilitarianism and rule-utilitarianism in resolving the following moral problems. Do the two versions of utilitarianism lead to the same or different answers to the problems? **(A)**

a. George had a bad reaction to an illegal drug he accepted from friends at a party. He calls in sick the day after, and when he returns to work the following day he looks ill. His supervisor asks him why he is not feeling well. Is it morally permissible for George to lie by telling his supervisor that he had a bad reaction to some medicine his doctor prescribed for him?

b. Jillian was aware of a recent company memo reminding employees that office supplies were for use at work only. Yet she knew that most of the other engineers in her division thought nothing about occasionally taking home notepads, pens, computer disks, and other office "incidentals." Her eight-year-old daughter had asked her for a company inscribed ledger like the one she saw her carrying. The ledger costs less than \$20, and Jillian recalls that she has probably used that much from her personal stationery supplies during the past year for work purposes. Is it all right for her to take home a ledger for her daughter without asking her supervisor for permission?

Unit – III
Engineering as Social Experimentation
Part – A

1. What is the need to view engineering projects as experiments? (U)

- Any project is carried out in partial ignorance.
- The final outcomes of engineering projects, like those of experiments, are generally uncertain.
- Effective engineering relies upon knowledge gained about products before and after they leave the factory – knowledge needed for improving current products and creating better ones.

2. Differentiate scientific experiments and engineering projects. (AZ)

Scientific experiments are conducted to gain new knowledge, while “engineering projects are experiments that are not necessarily designed to produce very much knowledge”.

3. What are the uncertainties occur in the model designs? (U)

- 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.

4. What is the logic of engineering as social experimentation? (U)

Engineering which does not involve laboratory oriented experiments is characterized by an experiment on a social scale involving human subjects.

5. How Titanic tragedy could be brought under engineering as social experimentation? (C)

Failure in the far-sighted approach of not providing enough number of life boats and non-availability of proper safe exits had led to the sinking of titanic ship that caused the death toll of 1522 persons on board. These lapses in designing are the reasons for bringing titanic tragedy under engineering as social experimentation.

6. What are the basic similarities between engineering experiments and standard experiments? (U)

- Both the engineering and standard experiments are carried out in partial ignorance.
- The overall results of both the experiments remain mostly uncertain.
- In both the experiments, monitoring is very essential to gain new knowledge.
- Final results have to be properly analyzed to get good results in both engineering.

7. What are the various reasons for the repeated recurrences of tragedies like that of titanic incident? (C)

Lack of interest and willingness of engineers to learn from their own earlier designs, lack of established channels of communications, reservations in obtaining relevant details of information, mental frustration and embarrassment at failures and negligent attitude are the reasons for the titanic tragedy.

8. What are the differences between engineering and standard experiments? (AZ)

Engineering experimentation involves human subjects as control groups, unlike in the standard experimentation. The process of obtaining the informed consent from the human subjects is not prevalent in engineering experimentation. Unlike in the scientific experiments, new knowledge is not gained in engineering experiment.

9. What are the two main elements which are included to understand informed consent? (R)

- Knowledge [Subjects should be given not only the information they request, but all the information needed to make a reasonable decision].
- Voluntariness [Subjects must enter into the experiment without being subjected to force, fraud, or deception].

10. What is the specific role of informed consent in engineering experimentation? (U)

- 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.

11. What are the salient features of informed consent in engineering experimentation? (R)

- Consent is given on voluntary basis.
- All the information requested and wanted by the persons, are provided in understandable forms.
- The person who gives the consent is allowed to process the information before taking any rational decisions.

12. What are the general features of morally responsible engineers? (R)

a. Conscientiousness. b. Comprehensive perspective. c. Autonomy. d. Accountability

13. What are the moral responsibilities of engineers to society? (R)

- Protection of safety of human subjects.
- Awareness of the experimental procedure of any project and predictive attitude of possible side effects of the projects.
- Dedicated and motivated involvement in all aspects of the projects.
- Development of attitude to have the accountability for the final results of the projects.

14. What is conscientiousness in terms of engineers as responsible experimenters? (U)

The sensitive commitment to the moral values and responsibilities and inclination to develop the capability in a particular situation is called conscientiousness.

15. Examine the role of conscientiousness in professional engineering. (U)

Conscientiousness is able to restore the goodwill of engineers as guardians of public society there by protecting the welfare and safety of those who are heavily affected by the engineering projects.

16. How engineering could be regarded as preventive technology? (U)

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.

17. Define the term moral autonomy. (R)

The moral beliefs and attitudes of an individual with a committed action towards the specific principles and goals, is called moral autonomy.

18. How will you relate the role of moral autonomy in professional engineering? (U)

Moral autonomy imposes moral commitments on an engineer to serve in the best interest of a company. It also helps to restore a conducive climate for an autonomous participation in his professional work. It enables him to act as an experimenter by enhancing his professional outlook.

19. How professional societies are actively associated with moral autonomy of engineers? (U)

Professional societies serve a dedicated purpose of exchanging technical information's and also protect the basic interests of engineers. When the moral autonomy of engineers is encroached or violated, these professional societies rescue engineers to safeguard their interests and ethical problems.

20. What is accountability? (R)

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 accountability.

21. What is the purpose of various types of standards? (R)

- a. Accuracy in measurement, interchangeability, ease of handling.
- b. Prevention of injury, death and loss of income or property.
- c. Fair value of price.
- d. Competence in carrying out tasks.
- e. Sound design, ease of communications.
- f. Freedom from interference.

22. Define Code. (R)

Code is a set of standards and laws.

23. Discuss the roles of codes. (U)

- Inspiration and Guidance

- Support
- Deterrence and Discipline
- Education and Mutual Understanding
- Protecting the Status Quo
- Contributing to the Profession's Public Image
- Promoting Business Interests

24. Determine the limitations of codes. (U)

- Codes are restricted to general and vague wording.
- Codes can't give a solution or method for solving the internal conflicts.
- Codes cannot serve as the final moral authority for professional conduct.
- Codes can be reproduced in a very rapid manner.

25. What are the problems with the law in engineering? (U)

a. Minimal compliance b. Many laws are without enforceable sanctions.

26. What was the primary reason that caused the failure of space shuttle program "challenger"? (C)

The consequent rupturing of O-ring that constitute the field joints due to extreme cold weather was the primary reason that resulted in the failure of challenger as space shuttle.

27. Name the aerospace experts and scientists who were associated with the launching of challenger. (R)

Allan McDonald of Morton-Thiokol at Cape Kennedy, Arnold Thomson and Roger Boisjoly who were the seal experts at Morton- Thiokol and engineering managers, Bob Lund and Joe Kilminster were the experts associated with the launching of challenger space program.

28. How exactly the tragic collapse of challenger space shuttle took place? (AZ)

When challenger was launched on 28th January 1986 at the final countdown of 11.38 AM, smoke puff emanated from one of the field joints on the right booster rocket. This was followed by intense firing in the hydrogen tank and subsequently booster rocket smashed into challenger's wing. Finally, when challenger reached the height of 50,000 feet, it was completely engulfed in a fireball, thereby killing all the cabin crews on board.

29. Name some of the safety issues concerned with the launching of challenger. (R)

- There was no escape mechanism for the crews.
- The challenger astronauts were not informed of the problems of field joints.
- The crew members were not asked for their consent about the unsafe mission.

30. Mention about the significance of teleconference held before the launching of challenger. (U)

The convening of teleconference which is a notable feature of the challenger case, discussed the seal problems with the technical team of experts; although the discussion was not focused on ethical aspects, it was able to distinguish between right stuff and wrong stuff of the space shuttle.

31. What are the positive aspects of code of ethics? (U)

Provision of positive stimulus for ethical conduct, guidance to engineers for the fulfillment of their aspirations and obligations, inspiration to protect the safety and welfare of public society are the positive aspects of code of ethics.

32. Name some of the important code of ethics published by engineering societies. (R)

- National society of professional Engineers.
- Board of Ethical review.
- NSPE opinions of the Board of ethical review.
- American Association of Engineering societies (AAES).
- Institute of Electrical and Electronics Engineers (IEEE).

33. What are the specific contributions by the code of ethics to engineers? (U)

Positive and legal support, disciplined ethical conduct, education on moral values and issues, positive image of ethically committed profession and promotion of business interests are the specific contributions by the code of ethics to the professional engineers.

34. What are the limitations of ethical codes? (U)

- The generalized vague wordings are not uniformly applicable to all conditions.

- Codes create differences of opinions in moral values, since the different entries in codes overlap with each other.
- Codes do not serve as the final authority for professional conduct. The conventional and customary practices are not properly endorsed by the codes.
- Presence of separate codes for different professional engineering societies through successive multiplications.

35. Elaborate the code of ethics of engineers. (U)

- Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
- Engineers shall perform services only in the areas of their competence.
- Engineers shall issue public statements only in an objective and truthful manner.
- Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
- Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
- Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the profession.
- Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

Part - B

1. Explain in detail the challenger accident. What are the ethical problem involved in this?(U)
2. How can engineer become a responsible experimenter?(U)
3. Highlight the code of ethics for Engineers. (R)
4. What is the important code of ethics? Give brief account on '4' canons of codes of ethics quoted by international standard or association.(U & R)
5. State the similarities to view engineering projects as experiments. (U)
6. How engineering project differs from standard experimentation. (U)
7. Discuss on the roles played by the codes of ethics set by professional societies. (U)
8. Give justification on how the challenger disaster could have been avoided by engineers.(U)
9. Compare and contrast engineering experiments with standard experiments. (AZ)
10. Explain with help of example that engineers would learn not only from their earlier design and operating results, but also from those of other engineers. (U)
11. Discuss Research Ethics.(U)
12. Explain work ethics in detail.(U)

Assignment Questions

1. From the Web site of an engineering professional society, select a code of ethics of interest to you, given your career plans; for example, the American Society of Civil Engineers, the American Institute of Chemical Engineers, the American Society of Mechanical Engineers, or the Institute of Electrical and Electronics Engineers. Compare and contrast the code with the NSPE code, selecting three or four specific points to discuss. Do they state the same requirements with the same emphasis?(A)
2. With regard to the same two codes you used in question 1, list three examples of responsibilities that you believe would be incumbent on engineers even if the written code did not exist, and explain why. Also list two examples, if any, of responsibilities created (entirely or in part) because the code was written as a consensus document within the profession.(A)
3. Is the following argument for ethical relativism a good argument? That is, is its premise true and does the premises provide good reason for believing the conclusion?(A)
 - a. People's beliefs and attitudes in moral matters differ considerably from society to society. (Call this statement "descriptive relativism," because it simply describes the way the world is.)
 - b. Therefore, the dominant conventional beliefs and attitudes in the society are morally justified and binding (ethical relativism).
4. Reflection on the Holocaust led many anthropologists and other social scientists to reconsider ethical relativism. The Holocaust also reminds us of the power of custom, law, and social authority to shape conduct. Nazi Germany relied on the expertise of engineers, as well as other professionals, in carrying out genocide, as well as its war efforts.(A)
 - a. Do you agree that the Holocaust is a clear instance of where a cross-cultural judgment about moral wrong and right can be made?
 - b. Judging actions to be immoral is one thing; blaming persons for wrongdoing is another (where blame is a morally negative attitude toward a person). Present and defend your view about whether the Nazi engineers and other professionals are blameworthy. Is blaming pointless, because the past is past? Or is cross-cultural blame, at least in this extreme instance, an important way of asserting values that we cherish?

5. Moral skeptics challenge whether sound moral reasoning is possible. An extreme form of moral skepticism is called *ethical subjectivism*: Moral judgments merely express feelings and attitudes, not beliefs that can be justified or unjustified by appeal to moral reasons. The most famous version of ethical subjectivism is called emotivism: Moral statements are merely used to express emotions—to emote—and to try to influence other people’s behavior, but they are not supportable by valid moral reasons. What would ethical relativists say about ethical subjectivism? What should be said in reply to the ethical subjectivist?(A)

Unit-IV
Safety, Responsibilities and Rights
Part - A

1. Define Risk. (R)

A risk is the potential that something unwanted and harmful may occur. Risk is the possibility of suffering harm or loss. It is also defined as the probability of a specified level of hazardous consequences, being realized. Hence Risk (R) is the product of Probability (P) and consequence(C) (i.e.) Risk = Probability X Consequences.

2. Define safety. (R)

In the definition stated by William W. Lawrence safety is defined, as a thing is safe if its risks are acceptable. A thing is safe with respect to a given person or group, at a given time, if its risk is fully known, if those risks would be judged acceptable, in light of settled value principles. In the view of objective, safety is a matter of how people would find risks acceptable or unacceptable.

3. Define a Disaster. (R)

A DISASTER = A seriously disruptive event + A state of unpreparedness. A disaster does not take place until a seriously disruptive event coincides with a state of insufficient preparation. Example: The Titanic collision with an iceberg constituted an emergency, which turned into a disaster because there were too few lifeboats.

4. How do you identify Risk? (U)

We identify risk by the following methods, by way of inspection, discussion with workers, independent audits, job safety analysis and previous accident statistics.

5. Is risk accepted? (E)

A risk is acceptable when those affected are generally no longer or not apprehensive about it. Apprehensiveness depends on how people perceive it.

6. What is an accident? (U)

Accidents are caused by negligence of worker, faulty instrument and readings.

7. What are the three types of accidents? (R)

The three types of accidents are procedural, engineered and systematic accidents.

- Procedural accidents are the most common accidents caused by not following the procedures (like laws, and rules).
- Engineered accidents are caused by wrong design, failure of materials, devices not functioning, etc.
- Systematic accidents are caused by many systems work in coordination, if one fails; it leads to accumulated problems resulting in accidents.

8. What is safe design? (U)

Risk is very rarely designed into a product, it occurs due to many uncertainties faced during design, manufacturing and sales. Even a careful analyst will face difficulties when confronted with data mix-ups. A product may be safe if its capability exceeds its duty. Factor of safety is a process to be considered during design which will protect against problem arising when the stresses due to anticipated loads, the product has to with stand.

9. How useful is knowledge of risk to designers? (U)

Experience and historical data will provide good information about safety of standards products, some industries where information is not freely shared; there are always new applications of old technology that render the available information less useful. The new engineers and new companies have to learn from scratch, although some time past experience is used effectively to educate beginners.

10. What are the tests for safety? (R)

A thorough experience is necessary for testing. A proto type testing and continuous test running do not ensure reliable machine, sufficient time should be allowed for all tests, and more than one individual should do the test. Engineers should do test at regular interval on their own responsibilities.

11. Is risk accepted by public? (E)

Yes, Risk is accepted by public. Risks and benefit to the public at large are more easily determined because individual differences tend to even out as larger numbers of people are considered.

12. How do you reduce risk? (AZ)

To reduce risk we have to identify risk, evaluate risk, and control risk.

13. Define Hazard. (R)

The hazard presented by a system/substance is its potential to cause harm. Hazard is associated with degree of danger and it's quantifiable.

14. At what level is risk accepted in public? (U)

A human life can be nothing more than some Numerical figure. We have provided an estimate of some of the quantifiable losses is social welfare resulting from a fatality and can hope that this estimate is not considered as some type of basic for determining the optimal amount of expenditure to be allocated to saving life. The most effective way to fix accountability for safety and risk management, responsibilities is by financial accountability of directors and managers.

15. Define Risk Management.(R)

Risk management may be defined as the eradication or minimization of the adverse effects of the pure risks to which an organization is exposed.

16. How do you evaluate risk? (E)

Risk evaluation may be based on economic, social, or legal considerations, including financial aspects, uninsured cost of accidents, insurance premium, and overall effect on the profitability and possible loss of production.

17. What are the methods by which you control risk? (R)

There are four methods by which we can control risk. They are risk avoidance, risk retention, risk transfer and risk reduction.

18. How is risk accounted? (U)

Engineers who account for compensation should do this with most care and use all the cost benefit formula to the benefit of the recipient and more so do with a humane approach.

19. What is improved safety? (U)

A safe designed product is the best recommended for public utilities. An example of improved safety is a magnetic automatic door of a refrigerator will close light, but if a child is trapped inside, it is easy for it to push open and get to safety.

20. Give the criteria which helps to ensure a safety design? (R)

- The minimum requirement is that a design must comply with the applicable laws.

- An acceptable design must meet the standard of “accepted engineering practice.”
- Alternative designs that are potentially safer must be explored.
- Engineer must attempt to foresee potential misuses of the product by the consumer and must design to avoid these problems.
- Once the product is designed, both the prototypes and finished devices must be rigorously tested.

21. What are the factors for safety and risk? (R)

- Voluntary and Involuntary risk Short-term and Long-term risk
- Expected probability Reversible effects
- Threshold levels to risk Delayed or Immediate risk etc.

22. What are the drawbacks in the definition of Lawrence? (U)

Underestimation of risks; Overestimation of risks; No estimation of risks

23. Give the Classification of Risk? (R)

- Low consequence, Low probability (which can be ignored)
- Low consequence, High probability
- High consequence, Low probability
- High consequence, High probability

24. What are the factors that affect Risk Acceptability? (R)

- Voluntarism and control Effect of information on risk assessment
- Job related pressures Magnitude and proximity of the people facing risk

25. What is the knowledge required to assess the risk? (U)

- Data in design Uncertainties in design Testing for safety
- Analytical testing Risk-benefit analysis

26. What are the steps involved in design for safety? (R)

1. Define the problem
2. Generate alternate solutions
3. Analyze each solution
4. Test the solution
5. Select the best solution
6. Implement the chosen solution.

27. What are the ways in which risks are identified? (U)

1. Work place inspection
2. Management/worker discussions
3. Job safety analysis
4. Hazard and operate ability studies
5. Accident statistics.

28. Give any two action plan that would ensure safe design. (U)

1. Ensure advice on health and safety is made available to the project
2. Conduct brainstorming meeting of key personnel associated with the development of the project to establish, identify risk and control action if necessary.

29. What is risk transfer? (R)

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.

30. Three mile island disaster: Discuss.(U)

It was an accident happened at the Three Mile Island unit-II, nuclear power plant at Pennsylvania on March 28, 1979. It was happened due to the lack of maintaining safety, insufficient training, human error and followed bad operating procedures.

31. What are the analytical methods? (R)

- Scenario analysis Failure modes & effect analysis
- Fault tree analysis Event tree analysis etc.

32. What are the three conditions referred as safe exit? (R)

- Assure when a product fails it will fail safely.
- Assure that the product can be abandoned safely.
- Assure that the user can safely escape the product.

33. How will an engineer assess the safety? (U)

- The risks connected to a project or product must be identified.
- The purposes of the project or product must be identified and ranked in importance.
- Costs of reducing risks must be estimated.

- The costs must be weighed against both organizational goals and degrees of acceptability of risks to clients and the public.
- The project or product must be tested and then either carried out or manufactured.

34. What are the reasons for Risk-Benefit Analysis? (U)

- 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 design scores higher with that of the another one.

35. Are the engineers responsible to educate the public for safe operation of the equipment? How? (E)

Yes, as per the engineers are concerned with they should have their duty as to protect for the safety and wellbeing of the general public. Analyzing the risk and safety aspects of their designs can do this.

36. What are the safety measures an engineer must know before assessing a risk of any product? (U)

The factors are:

- Does the engineer have the right data?
- Is he satisfied with the present design?
- How does he test the safety of a product?
- How does he measure and weigh the risks with benefits for a product.

37. What is the use of knowledge of risk acceptance to engineers? (U)

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.

38. What are the positive uncertainties in determining risks? (U)

- Purpose of designing
- Application of the product
- Materials and the skill used for producing the product.

39. What is the use of Risk-Analysis? What are the three factors involved here? (U)

Risk Analysis is used for the assessment of the hazardous associated with an industrial or commercial activity. It involves identifying the causes of unwanted hazardous events and estimating the consequences and likelihood of these events. Three factors involved in this are:

a. Hazard Identification b. Consequences analysis c. Probability estimation.

40. Define Risk-Benefit Analysis? (R)

Risk benefit analysis is a method that helps the engineers to analyze the risk in a project and to determine whether a project should be implemented or not. In risk-benefit analysis, the risks and benefits of a product are allotted to money amounts, and the most benefit able ratio between risks and benefits is calculated.

41. Explain the two types of Risk? (U)

- i. 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 involuntary risks.
- ii. Public Risks: Risks and benefits to the public are more easily determined than to individuals, as larger number of people is taken into account. Involuntary risks are found here.

42. What does Strict Liability mean? (R)

Strict liability means if the sold product is defective; the manufacturer concerned is liable for any harm that results to users. Negligible is not at all an issue based.

43. Give the reasons for the Three Mile Island disaster? (U)

- i. Inadequate training to the operators.
- ii. Use of B & W reactors.

44. What is the main barrier to educational attempts? (U)

An important barrier to educational attempt is that people belief change slow and are extraordinarily resistant to new information.

45. What happens to the products that are not safe? (U)

Products that are not safe incur secondary costs to the manufacturer beyond the primary costs that must also be taken into account costs associated with warranty expenses, loss of customer will and even loss of customers and so.

46. What does Open-mindedness refer to? (R)

Open-mindedness refers once again not allowing a preoccupation with rules to prevent close examination of safety problems that may not be covered by rules.

47. What was the problem in the Chernobyl reactor? (U)

- The output was maintained to satisfy an unexpected demand.
- The control device was not properly reprogrammed to maintain power at the required level.
- Instead of leaving fifteen control rods as required, the operators raised almost all control rods because at the low power level, the fuel had become poisoned.

48. Define Collegiality. (R)

Collegiality is a kind of connectedness grounded in respect for professional expertise and in a commitment to the goals and values of the profession and collegiality includes a disposition to support and cooperate with one's colleagues.

49. What are the central elements of collegiality? (R)

i. Respect ii. Commitment iii. Connectedness iv. Cooperation

50. Write short notes on (i) Respect (ii) Commitment (iii) Connectedness (U)

Respect is value for their professional expertise and their devotion to the social goods promoted by the profession. Like friendship, collegial respect ought to be reciprocal, but unlike friendship it need not involve personal affection

Commitment means sharing moral ideals inherent in the practice of engineering. This also means how members of competing teams in sports maintain a sense of underlying values beyond winning.

Connectedness is an awareness of being a co-operative undertaking created by shared commitments and expertise

51. What is loyalty? (R)

Loyalty means being truthful to one's employer

52. What are the two senses of Loyalty? (R)

- i. Agency Loyalty – Acting to fulfill one’s contractual duties to an employer. It’s a matter of actions, whatever its motives.
- ii. Identification Loyalty – Has as much as to do with attitudes, emotions, and a sense of personal identity as it does with actions.

53. When may an Identification Loyalty be said as obligatory? (C)

- i. Employees must see some of their own important goals as met by and through a group in which they participate.
- ii. Employees must be treated fairly, each receiving his or her share of benefits and burdens.

54. What is the relationship between the Loyalty to the company and Professional responsibility to the public? (E)

- i. Acting on professional commitments to the public can be a more effective way to serve a company than a mere willingness to follow company orders.
- ii. Loyalty to companies or their current owners should not be equated with merely obeying one’s immediate supervisor.
- iii. An engineer might have professional obligations to both an employer and to the public that reinforce rather than contradict each other.

55. Define Institutional Authority. (R)

Institutional Authority is acquired, exercised and defined within organizations. It may be defined as the institutional right given to a person to exercise power based on the resources of the institution.

56. Define Expert Authority. (R)

Expert authority is the possession of special knowledge, skill or competence to perform task or give sound advice.

57. Explain Misguided loyalty. (U)

Employee sometimes with over enthusiasm and loyalty will be misled to act on own and unknowingly exceed legal commitments to gain or profit for his employer, which may backfire sometime, this is called misguided loyalty.

58. Differentiate Authority and Power. (AZ)

- Authority is an assignment of the resources needed to complete a task; one should have leadership quality and a good motivator, to execute his authority to get work done.
- Power goes beyond the authority and position one holds. The respect and charisma one has will influence one to excel to prove their self.

59. What is moral right? (R)

By definition, Human Rights such as the right to life, the pursuit of happiness, are possessed by virtue of being a person, not by virtue of being a member of an institution. Moral Rights: - Institutional duties are the duties specified by the rules of the institutions, these rights and duties may be established as means to the end of meeting institutional goals

60. What is the basic moral task of salaried engineers? (U)

The basic moral task of salaried engineers is to be aware of their obligations to obey employers on one hand and to protect and serve the public and clients of the other.

61. What are the guidelines to reach an agreement? (R)

- i. Attack problem and not people.
- ii. Build trust.
- iii. Start with a discussion and analysis of interests, concerns, needs. It begins with interests, not positions or solutions.
- iv. Listen.
- v. Brainstorm; suggesting an idea does not mean one aggress with it. Develop multiple options.
- vi. Use objective criteria whenever possible. Agree on how something will be measured.

62. Distinguish between human moral rights and special moral rights. (AZ)

Human rights such as the right to life, liberty, and pursuit of happiness are possessed by virtue of being a person not by virtue of an institution. Special moral rights are the right an employee acquires through employment agreement to protect proprietary information, and employers have an institutional right to require that employee do so.

63. What is Accepting Authority? (U)

Employees recognize their employer's authority when for the most part they accept the guidance and obey the directive issued by the employer having to do with the area of activity covered by the employer's institutional authority. There are exceptions, since it is possible in special cases to recognize someone's authority but to disobey an order on moral grounds. But our present concern is to obtain a clearer idea of what accepting authority under normal conditions should and should not involve

64. Define confidential information. (R)

Confidential information is information deemed desirable to keep secret.

65. What are the criteria for identifying that information is “labeled” confidential at the workplace? (R)

- * Engineers shall treat information coming to them in the course of their as confidential.
- * Identify any information which if it became known would cause harm to the corporation or client.
- * Confidential information is any information that the employer or client would like to have kept secret in order to compete effectively against business rivals.

66. What are the terms associated with Confidentiality? (R)

i. Privileged Information ii. Proprietary Information iii. Patents iv. Trade secrets.

67. Explain Proprietary Information. (U)

Proprietary information is information that a company owns or is the proprietor of, like ownership, normally refers to new knowledge generated within the organisation that can be legally protected from use by others.

68. Explain Trade Secret. (U)

Is information that has not become public and which an employer has taken steps to keep secret? It may be data about design and technical processes, organization of plant facilities, quality control procedures, customer list, business plan and so on. Trade secret are given legal protection and protected by common law.

69.Explain Patents. (U)

Patents legally protect specific products from being manufactured and sold by competitors without the express permission of the patent holder. Trade secrets do not have such protection.

70. How will you justify the obligation of confidentiality? (E)

The obligation of confidentiality can be justified at two levels.

First Level: Moral Considerations Respect for autonomy Respect for promises
Regard for public well-being

Second Level: Major Ethical Theories

Rights Ethicists Duty Ethicists Rule-utilitarian's Act-utilitarian's

71. Define Conflicts of Interest. (R)

Conflict of interests is a situation in which two or more interests are not simultaneously realizable. It is the disagreement between public obligation and self-interest of an official.

72. Why does a conflict of interests arise? (AZ)

a. Financial Investments b. Insider Trading c. Bribe d. Gifts e. Kickbacks

73. What is a Bribe? (U)

A Bribe is a substantial amount of money or goods offered beyond a stated business contract with the aim of winning an advantage in gaining or keeping the contract.

74. What is a Gift? (U)

Gifts are not bribes as long as they are small gratuities offered in the normal conduct of business.

75. What is called Kickbacks? (U)

Prearranged payments made by contractors to companies or their representatives in exchange for contracts actually granted are called kickbacks.

76. What are the types of Conflicts of interest? (R)

i. Actual conflict of interest ii. Potential conflict of interest iii. Apparent conflict of interest

77. What are the forms of Conflicts of interest? (R)

i. Interest in other companies ii. Moonlighting iii. Insider information

78. How will you solve the Conflict problems?(U)

- i. Finding the creative middle way.
- ii. Employing Lower-level considerations.
- iii. Making the hard choice.

79.Explain Insider Information. (U)

Getting information about a company through someone known to us working in the company to gain something from the information.

80.Explain Occupational Crime. (U)

Occupational Crime is illegal acts made possible through one's lawful employment. It is the secretive violation of laws regulating work activities. When committed by office workers or professionals, occupational crime is called "white collar crime".

Many occupational crimes are special instances of conflicts of interest, especially when the crime involves personal gain that constitutes or leads to the failure to meet professional obligation.

81. What is called “White-collar crime”? (R)

Occupational crimes are illegal acts made possible through one’s lawful employment. It is the secret violation of laws regulating work activities. When committed by office workers of professionals, occupational crime is called “white-collar crime”.

82.What is price fixing? (U)

Companies join together and fix price before going for an auction or government tenders, thus take chance in rotation in getting the tender in their favor, this is an illegal act.

But there is an argument that the public stands to gain by this as prices are stabilized.

83.How are employees life protected? (U)

An employer who exposes their employee to safety hazards usually escapes criminal penalties. Victims will often have for sue companies'~r1 damages and get compensated.

84. What is Professional Rights? (R)

Engineers have fundamental rights to live and freely pursue their legitimate interests. They have a human right to pursue their work and not to be fairly discriminated against in employment on the basis of sex, race, or age.

The right also include, the right to refuse to carry out illegal and unethical activity, the right to talk publically about one's work within bounds set by the confidentiality obligation, the right to engage in the activities of professional societies, the right to protect clients and the public from the dangers or harm that might arise from one's work, and the right to professional recognition for one's services

85.What is the Basic Right of Professional Conscience? (R)

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.

86.What is Institutional Recognition of Rights? (R)

One should have moral right, having it respected by others and given recognition within the institution is the other. Koning states in 1975, conference on Engineering Ethics. "I think that one item that should be in the code of ethics is that engineers have the right at all times to exercise the dictates of their own conscience.

87.State the specific right. (R)

Specific rights can be stated as a particular professional obligation to apply professional rights according to specific circumstances.

88.What is Right of conscientious refusal? (R)

The right of conscientious refusal is the right to refuse to engage in unethical behaviour and to refuse to do so solely because one views it as unethical. It arises because other rights to pursue moral obligations within the authority based relationships of employment sometimes come into conflict.

89.Limited right - Explain. (U)

Engineer have a limited right to turn down assignments that violates their personal consciences in mater of great importance, such as threats to human life, the limited is emphasized for the right is contingent on the organization's ability to reassign the engineer to alternative projects without reasons. The right of professional conscience does not extend to the right to be paid for not working

90.What are the two basic rights of professional / conscience? (R)

First is to proceed piecemeal by reiterating the justification given for the specific professional duties

Second, is to justify the right of professional conscience, which involves grounding it more directly in the ethical theories, for organizing moral reflections and approaching practical problems.

91.Explain Right Ethics. (U)

Rights theories emphasize human moral rights as at least one ultimate ground of morality. Thus, a right ethics is the basic right of professional conscience as referred by human rights

92.What is Duty Ethics? (R)

Duty ethics, rights are not the ultimate moral appeal.

Engineers have a right to do something it is only because other has duties or obligations to allow him to do it. No employer has the right to threaten engineers with loss of their jobs for refusing to work on projects they see as likely to lead to the death or injury of unsuspecting victims.

93.What is Utilitarianism? (R)

Utilitarianism will justify the right of professional conscience by referring to the basic goal of producing the most good for the greatest number of people the public good is certain to be served by allowing professionals to meet their obligations to the public

94. What are the essential elements of IPR? (R)

i. Patents ii. Copyrights iii. Trademarks iv. Trade secrets

95. What are the requirements of Patents? (R)

- a) Problem of invention
- b) Current report of the problems to address
- c) Solution or procedure to the problem
- d) Extent of novelty or inventive
- e) Application or uses
- f) Details of the inventor
- g) Resources of funds

96. What are the types of Patents? (R)

a. Utility patents b. Design patents c. Plant patents

97. Define Whistle Blowing. (R)

Whistle-blowing is alerting relevant persons to some moral or legal corruption, where “relevant persons” are those in a position to act in response, if only by registering protest. i.e. the employee disclosure of an employer’s illegal or illegitimate practices to persons or organizations that may be able to take corrective actions. The conditions to be met for whistle-blowing are; a.Need b.Proximity c.Capability d.Last resort

98. What are the main features of Whistle Blowing? (U)

a. Act of disclosure b Topic c. Agent d. Recipient

Act of disclosure- information is intentionally conveyed, under pressure

Topic - The problem may be criminal behaviour, unethical policies or practice, injustices to workers within the organizations and serious threats to public safety and well-being.

*Agent-*The person disclosing the information it’s an employee or former employee

Recipient- the information is passed on to a person to take action

99. Differentiate External Whistle Blowing and Internal Whistle Blowing? (AZ)

- External Whistle Blowing – Information is passed outside the organization.
- Internal Whistle Blowing – Information is conveyed to someone within the organization,

100. Differentiate Open Whistle Blowing and Anonymous Whistle Blowing? (AZ)

- Open– Individuals openly reveal their identity as they convey the information.
- Anonymous Whistle Blowing – Involves concealing one’s identity.

101. When is Whistle Blowing morally permitted and morally obligated? (U)

Whistle blowing is morally permitted when

- i. If the harm that will be done by the product to the public is serious and considerable.

- ii. If they make their concerns known to their superiors.
- iii. If getting no satisfaction from their immediate supervisors, they exhaust the channels available within the corporation, including going to the board of directors.

102. Whistle is morally obligated when? (U)

He or she must have documented evidence that would convince a reasonable, impartial observer that his [or her] view of the situation is correct and the company policy wrong.

- ii. There must be strong evidence that making the information public will in fact prevent the threatened serious harm.

103. Collective bargaining in Public Service. Discuss. (U)

Unions are against the paramount duty of engineers to serve the public, they seek to promote the special interests of their members, not the general interest of the public. Strikes which are the ultimate source of power for unions may wreak havoc with the public good

104. Is whistle blowing a right? (U)

Whistle blowers who proceed responsibly and take special care to document their views are fulfilling their obligations to protect and serve the public. They have a professional moral right to whistle blow

105. What are the two general ways to apply ethical theories to justify the basic right of professional conscience? (R)

- i. Proceed piecemeal by reiterating the justifications given for the specific professional duties.
- ii. Justify the right of professional conscience, which involves grounding it more directly in the ethical theories.

106. Define Employee Rights. (R)

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.

107. What is Employee Bill of Rights? (R)

No public or private organisation shall discriminate against an employee for criticizing the ethical, moral, or legal policies and practices of the organisation, nor shall any organisation discriminate against an employee to engaging in

outside activities of his choice, or for objecting to a directive that violates common norms of morality.

108. Define Sexual Harassment. (R)

Sexual Harassment means continuous annoying and attacks on men or women on the basis of sexual considerations. It also covers the harassment by female superiors on the male employees and sexual harassment of employees by superiors of the same sex. It includes physical and psychological attacks, coercion, misuse of authority and a variety of undesirable and indecent actions.

109. Define Discrimination. (R)

Discrimination means morally unjustified treatment of people on arbitrary or irrelevant grounds. To condemn one for his sex, race, skin color, age, or religion etc. is called discrimination. According to human rights to fair and decent treatment at work place and in job are vitally important.

110. What are the general procedures for implementing the right to due process? (R)

- i. Written explanations should be established that is available to all employees who believe their rights have been violated.
- ii. An appeals procedure should be established that is available to all employees who believe their rights have been violated.

111. Differentiate Human Rights and Professional Rights. (AZ)

- Human Rights – Possessed by virtue of being people or moral agents.
- Professional – Possessed by virtue of being professional having social moral responsibilities.

112. Differentiate Weak Preferential Treatment and Strong Preferential Treatment. (AZ)

Weak preferential treatment involves giving an advantage to members of traditionally discriminated-against groups over equally qualified applicants who are members of other groups.

Strong preferential treatment involves giving preference to minority applicants or women over better qualified applicants from other groups.

113. What is the need for Protection to IPR? (U)

- Prevent plagiarism.

- Prevent others using it.
- Prevent using it for financial gain.
- Fulfill as an obligation to funding agency.
- Support income generation strategy.

114. What is the Importance of IPR? (U)

- Give the inventors exclusive rights of dealing.
- Permit avoiding of competitors and raise entry barriers.
- Permit entry to a technical market.
- Generate steady income by issuing license.

115. What is collective bargaining? (R)

Unions are collective bargaining agents that sometimes place the economic interests of the members ahead of those of the clients or employers

116. Who is a Faithful Agent? (R)

The engineer will be guided in all his professional relations by the highest standards of integrity and will act in professional matter for each client or employer as a faithful agent or trustee. He will not actively participate in strikes, picket line, or other collective coercive action. (1979 NSPE Code)

Part – B

1. Define Collegiality. State and explain the elements of collegiality. Why collegiality a virtue? What are its negative aspects? **(R & U)**
2. What is meant by Loyalty? Explain Sense of Loyalty? Is loyalty Obligatory? What are the relationship between responsibility and loyalty to employees? **(R & U)**
3. Describe the Various occupational crimes among the professional. **(U)**
4. Write a note on Intellectual Property Rights. Explain the various elements of IPR. **(U)**
5. Explain in detail conflict of interest with examples. **(U)**
6. Explain the meaning of Professional Rights. **(U)**
7. Define collective bargaining. Explain the role of collective bargaining in work place rights and responsibilities. **(R & U)**
8. How will you apply confidentiality for avoiding harmful conflicts of interest in work place? **(U)**
9. What are the procedures to be followed in whistle blowing? How he avoids risks? **(U)**
10. Discuss human rights and professional rights in engineering field. **(U)**
11. Discuss the significance of IPR. Also explain the legislations covering IPR in India. **(U)**
12. Explain in detail about the effect of information on risk assessments. **(U)**
13. How to account publicly for benefits and risks? **(U)**
14. Give a detailed discussion on safety and risk. **(U)**

15. Discuss on safety. Explain what safety measures are to be taken to establish a nuclear power plant in a country. **(R & U)**
16. Write short notes on a) personal risk b) public risk. **(U)**
17. Describe the concept of risk benefit analysis. **(U)**
18. Give any four examples of improved safety and explain. **(U)**
19. Discuss on safety. Explain what safety measures to be taken by an engineer working in deep ground mine. **(U)**
20. Explain various measures for assessing and reducing risk. **(U)**
21. Discuss the concept of safety exists in the Chernobyl case studies. **(U)**
22. 'A nuclear accident anywhere is a nuclear accident everywhere'. Explain this with respect to Three Mile Island case study. **(U)**
23. What is risk-benefit analysis? Explain the different analytical methods used when testing are inappropriate. **(R & U)**

Assignment Questions

1. On June 5, 1976, Idaho's Teton Dam collapsed, killing eleven people and causing \$400 million in damage. The Bureau of Reclamation, which built the ill-fated Teton Dam, allowed it to be filled rapidly, thus failing to provide sufficient time to monitor for the presence of leaks in a project constructed with less-than ideal soil. Drawing on the concept of engineering as social experimentation, discuss the following facts uncovered by the General Accounting Office and reported in the press. **(A)**
 - a. Because of the designers' confidence in the basic design of Teton Dam, it was believed that no significant water seepage would occur. Thus sufficient instrumentation to detect water erosion was not installed.
 - b. Significant information suggesting the possibility of water seepage was acquired at the dam site six weeks before the collapse. The information was sent through routine channels from the project supervisors to the designers and arrived at the designers the day after the collapse.
 - c. During the important stage of filling the reservoir, there was no around-the-clock observation of the dam. As a result, the leak was detected only five hours before the collapse. Even then, the main outlet could not be opened to prevent the collapse because a contractor was behind schedule in completing the outlet structure.
 - d. Ten years earlier the Bureau's Fontenelle Dam had experienced massive leaks that caused a partial collapse, an experience the bureau could have drawn on.
2. Research the collapse of the Interstate 35W Bridge in Minneapolis on August 1, 2007, which killed 13 people and injured 100 more. In light of the social experimentation model, discuss its causes and whether it could have been prevented. **(A)**

3. Debates over responsibility for safety in regard to technological products often turn on who should be considered mainly responsible, the consumer (“buyer beware”) or the manufacturer (“seller beware”). How might an emphasis on the idea of informed consent influence thinking about this question?(A)
4. Thought models often influence thinking by effectively organizing and guiding reflection and crystallizing attitudes. Yet they usually have limitations and can themselves be misleading to some degree. With this in mind, critically assess the strengths and weaknesses you see in the social experimentation model. One possible criticism you might consider is whether the model focuses too much on the creation of new products, whereas a great deal of engineering involves the routine application of results from past work and projects. Another point to consider is how informed consent is to be measured in situations where different groups are involved, as in the construction of a garbage incinerator near a community of people having mixed views about the advisability of constructing the incinerator.(A)
5. A worker accepts a dangerous job after being offered an annual bonus of \$2,000. The probability that the worker may be killed in any one year is 1 in 10,000. This is known to the worker. The bonus may therefore be interpreted as a self-assessment of life with a value equal to \$2,000 divided by 1/10,000, or \$20 million. Is the worker more or less likely to accept the job if presented with the statistically nearly identical figures of a \$100,000 bonus over 50 years (neglecting interest) and a 1/200 probability of a fatal accident during that period?(A)
6. “Airless” paint spray guns do not need an external source of compressed air connected to the gun by a heavy hose (although they do need a cord to attach them to a power source) because they have incorporated a small electric motor and pump. One common design uses an induction motor that does not cause sparking because it does not require a commutator and brushes (which are sources of sparking). Nevertheless the gun carries a label warning users that electrical devices operated in paint spray environments pose special dangers. Another type of gun that, like the first, also requires only a power cord is designed to weigh less by using a high-speed universal motor and a disk type pump. The universal motor does require a commutator and brushes, which cause sparking. This second kind of spray gun carries a warning similar to that attached to the first, but it states in addition that the gun should never be used with paints that employ highly volatile and flammable thinners such as naphtha. The instruction booklet is quite detailed in its warnings. A painter had been lent one of the latter types of spray guns. To clean the apparatus, he partially filled it with paint thinner and operated it. It caught fire,

and the painter was severely burned as the fire spread. The instruction booklet was in the cardboard box in which the gun was kept, but it had not been read by the painter, who was a recent immigrant and did not read English very well. He had, however, used the first type of airless paint spray gun in a similar manner without mishap. The warning messages on both guns looked pretty much the same. Do you see any ethical problems in continuing over-the-counter sales of this second type of spray gun? What should the manufacturer of this novel, lightweight device do?

In answering these questions, consider the fact that courts have ruled that hidden design defects are not excused by warnings attached to the defective products or posted in salesrooms. Informed consent must rest on a more thorough understanding than can be transmitted to buyers by warning labels.**(A)**

7. It has been said that Three Mile Island showed us the risks of nuclear power and the Arab oil embargo the risk of having no energy. Forcing hazardous products or services from the market has been criticized as closing out the options of those individuals or countries with rising aspirations who can now afford them and who may all along have borne more than their share of the risks without any of the benefits. Finally, pioneers have always exposed themselves to risk. Without risk there would be no progress. Discuss this problem of “the risk of no risk.”**(A)**
8. Discuss the notion of safe exit, using evacuation plans for communities near nuclear power plants or chemical process plants. **(A)**
9. Research the events at Chernobyl in 1986, and discuss what you see as the main similarities and differences with Three Mile Island.**(A)**

10. Consider the following example:

Who owns your knowledge? Ken is a process engineer for Stardust Chemical Corp., and he has signed a secrecy agreement with the firm that prohibits his divulging information that the company considers proprietary.

Stardust has developed an adaptation of a standard piece of equipment that makes it highly efficient for cooling viscous plastics slurry. (Stardust decides not to patent the idea but to keep it as a trade secret.) Eventually, Ken leaves Stardust and goes to work for a candy-processing company that is not in any way in competition. He soon realizes that a modification similar to Stardust’s trade secret could be applied to a different machine used for cooling fudge and, at once, has the change made.

Has Ken acted unethically?**(A)**

- 11.** In the following case, are the actions of Client A morally permissible?(**A**)
- a.** Client A solicits competitive quotations on the design and construction of a chemical plant facility. All the bidders are required to furnish as a part of their proposals the processing scheme planned to produce the specified final products. The process generally is one which has been in common use for several years. All of the quotations are generally similar in most respects from the standpoint of technology.
 - b.** Contractor X submits the highest-price quotation. He includes in his proposals, however, a unique approach to a portion of the processing scheme. Yields are indicated to be better than current practice, and quality improvement is apparent. A quick laboratory check indicates that the innovation is practicable.
 - c.** Client A then calls on Contractor Z, the low bidder, and asks him to evaluate and bid on an alternate scheme conceived by Contractor X. Contractor Z is not told the source of alternative design. Client A makes no representation in his quotation request that replies will be held in confidence.
- 12.** Present and defend your view as to whether affirmative action is morally permissible and desirable in (a) admissions to engineering schools, (b) hiring and promoting within engineering corporations.(**A**)
- 13.** .The majority of employers have adopted mandatory random drug testing on their employees, arguing that the enormous damage caused by the pervasive use of drugs in our society carries over into the workplace. Typically the tests involve taking urine or blood samples under close observation, thereby raising questions about personal privacy as well as privacy issues about drug use away from the workplace that is revealed by the tests. Present and defend your view concerning mandatory drug tests at the workplace.
In your answer, take account of the argument that, except where safety is a clear and present danger (as in the work of pilots, police, and the military), such tests are unjustified. Employers have a right to the level of performance for which they pay employees, a level typically specified in contracts and job descriptions. When a particular employee fails to meet that level of performance, then employers will take appropriate disciplinary action based on observable behavior. Either way, it is employee performance that is relevant in evaluating employees, not drug use per se.(**A**)
- 14.** A company advertises for an engineer to fill a management position. Among the employees the new manager is to supervise is a woman engineer, Ms. X, who was told by her former boss that she would soon be assigned tasks with increased responsibility. The prime candidate for the manager's position is Mr. Y, a recent immigrant from a country known for confining the roles for

women. Ms. X was alerted by other women engineers to expect unchallenging, trivial assignments from a supervisor with Mr. Y's background. Is there anything she can and should do? Would it be ethical for her to try to forestall the appointment of Mr. Y?(A)

Unit – V
Global Issues
Part – A

1. What are global issues? (R)

The social and environment aspects of engineer's profession and also the international context of engineering are called global issues. The global issues involve engineers as social experimenters

2. What are the three versions of Relativism? (R)

i. Ethical Relativism ii. Descriptive Relativism iii. Moral Relativism

3. Distinguish between ethical relativism and descriptive relativism. (U)

The morally correct actions that are acceptable by legal systems, customary practices and conventions of the society are called ethical relativism. Whereas, descriptive relativism is the value-based beliefs and attitudes that are different in each cultural society

4. What are the roles of international rights in multinational companies? (R)

The international rights focuses on the general concepts of human rights that enable the multinational companies to realize their responsibilities and limitations to carry out their functional duties in an ethical manner, when they do business in other countries.

5. Differentiate between technology transfer and appropriate technology. (U)

The process by which technology is shifted to a novel setting and its subsequent implementation is called technology transfer. Whereas the process by which the suitable technology is properly identified, transferred and implemented in a new set of an environment is called appropriate technology.

6. What are the typical examples for appropriate technology? (U)

Motorized ploughs, agricultural machines, and microwave technology for long-distance transmission are the examples for appropriate technology.

7. What are the moral dimensions of an Engineer manager? (U)

- Information rights and obligation

- Property rights
- Accountability and control
- System quality
- Quality of life

8. Give any ten International rights suggested by Donaldson? (U)

- 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 nondiscriminatory 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.

9. What are the reasons for the disaster at Bhopal? (U)

- 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.

10. What is environmental ethics? (R)

The new branch of applied ethics which is associated with the restoration of natural environment in a balanced state by not harming the human society through vast industrialization is called environmental ethics.

11. What is sentient - centered ethics? (R)

The ethical values that underline the welfare and interest of all animals and humans who are capable of feeling the basic senses of pain, sight, smell and pleasure is called sentient - centered ethics. This ethics further emphasizes the important need of protecting the animals in their natural surroundings, when engineering projects are undertaken.

12. Mention about the salient features of eco-centric ethics. (U)

The preservation of integrity, stability and the natural beauty of the biotic community of an environment thereby respecting the values of ecological systems is the salient feature of eco-centric ethics.

13. What are the characteristic features of human-centered environmental ethics? (U)

The conservation of natural resources for the benefit of present and future generations and the strong emphasis on the human awareness on the destruction of nature are the characteristic features of human-centered environmental ethics

14. Give some of the Environmental issues of concern to engineers? (U)

- a. Releasing harmful substance into air and water.
- b. Using toxic substance in food processing.
- c. Disturbing land and water balances.

15. What are computer abuses? (R)

The unethical conduct in which the computers are illegally misused for power relationships and for encroachment of privacy are called abuses

16. What are the issues in Computer ethics? (U)

- Power Relationship
- Job Elimination Customer Relations Biased Software
- Stock Trading Unrealistic Expectations Political Power
- Military Weapons
- Property
- Embezzlement Data and Software
- Privacy
- Cybercrimes Computer Virus Techno stress
- Cyber Scams and Frauds Internet Defamation Software Piracy
- Cyber Squatting Inappropriate Access Data Bank Errors
- Hackers Legal Responses

- Professional Issues
- Computer Failures Computer Implementation Health conditions

17.What are the roles of power relationships in computer ethics? (U)

The centralization and decentralization of computer power to accelerate the data processing technology for updating welfare schemes, medical and engineering systems are the valid contributions of power relationships in computer ethics.

18. What is embezzlement? (R)

The process of committing computer crimes such as stealing or cheating clients and consumers and conspiracy in the fraudulent uses of computer networks is called embezzlement.

19. Who are hackers? (R)

The individuals who directly meddle with any computer security systems by implanting unwanted code; with the objective of paralyzing the network and also destroying the equipment's are called hackers.

20. What are the professional issues that are related with computer ethics? (U)

Computer failures due to errors in software and hardware, switch over to a new computer system only after incorporating the operational data of the old system and comfortable working conditions to prevent any health problem to any individual are the important professional issues in computer ethics.

21. What are the moral values of engineers involved in weapons development? (U)

Engineering professionals involved in the weapons development should be highly patriotic and must be fully aware of the dangerous consequences of development of weaponry items. They should decline to work in an unethical atmosphere that would be very harmful to the human society and should carry out their duties with ethical obligations.

22.How engineers justify their involvements in weapons works? (U)

A steady and constant source of income for the livelihood of their families, better job promotional avenues with an enhanced salary and compulsive reservations in mental attitude are the primary factors with which engineers justify and compromise themselves to work defense industries.

23. What are the problems of Defense industry? (U)

- a) Problem of waste and huge cost in implementing and maintaining a weapons system.
- b) Problem of Technology creep.
- c) Problems in maintaining secrecy.
- d) Every country allocates large amount of its resources to defense sector [India spent $\frac{1}{4}$ of its resource for defense]

24. What is an ethical climate? (R)

The favorable and workable atmosphere that is essential for the responsible conduct of an engineer is called ethical climate. This ethical climate enables engineers to contribute their maximum best to their corporate companies.

25. What is the role of Martin Marietta Corporation of US in the promotion of Ethical climate? (U)

Martin Marietta Corporation which is a large aerospace. and defense contractor, strongly emphasized about the ethical values of honesty, fairness, awareness on natural environmental, production of high quality products and drafting of code of conduct for its employees, thus contributing for the promotion of ethical climate.

26. What are the special features of an ethical corporate climate? (U)

- Ethical values are widely appreciated by managers and employees.
- A corporate code of ethics is emphasized for using ethical language.
- Moral tones are set up in policies by management by providing suitable guidelines for professional codes of ethics.
- Proper methods and procedures for conflict resolution are suitably evolved.

27. What are ways to promote an Ethical climate? (U)

- Ethical values in their full complexity are widely acknowledged and appreciated by managers and employees alike.
- The sincere use of ethical language has to be recognized as a legitimate part of corporate dialogue.
- The top level management must establish a moral tone in words, in policies, by personal example etc.

- The management has to establish some procedures for resolving conflicts.

28. What are the important forms of Conflicts? (U)

- Conflicts based on schedules
- Conflicts which arises in evolving the importance of projects and the department.
- Conflicts based on the availability of personal for a project.
- Conflicts over technical matters.
- Conflicts arise due to administrative procedure.
- Conflicts of personality.
- Conflicts over cost or expenditure or money.

29. What are the Principles of Conflicts of interest? (R)

- Separate people from the problem.
- Focus on interest and not on positions.
- Generate a variety of possibilities before deciding what to do.
- Insist that the result be based on some objective standard.

30. What are the normative models to be used to avoid conflicts? (R)

Hired Guns Value-neutral Analysts Value-guided Advocates

31. How do you evaluate that engineers are best suited to be managers? (U)

The high technical knowledge with professional enrichment to manage the technological companies, easy accessibility of understanding the corporate works than the non-engineering individuals and possession of high strength of quantitative analysis are the positive qualities of engineers for considering them as managers.

32. Mention the statements of Milton Friedman about the social responsibility movement of engineers as professional managers. (U)

Milton Friedman stated that managements merely satisfy the desires of stockholders; encourage them unethically to earn enormous money thereby violating the ethical customs of the public. Engineers should fulfill the moral responsibility of producing valuable products for the ultimate benefit of society.

33. What are the characteristics of an engineer as expert advisers in public planning and policy making? (U)

a. Honesty; b. Competence; c. Diligence; d. Loyalty

34. What are the four important areas that highlight the important responsibilities of consulting engineers? (U)

Advertising services in the product sales divisions, competitive bidding by submitting priced proposals, and contingency fees for the payment of their works and necessary provisions for resolving disputes and conflicts are the responsible duties of consulting Engineers.

35. What are the qualities of engineers to act as expert witnesses and advisers? (U)

- Engineers must act as consultants by providing expert testimony in adversarial contexts.
- They must involve in public planning and policy making.
- They should act as impartial seekers and communicators of truth.
- They should function as advocates in the interest of their corporations, instead of becoming hired guns.

36. Mention the important responsibilities of engineers as expert witnesses in the court? (U)

- Engineers should take utmost efforts for the payment of compensatory damages for injuries, loss of property and violation of rights for their genuine clients.
- They should take up the roles of attorneys in the best interests of their clients.
- They must have the confidentiality by not divulging the results of their investigations to the opposing side before they are asked to testify in court of law.
- They must provide truthful answers for all the questions in the court in an impartial manner.

37. What are hired guns? (R)

Hired gun is the typical type of ethical abuse in which engineers unscrupulously resort to non-objective living methods by violating the standards of honesty and integrity and also by acting in a partial and biased manner.

38. How engineers could act as morally creative leaders? (U)

Engineers should direct, motivate and organize the groups towards morally valuable goal. They should have the total participation and involvement at all levels of organizations. They should act in positive way for the betterment of the professional society.

39. What are the ideals of voluntary service in engineering profession? (U)

Although engineers are restrained to have voluntary service, they must tend to help the needy people through group efforts just like doctors and lawyers. They should be properly motivated to help elderly and minority people who are leading sub-standard life even without the basic amenities such as drinking water, sewage systems and electricity. They could provide a comparatively cheaper services than the normal costs or free services by associating with philanthropic engineering service organizations.

40. How can Deceptive advertising be done? (U)

- By outright lies.
- By half-truths.
- Through exaggeration.
- By making false innuendos, suggestions or implications.
- Through obfuscation created by ambiguity, vagueness or incoherence.
- Through subliminal manipulation of the unconscious.

41. Give the usage of the code of conduct? (U)

The code of conduct will help the engineers to have a set of standards of behavior. They act as guidelines for their behavior. It helps to create workplaces where employees are encouraged to make ethical implications.

42. Give the IEEE Code of Ethics? (R)

The members of the IEEE, in recognition of the importance of their technologies affecting the quality of life throughout the world, and in accepting a personal obligation to their profession, its members and the communities they serve, do hereby commit themselves to the highest ethical and professional conduct and agree...

- i. To accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment.

- ii. To avoid real or perceived conflicts of interest whenever possible and to disclose them to the affected parties when they do exist.
- iii. To be honest and realistic in stating claims or estimates based on available data.
- iv. To reject bribery in all its forms.
- v. To improve the understanding of technology, its appropriate application, and potential consequences.
- vi. To maintain and improve their technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations.
- vii. To seek, accept and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others.
- viii. To treat fairly all persons regardless of such factors such as religion, gender, disability, age or national origin.
- ix. To avoid injuring others, their property, reputation or employment by false or malicious action.
- x. To assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

43. Enumerate the code of ethics of engineers? (U)

- Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
- Engineers shall perform services only in the areas of their competence.
- Engineers shall issue public statements only in an objective and truthful manner.
- Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
- Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
- Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the profession.
- Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

44. What is Cybercrime? (R)

Cybercrime, or computer crime, is crime that involves a computer and a network. The computer may have been used in the commission of a crime, or it may be the target.

Part - B

1. Explain the issues related to computer ethics and internet with personal experience. **(U)**
2. Discuss on the Professional Societies? **(U)**
3. Describe the concept of environmental ethics with a case study. **(U)**
4. What are the professional issues that are related with computer ethics? **(U)**
5. Describe how the sample code of ethics serves as a model guide for professional conduct. **(U)**
6. Discuss on Engineers involved in weapon development and analyze the problems faced by Defenseindustry. **(U)**
7. Write briefly a)Engineer as expert witness b)Engineer as good manager's c)Engineers as consulting engineers' d)Engineer as advisor. **(U)**
8. Discuss on the pros and cons of multinational companies from the point of view of ethics. **(U)**

Assignment Questions

1. Consider an engineer who develops a program used as a tool in developing other programs assigned to her. Subsequently she changes jobs and takes the only copy of the first program with her for use on her new job. Suppose first that the program was developed on company time under the first employer's explicit directives. Taking it to a new job without the original employer's consent would be a violation of that employer's right to the product (and possibly a breach of confidentiality). As a variant situation, however, suppose the program was not written under direct assignment from the first employer, but was undertaken by the engineer at her own discretion to help her on her regular work assignments. Suppose also that to a large extent the program was developed on her own time on weekends, although she did use the employer's facilities and computer services. Did the employer own or partially own the program? Was she required to obtain the employer's permission before using it on the new job? **(A)**

2. Dependence on computers has intensified the division of labor within engineering. For example, civil engineers designing a flood control system have to rely on information and programs obtained from systems analysts and implemented by computer programmers. Suppose the systems analysts refuse

to assume any moral or legal responsibility for the safety of the people affected by the flood control plans, arguing that they are merely providing tools whose use is entirely up to the engineers. Should the civil engineers be held accountable for any harm caused by poor computer programs? Presumably their accountability does extend to errors resulting from their own inadequate specifications that they supply to the computer experts. Yet should not the engineers also be expected to contract with computer specialists who agree to be partially accountable for the end-use effects of their programs? **(A)**

3. An engineer working as a computer programmer played a minor role in developing a computer system for a state department of health. The system stored medical information on individuals identified by name. Through no fault of the engineer, few controls had been placed on the system to limit easy access to it by unauthorized people. Upon learning of this, the engineer first informed his supervisor and then higher management, all of whom refused to do anything about the situation because of the anticipated expense required to correct it. In violation of the rules for using the system, the programmer very easily obtained a copy of his own medical records. He then sent them to a state legislator as evidence for his claims that the right of citizens to confidentiality regarding such information was threatened by the system. Was his behavior improper? Was his subsequent firing justified? **(A)**

4. A project leader working for a large retail business was assigned the task of developing a customer billing and credit system. The budget assigned for the project appeared at first to be adequate. Yet by the time the system was half completed it was clear the funds were not nearly enough. The project leader asked for more money, but the request was denied. He fully informed management of the serious problems that were likely to occur if he had to stay within the original budget. He would be forced to omit several important program functions for convenience and safety: for example, efficient detection and correction mechanisms for errors, automatic handling and reporting of special customer exceptions, and audit controls. Management insisted that these functions could be added after the more minimal system was produced and installed in stores. Working under direct orders, the project leader completed the minimal system, only to find his worst fears realized after it was installed. Numerous customers were given incorrect billings or ones they could not understand. It was easy for retail salespersons to take advantage of the system to steal from the company, and several did so. Within a year the company's profits and business were beginning to drop. This led to middle-level

management changes, and the project leader found himself blamed for designing an inadequate system. Did the project leader have an obligation either to clients or to the company to act differently than he did? Did he have a moral right to take further steps in support of his original request or later to protect himself from managerial sanctions? **(A)**

5. A team of engineers and biomedical computer scientists develop a system for identifying people from a distance of up to 200 meters. A short tube attached to a sophisticated receiver and computer, and aimed at a person's head, reads the individual's unique pattern of brain waves when standard words are spoken. The team patents the invention and forms a company to manufacture and sell it. The device is an immediate success within the banking industry. It is used to secretly verify the identification of customers at tellers' windows. The scientists and engineers, however, disavow any responsibility for such uses of the device without customer notification or consent. They contend that the companies that buy the product are responsible for its use. They also refuse to be involved in notifying public representatives about the product's availability and the way it is being used. Does employing the device without customer awareness violate the right to privacy or to informed consent? Do the engineers and scientists perhaps have a moral obligation to market the product with suggested guidelines for its ethical use? Should they be involved in public discussions about permissible ways of using it? (Retina scan identification systems using laser beams are already in use. An example would be to determine if a person using a particular computer is authorized to use it.) **(A)**

6. The following warning to parents whose children use home computers was carried by the Associated Press: "In recent years more sexually oriented materials have been showing up for home computers—some on floppy disks with X-rated artwork and games, and other accessed by phone lines from electronic bulletin boards . . . with names like Cucumber, . . . Orgy, Nude pics, Porno, Xpics, and Slave." Discuss the ethical issues raised by pornography in this new medium, as well as the issues raised by racist, sexist, and libelous (false and defamatory) statements. How can access be denied to children? Should there be controls for adults? Already there are thousands of bulletin boards, largely because it is so easy and inexpensive to create them. Should bulletin board operators be held liable for failing to filter illegal forms of verbal assaults, even if that forces them to buy liability insurance and thereby raise the costs of creating bulletin boards? **(A)**

7. Write a short research paper exploring the threats to privacy posed by data banks. In your essay, comment on some specific advantages and disadvantages of having one centralized national data bank that pools all available government information on citizens. **(A)**

8. Identify and comment on the importance of each of the environmental impacts described in the following passage: “The Swedish company IKEA, the world’s largest furniture and home furnishings retailer, has adopted a global corporate policy that prohibits the use of old-growth forest wood or tropical wood in its furniture. All timber must come from sustainably managed forests. IKEA has eliminated the use of chlorine in its catalog paper, uses 100 percent recycled paper fibers, and is committed to eliminating waste in its retail stores. The ‘Trash is Cash’ program has transformed the thinking of retail store workers to see trash as a revenue-generating resource.” **(A)**

9. Most companies want to have a reputation for environmental responsibility, but there are different “shades of green” in their commitments. They include (1) “light green”—compliance with the law; (2) “market green”—seeking competitive advantage by attending to customer preferences; (3) “stakeholder green”—responding to and fostering environmental concern in the stakeholders of the corporation, including suppliers, employees, and stockholders; and (4) “dark green”—creating products and using procedures that include respect for nature as having inherent worth. Which of these shades of green would you ascribe to GE and to SELF? **(A)**

10. Identify and discuss the moral issues involved in the following case. The great marshes of southern Florida have attracted farmers and real estate developers since the beginning of the century. When drained, they present valuable ground. From 1909 to 1912 a fraudulent land development scheme was attempted in collusion with the U.S. Secretary of Agriculture. Arthur Morgan blew the whistle on that situation, jeopardizing not only his own position as a supervising drainage engineer with the U.S. Department of Agriculture, but also that of the head of the Office of Drainage Investigation. An attempt to drain the Everglades was made again by a Florida governor from 1926 to 1929. Once more Arthur Morgan, this time in private practice, stepped in to reveal the inadequacy of the plans and thus discourage bond sales. But schemes affecting the Everglades did not end then. Beginning in 1949, the U.S. Army Corps of Engineers started diverting excess water from the giant Lake Okechobee to the Gulf of Mexico to reduce the danger of flooding to nearby

sugar plantations. As a result, the Everglades, lacking water during the dry season, were drying up. A priceless wildlife refuge was falling prey to humanity's appetite. In addition, the diversion of waters to the Gulf and the ocean also affected human habitations in southern Florida. Cities that once thought they had unlimited supplies of fresh groundwater found they were pumping salt water instead as ocean waters seeped in. Current estimates are that \$10 billion will be needed to reverse generations of damage, but initial federal funding faded quickly after the combination of September 11, 2001 and Hurricane Katrina diverted money in other directions. **(A)**

11. Discuss one of the following topics with an eye to how individual choices in everyday life affect the environment: (a) drinking from disposable cups for coffee or soda pop, (b) driving a sports utility vehicle that gets low gas mileage, (c) eating beef, (d) going the extra mile to dispose of your spent dry cell at a collection point (such as Radio Shack). **(A)**

12. The social experimentation model of engineering highlights the need to monitor engineering projects after they are put in place. Discuss this idea in connection with Hurricane Katrina. **(A)**

13. Research the recent approaches, legislation, and international agreements in fighting global warming. Which hold the most promise? **(A)**

14. Do you agree or disagree, and why, with Peter Singer's claim that it is a form of bigotry—"speciesism"—to give preference to human interests over the interests of other sentient creatures? Also, should we follow Albert Schweitzer in refusing to rank life forms in terms of their importance? **(A)**

15. Exxon's 987-foot tanker Valdez was passing through Prince William Sound on March 24, 1989, carrying 50 million gallons of oil when it fetched up on Bligh Reef, tore its bottom, and spilled 11 million gallons of oil at the rate of a thousand gallons a second. The immediate cause of the disaster was negligence by the ship's captain, Joseph J. Hazelwood, who was too drunk to perform his duties. Additional procedural violations, lack of emergency preparedness, and a single- rather than double-hull on the ship all contributed in making matters worse. This was one of the worst spills ever, not in quantity, but in its effect on a very fragile ecosystem. No human life was lost, but many thousands of birds, fish, sea otters, and other creatures died. Discuss how each of the human-

centered and nature centered ethical theories would interpret the moral issues involved in this case, and apply your own environmental ethic to the case. **(A)**

16. Discuss the “last person scenario”: You are the last person left on earth and can press a button (connected to nuclear bombs) destroying all life on the planet. Is there a moral obligation not to press the button, and why? How would each of the environmental ethics answer this question? **(A)**

17. Evaluate the following argument from W. Michael Hoffman. In most cases, what is in the best interests of human beings may also be in the best interests of the rest of nature. . . . But if the environmental movement relies only on arguments based on human interests, then it perpetuates the danger of making environmental policy and law on the basis of our strong inclination to fulfill our immediate self-interests. . . . Without some grounding in a deeper environmental ethic with obligations to nonhuman natural things, then the temptation to view our own interests in disastrously short-term ways is that much more encouraged. **(A)**

18. Buckminster Fuller compared the earth to a spaceship. Compare and contrast the moral implications of that analogy with the Gaia Hypothesis set forth by James Lovelock in the passage that follows: “We have . . . defined Gaia as a complex entity involving the Earth’s biosphere, atmosphere, oceans, and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet. The maintenance of relatively constant conditions by active control may be conveniently described by the term ‘homoeostasis.’” What are the strengths and weaknesses of each analogy? **(A)**

19. Write an essay on one of the following topics: “Why Save Endangered Species?” “Why Save the Everglades?” “What are corporations’ responsibilities concerning the environment?” In your essay, explain and apply your environmental ethics. **(A)**

20. Following the disaster at Bhopal, Union Carbide argued that officials at its U.S. corporate headquarters had no knowledge of the violations of Carbide’s official safety procedures and standards. This has been challenged as documents were uncovered showing they knew enough to have warranted inquiry on their part, but let us assume they were genuinely ignorant. Would ignorance free them of responsibility? **(A)**

21. The moving of hazardous technologies, such as the manufacture of asbestos, to less-developed countries is motivated in part by cheaper labor costs, but another factor is that workers are willing to take greater risks. How does Donaldson's view apply to this issue? Also, do you agree with Richard De George's view that taking advantage of this willingness need not be unjust exploitation if several conditions are met: (1) Workers are informed of the risks. (2) They are paid more for taking the risks. (3) The company takes some steps to lower the risks, even if not to the level acceptable for U.S. workers. How would you assess Union Carbide's handling of worker safety? Take into account the remarks of an Indian worker interviewed after the disaster. The worker was then able to stand only a few hours each day because of permanent damage to his lungs. During that time he begged in the streets while he awaited his share of the legal compensation from Union Carbide. When asked what he would do if offered work again in the plant knowing what he knew now, he replied: "If it opened again tomorrow I'd be happy to take any job they offered me. I wouldn't hesitate for a minute. I want to work in a factory, any factory. Before 'the gas' [disaster] the Union Carbide plant was the best place in all Bhopal to work." **(A)**

22. How would you balance respect for diversity with commitments to respect for individual rights in the following two cases? **(A)**

a. You are a woman assigned to work in a Middle Eastern country that requires women to wear traditional clothing, but doing so conflicts with your religious faith; or, you are a man who is a member of a team whose members include women who are required to wear traditional clothing. If you decline the assignment, your career advancement might suffer.

b. Your company is asked to design a more efficient weaving apparatus whose size is quickly adjustable to young children, and you are assigned to the project. You know that the primary market for the apparatus is countries that use child labor.

23. During 1972 and 1973 the president of Lockheed, A. Carl Kotchian, authorized secret payments totaling around \$12 million beyond a contract to representatives of Japan's Prime Minister Tanaka. Later revelations of the bribes helped lead to the resignation of Tanaka and also to the Foreign Corrupt Practices Act that forbade such payments by American-based corporations. In 1995, long after Tanaka's death, the agonizingly slow trial and appeals process came to an end as Japan's Supreme Court reaffirmed the guilty verdicts, but so

far no one has been jailed, and the case appears to have had little recent impact on business and politics in Japan. Mr. Kotchian believed at that time it was the only way to assure sales of Lockheed's TriStar airplanes in a much-needed market. In explaining his actions, Mr. Kotchian cited the following facts:

- There was no doubt in his mind that the only way to make the sales was to make the payments.
- No U.S. law at the time forbade the payments. Only later, in 1977, was the Foreign Corrupt Practices Act signed into law, largely based on the Lockheed scandal forbidding the payment of overseas bribes.
- The payments were financially worthwhile, for they totaled only 3 percent of an expected \$430 million income for Lockheed.
- The sales would prevent Lockheed layoffs, provide new jobs, and thereby benefit workers' families and their communities as well as the stockholders.
- He himself did not personally initiate any of the payments, which were all requested by Japanese negotiators.
- To give the TriStar a chance to prove itself in Japan, he felt he had to "follow the functioning system" of Japan. That is, he viewed the secret payments as the accepted practice in Japan's government circles for this type of sale.

Present and defend your view about whether Mr. Kotchian's actions were morally justified. In doing so, apply utilitarianism, rights ethics, and other ethical theories that you see as relevant. **(A)**

24. The World Trade Organization (WTO) was established to oversee trade agreements, enforce trade rules, and settle disputes. Some troublesome issues have arisen when WTO has denied countries the right to impose environmental restrictions on imports from other countries. Thus, for example, the United States may not impose a ban on fish caught with nets that can endanger other sea life such as turtles or dolphins, while European countries and Japan will not be able to ban imports of beef from U.S. herds injected with antibiotics. Yet, other countries ban crops genetically modified to resist certain pests, or products made there from, unless labeled as such. Investigate the current disputes and, using a case study, discuss how such problems may be resolved.

(A)

25. Corporations' codes of ethics have to take into account international contexts. Compare and contrast the benefits and liabilities of the types of ethics programs (a and b) at Texas Instruments at two different times, described as follows: **(A)**

a. Texas Instruments (TI) always had a long-standing emphasis on trust and integrity, but during the 1980s it greatly intensified its efforts to make ethics central to the corporation. In 1987 TI appointed a full-time ethics director, Carl Skooglund, who was then a vice president for the corporation. Skooglund reported to an ethics committee that in turn reported directly to the board of directors. His activities included raising employees' ethical awareness through discussion groups and workshops on ethics, making himself directly available to all employees through a confidential phone line, and—especially relevant here—addressing specific cases and concerns in weekly newsletters and detailed brochures called “Cornerstones.”

b. In 1995, TI's popular chairman died suddenly, prompting a rapid review of its policies. In two years, it made 20 acquisitions and divestitures, including selling its defense-industry business, leaving it with more non-U.S. employees than U.S. employees. The new chairman called for rethinking its ethics programs to have both a greater international focus and more emphasis on a competitive and “winning” attitude. Before his retirement, Carl Skooglund scrapped the Cornerstone series, focused on specific issues and cases, and replaced it with three core values: integrity (honesty together with respect and concern for people), innovation, and commitment (take responsibility for one's conduct).

26. The following problem is taken from an article by Tekla Perry in the IEEE Spectrum. Although it involves the U.S. National Aeronautics and Space Administration rather than the Defense Department, many of the actors (companies and government) involved in space research are also involved in weapons development: Arthur is chief engineer in a components house. As such, he sits in meetings concerning bidding on contracts. At one such meeting between top company executives and the National Aeronautics and Space Administration, which is interested in getting a major contract, NASA presents specifications for components that are to be several orders of magnitude more reliable than the current state of the art. The components are not part of a life-support system, yet are critical for the success of several planned experiments. Arthur does not believe such reliability can be achieved by his company or any other, and he knows the executives feel the same. Nevertheless, the executives indicate an interest to bid on the contract without questioning the

specifications. Arthur discusses the matter privately with the executives and recommends that they review the seemingly technical impossibility with NASA and try to amend the contract. The executives say that they intend, if they win the contract, to argue mid-stream for a change. They remind Arthur that if they don't win the contract, several engineers in Arthur's division will have to be laid off. Arthur is well-liked by his employees and fears the layoffs would affect some close friendships. What should Arthur do? **(A)**

27. Are there any ethical grounds for maintaining a large nuclear stockpile today? Discuss any stabilizing or destabilizing effects you see. **(A)**

28. The just-war theory considers a war acceptable when it satisfies several stringent criteria: The war must be fought for a just cause, the motives must be good, it must follow a call from a legitimate authority, and the use of force must be based on necessity (as a last resort). Central to notions of a just war are the principles of noncombatant immunity and proportionality. Noncombatants are those who will not be actively participating in combat and therefore do not need to be killed or restrained. Proportionality addresses the extent of damage or consequences allowable in terms of need and cost. Describe a scenario for the conduct of a just war and describe the kinds of weapons engineers might have to develop to wage one. In your view, is the U.S.-Iraq war a just war? **(A)**

29. Wernher von Braun designed Hitler's V-2 rocket that terrorized London toward the end of World War II; after the War he worked for the U.S. Army and designed the Saturn rockets that launched Apollo astronauts to the moon. Research his career and comment on its implications for thinking about engineering **(A)**

SUBJECT CODE: MG 6071

**SUBJECT NAME: ENTREPRENEURSHIP
DEVELOPMENT**

UNIT I – ENTREPRENEURSHIP

PART - A

1. Who is an entrepreneur? (R)

- A person who is able to identify business opportunities and implement actions to maximize on the opportunities.
- An entrepreneur initiates enterprise creation, undertakes risks, and manages resources to establish and operate a business enterprise that is capable of self-sustenance.

2. Who is an intrapreneur? (R)

- Intrapreneur is an employed staff (e.g. manager who innovates for the company and takes risks only on behalf of the employer.
- They are creative people usually working together as teams, who function as entrepreneurs within corporations.

3. Who is co-preneurship? (R)

- Copreneurs is a subset of family business and is the fastest growing segment of small business activity.
- Married couples who share ownership, management and responsibility for a business known as co-entrepreneurial couples.
- Co-preneurs have committed relationship based on emotional ties and trust with a marked division of labor and responsibilities.

4. What is Intrapreneurship? (R)

- This is the development within a large co-operation of internal markets and relatively small autonomous business units producing products, services or technologies that employ the firms resources in a unique way.
- It gives managers of the co-operation the freedom to take initiatives and by new ideas.

5. Who are ultrapreneurs? (R)

- Today entrepreneur needs to have a different mindset about establishing and operating a business. This mindset is called ultrapreneuring.
- Ultrapreneurs identify business opportunity, determine its viability and form a company
- They require assembling super competent management team, who then develop, produce and market the product or service in the shortest optimum time period.
- They create business and then sell out, merge or combine.

6. List out the entrepreneurial contributions to economic development. (Az)

- Utilization of local resources
- Promotion of Technology
- Capital formation
- Creation of employment opportunities
- Promotion of an entrepreneurial culture
- Export Promotion
- Favorable balance of payment

7. List out the factors to be considered before becoming an entrepreneur? (Az)

- Business Idea
- Skills (Technical/Managerial)
- Market
- Capital (Opening. Working or Long Term)
- Machinery (Technology)
- Raw Materials
- Location (Strategic)

- Legal Issues
- Competition

8. What the characteristics/traits of an entrepreneur? (R)

- An eye for opportunity
- Independence
- An appetite for hardwork
- Self-confidence
- Discipline
- Judgment
- Ability to accept change
- Focus on profits
- Risk bearing
- Locus on control
- Creative and Innovators

9. Compare entrepreneur and entrepreneurship. (Az)

Entrepreneur	Entrepreneurship
Entrepreneur is a person who is willing to launch a new venture or enterprise and accept full responsibility for the outcome.	Entrepreneurship is one who undertakes innovations, finance and business acumen in an effort to transform innovations into economic goods.
Entrepreneur is an individual who take upon himself the risk of going into business with the aim of making profit	Entrepreneurship is the combining of all factors of production which include LAND, LABOUR and CAPITAL
Entrepreneur one who undertakes and operates a new enterprise and	The process in which an entrepreneur starts and operates his business

assumes some accountability for the inherent risks.	enterprise is entrepreneurship.
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10. Distinguish between entrepreneur and intrapreneur. (Az)

Characteristics	Entrepreneur	Intrapreneur
Primary Motives	Wants freedom, goal oriented, self-reliant, and self-motivated	Wants freedom and access to corporate resources, goal oriented and self-motivated, but also responds to corporate rewards and recognition.
Time Orientation	Uses and goals of 5 to 10 year growth of the business as guides; takes action how to next step along the way	End goals of 3 to 15 years, depending on the type of venture;
Focus of Attention	Primarily on technology and marketplace,	Both inside and outside; sells insiders on needs of venture and market place but also focuses on customers.
Attitudes towards Risk	Likes moderate risk; invests heavily but expects to succeed,	Like moderate risks; generally not afraid of being fired, so sees little personal risk,

11. Distinguish between Entrepreneur and Manager (Az)

Bases of Difference	Entrepreneur	Manager
Motive	Start a venture by setting up an enterprise. He understands the venture for his personal	Render his services in an enterprise already set up by someone else i.e.,

	gratification.	entrepreneur.
Status	Owner of the enterprise.	Servant in the enterprise owned by the entrepreneur.
Risk Bearing	Assumes all risks and uncertainty involved in running the enterprise.	Does not bear any risk involved in the enterprise.
Qualification	High achievement motive, originality in thinking, foresight, risk-bearing ability and so on.	Possess distinct qualifications in terms of sound knowledge in management theory and practice.

12. What are the functions of Entrepreneur? (R)

- Risk-bearing function
- Organizational function
- Innovative function
- Managerial function
- Decision making function

13. List out the types of entrepreneurs. (Az)

Based on type of business	Based on Technology	Based on Ownership
<ul style="list-style-type: none"> • Trading • Manufacturing • Agricultural 	<ul style="list-style-type: none"> • Technical • Non-Technical 	<ul style="list-style-type: none"> • Private • State • Joint
Based on Gender	Based on Size of Enterprise	Based on Clarence Danhof
<ul style="list-style-type: none"> • Men • Woman 	<ul style="list-style-type: none"> • Small-Scale 	<ul style="list-style-type: none"> • Innovative

	<ul style="list-style-type: none"> • Medium Scale • Large Scale 	<ul style="list-style-type: none"> • Imitative • Fabian • Drone
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14. Define Innovative Entrepreneur. (R)

- Innovative entrepreneur is one who assembles and synthesis information and introduces new combinations of factors of production.
- These entrepreneurs sense the opportunities for introduction new ideas new technology, new markets and creating new organizations

15. Define Imitative / Adoptive Entrepreneur (R)

- Imitative entrepreneur is also known as adoptive entrepreneur.
- Simply adopts successful innovation introduced by other innovators.
- Imitate the existing entrepreneurs and setup their enterprise in the same manner.
- They adopt technology, which is already tested, they generate ample employment avenues for the youth and therefore they are treated as agent of economic development.

16. Define Fabian Entrepreneur (R)

- Fabian entrepreneur is timid and cautious.
- They are very much skeptical in their approach in adopting or innovating new technology in their enterprise.
- They love to remain in the existing business with the age-old techniques of production
- They only adopt the new technology when they realize that failure to adopt will lead to loss or collapse of the enterprise.

17. Define Drone Entrepreneur. (R)

- Drone entrepreneurs are conservative or orthodox in outlook.
- They always feel comfortable with their old fashioned technology of production even though the environment as well as the society have undergone considerable changes.
- They are laggards as they continue to operate in their traditional way and resist changes

18. Who is a social entrepreneur? (R)

- Social entrepreneurs are individuals with innovative solutions to society's most pressing social problems.
- They are ambitious and persistent, tackling major social issues and offering new ideas for wide-scale change.

19. Who is woman entrepreneur? (R)

- Woman entrepreneur defined as a woman or group of women who initiate, organize and run a business enterprise.
- Woman entrepreneurs are confident, innovative and creative woman capable of achieving self-economic independence individually or in collaboration, generates employment opportunities for others through initiating, establishing and running the enterprise by keeping pace with her personal, family and social life.

20. Justify the problems faced by woman entrepreneurs? (E)

- Problem of finance
- Scarcity of raw materials
- Limited Mobility

- Lack of Education
- Male dominated society
- Low Risk bearing ability

**21. What are the role entrepreneurship in developing economic society?
(R)**

- Rural Entrepreneurship
- Tourism Entrepreneurship
- Agricultural Entrepreneurship
- Social Entrepreneurship

22. Why many entrepreneurs fail? (R)

- The goals set are unreasonable and unmeasurable
- Has not made a total commitment to the business
- No experience in the planned business
- No sense of potential threats or weakness to the business
- Not properly collecting information from customer for the proposed product or service.

UNIT II - MOTIVATION

1. List the major motives influencing on entrepreneurs. (Az)

- Self-Actualization Motives
- Work Motives
- Autonomy and Power Motives
- Status Motives
- Application Motives
- Doentic Motives

2. What are the motivating factor influencing people to become entrepreneurs? (R)

- Educational Background
- Occupational experience
- Desire to work independently
- Family Background
- Assistance from Government
- Assistance from financial institutions

3. What is need for achievement motivation in entrepreneurship? (R)

- Achievement Motivation is an inner spirit that activates an entrepreneur to strive for success.
- This achievement motivation can be developed through training and experience.

4. How to develop achievement motivation? (R)

- It is first developed by an individual who has an extreme interest in accomplishing a task, therefore, is determined to put to forth an effort in accomplishing the task if one desires to.

- There are people who take on the role of achievement motivation in a different manner.
 - There are some who are motivated to achieve their goals only if their performance is evaluated and an award is given.
 - There are some who are motivated to achieve their goals because of their fear of success or failure

5. Discuss the features of Achievement Motivation. (C)

- Setting self-goals and goal achievement
- Emulating models of achievement by constant watch and alertness.
- Attainment of clear and frequent feedback
- Planning more realistic goals through self-performance appraisal
- Reshaping of ideas as opportunities through positive self-assessment and day dreaming.

6. What are the push and pull motivational factors to drive entrepreneurial intention? (R)

Factors	Push	Pull
Main Purpose	Getting away from the current situation	Orientation towards future gains
Motives	<ul style="list-style-type: none"> • Ending unemployment • Avoiding unemployment • Get out of an emergency situation • Dissatisfaction with own vocational situation 	<ul style="list-style-type: none"> • Seize of opportunity • Gain decision latitude • Take initiative • Become one's own boss • Gain independence • Do interesting tasks • Implement one's own idea • Gain better income

7. What is self-employment? (R)

- Self-employment owns their own business alone or in partnership with others or with members of their family.
- It is the alternative to wage employment.

8. What motivates individuals to do self-employment? (R)

- A person chooses to be self-employed if he/she has a particular interest in the trade or business
- Follows a family tradition
- Perception of own necessary skills and abilities
- Availability of role models
- Fear of failure and its personal, social, and financial consequences

9. List the major advantages of self-employment. (Az)

- Lead rather than follow
- Be creative and implement ideas
- Have the potential for increased income with hardwork
- Be independent
- Take initiative, make own decision at own pace
- Continue to learn more about business each day and this could provide an opportunity for self-fulfillment

10. List the exercises and games for Entrepreneurial Motivation Training (EMT). (Az)

- Micro-labs
- Thematic Apperception Test (TAT)
- Achievement Planning (APO) exercises/Boat Making Exercise
- Tower Building
- Creating Games
- Convic and Crown

11. What is Thematic Apperception Test? (R)

- **Thematic Apperception Test (TAT)** is a projective psychological **test** developed by McClelland.
- Helps to assess the need profile of technical entrepreneurs
- Helps to determine the existence and level of achievement motivation among entrepreneurs
- Through this test ambition related pictures were displayed to the entrepreneurs and then they were asked to interpret the pictures and what is happening in the picture.
- To emphasize the formation and use of achievement language in day-to-day thinking and action.

12. Outline the purpose of Micro-labs. (U)

- **Micro-labs** is a process-oriented package of experience, which is used to prepare entrepreneurs to learn psychosocially
- Helps them to motivate, get involved in the program make them aware of the importance of learning through experience and open their vision for the program in totality.
- Help trainees familiarize themselves with each other.
- Build up and break and trainees expectations about the program.

13. What the major causes of stress faced by entrepreneurs? (R)

- Competition
- Unrealistic goals
- Limited Capital
- Meeting expectations
- Growth and expansion issues
- Change and Challenges

14. What is self-efficacy? (R)

- Self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives.
- Self-efficacy beliefs determine how people feel, think, motivate themselves and behave.

15. What is locus of control? (R)

- Locus of control is the degree to which people believe that they have control over the outcome of events in their lives, as opposed to external forces beyond their control.
- It is one's belief about contingency relationships between one's action and outcome.

16. What is entrepreneurial competency? (R)

- Entrepreneurial competency is defined as the individual characteristics including attitude and behavior, which allows the entrepreneur to achieve business success.
- Entrepreneurial competencies include entrepreneurial traits, motives, self-image, attitude, behavior, skills, and knowledge.
- Entrepreneurial competencies are considered a higher-level characteristic encompassing personality traits, skills and knowledge, and therefore can be seen as the total ability of the entrepreneur to perform a job role successfully.

17. Compare competence and competency. (Az)

Competence	Competency
Skill Based	Behaviour Based
Standard attained	Means of Behavior
Helps what is to be measured	Helps how the standard is achieved

18. List the major competencies of successful entrepreneurs. (Az)

- Pro-activity
 - Initiative
 - Assessiveness
- Achievement Orientation
 - Sees and acts as opportunity
 - Efficiency orientation
 - Concern for high quality work
 - Systematic Planning
- Commitment to Others
 - Commitment to work contract
 - Recognizing the importance of business relationships

19. What is Entrepreneurship Development Program (EDP)? (R)

- EDP is to help an individual in strengthening his entrepreneurial motive and in acquiring skills and capabilities necessary for playing his entrepreneurial role effectively.
- It is necessary to promote this understanding of motives and their impact on entrepreneurial values and behaviour for this purpose.

20. Interpret the Need for Entrepreneurship Development Program. (U)

- Creation of Employment Opportunities
- Capital Formation
- Balanced Regional Development
- Use of Local Resources

21. What are the objectives of Entrepreneurship Development Program?

(R)

- Develop and strengthen the entrepreneurial quality, i.e. motivation or need for achievement.
- Analyse environmental set up relating to small industry and small business.
- Understand the process and procedure involved in setting up a small enterprise.
- Acquire the necessary managerial skills required to run a small-scale industry.
- Appreciate the needed entrepreneurial discipline.

22. What are the basic criteria to assess the effectiveness of Entrepreneurship Development Program (EDP)? (R)

- Activity level of respondents
- New enterprises established
- Total investment made
- No. of people employed
- No. of jobs created
- Increase in profit
- Increase in sales

23. What are the phases of Entrepreneurship Development Program (EDP)? (R)

- Pre-training EDP
- Training Phases
- Post training phase (Also Follow up)

24. What are the entrepreneurial dimensions to be assigned to become potential entrepreneurs? (R)

- Achievement Motivation
- Risk propensity
- Personal efficacy
- Leadership quality
- Commitment to task
- Planning and organizing ability

25. What the various methods to be employed in assessing potential entrepreneurs. (R)

- Thematic Apperception Test (TAT)
- Ring toss game
- Locus of control questionnaire
- Group planning exercises
- Application blank analysis
- Personal interview

UNIT III - BUSINESS

1. What is small scale unit? (R)

- Small scale unit has fixed investment in plant and machinery, whether held on ownership basis or lease basis or hire purchase basis not exceeding Rs. 1 crore.

2. What is Ancillary unit? (R)

- Ancillary unit are industrial undertakings having fixed investment in plant and machinery not exceeding Rs. 1 crore engaged in or proposed to engage in.

3. What are the objectives of small scale industries? (R)

- To create more employment opportunities with less investment.
- To remove economic backwardness of rural and less developed regions of the economy.
- To reduce regional imbalances.
- To mobilize and ensure optimum utilization of unexploited resources of the country.
- To improve standard of living of people.
- To ensure equitable distribution of income and wealth.

4. List the types of small scale industries. (R)

- Manufacturing industry
- Cottage industry
- Village industry
- Ancillary industry
- Service industry
- Mining and Quarrying
- Feeder industry

5. What is a micro enterprise? (R)

- **Micro enterprise** is an enterprise where investment in plant and machinery (original cost excluding land and building and the items specified by the Ministry of Small-Scale Industries vide its notification No. S.O. 1722(E) dated October 5, 2006) **does not exceed Rs. 25 lakh;**

6. What is small enterprise? (R)

- A small enterprise is an enterprise where the investment in plant and machinery (original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No. S.O. 1722(E) dated October 5, 2006) is **more than Rs. 25 lakh but does not exceed Rs. 5 crore.**

7. What is medium enterprise? (R)

- A medium enterprise is an enterprise where the investment in plant and machinery (original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification S.O. 1722(E) dated October 5, 2006) is **more than Rs. 5 crore but does not exceed Rs. 10 crore.**

8. What are the essential characteristics of small scale industries? (R)

- Labor intensive
- Flexibility
- One-man show
- Use of indigenous raw materials
- Localized operation
- Lesser gestation period

9. What are the differences between micro and macro enterprises? (R)

Competitive	Micro enterprises cannot compete with macro enterprises in certain circumstances and in selected products. Examples of such enterprises/ industries are bricks and tiles, fresh baked goods and perishable edibles, preserved fruits.
Supplementary	Micro enterprise can fill in the gaps between large scale production and standard outputs caused by macro enterprises.
Complementary	Micro enterprises have been a complementary to their macro counterparts. Many micro enterprises produce intermediate products for macro units.
Initiative	Attracted by the high profits of macro units, micro units can also take initiative to produce the particular product. If succeeds, the micro unit grows to macro over a period of time.

10. List the rationale behind micro and small enterprise development in the country. (Az)

- Employment argument
- Equality argument
- Decentralization argument
- Latent resource argument

11. What are objectives of developing micro enterprises? (R)

- To generate immediate and large scale employment opportunities with relatively low investment.
- To eradicate unemployment problem from the country.
- To encourage dispersal of industries to all over country covering small towns, villages and economically lagging regions.
- To promote balanced regional development in the whole country.

12. What are the various rationale arguments behind micro and macro enterprises? (R)

- Employment argument
- Equality argument
- Decentralization argument
- Latent resources argument

13. Infer how society helps and cooperates with enterprise / business? (U)

- Society offers business inputs like raw materials
- Society provides business different types of resources such as human resources, financial resources, technological resources
- Society creates market for the products or services of business
- In the forms of various acts, laws and regulations, society also monitors and protects business to run in a desired manner.

14. What are problems faced by micro and small enterprises? (R)

- **Problems in procuring raw materials** due to scarcity, poor quality and high cost.
- **Problems of finance** due to weak economic base, poor financial assistance from commercial banks and financial institutions.

- **Problem of marketing** by comparing products unfavorably with the quality of products of large scale industries
- **Problem of under-utilization of capacity** because of poor power supply, cannot afford to go for alternatives like large-scale industries.

15. What are the steps in setting up of a small business enterprise? (R)

- Information collection
- Information organization
- Acquiring required / vocational skills
- Financial requirements
- Market assessment
- Provision of Crisis

18. What is a business plan? (R)

- Development of a written document that spells out like a roadmap where you are, where you want to be, and how you want to get there.
- It is a formal written expression of the entrepreneurial vision, describing the strategy and operations of the proposed venture.

17. List the contents of business plan. (Az)

- General information
- Promoter
- Location
- Land and building
- Plant and Machinery
- Production Process
- Utilities
- Transport and Communication
- Raw material and Manpower
- Products and Market
- Requirements of working capital and funds

18. What is project formulation? (R)

- It is the process of examining technical, economic, financial and commercial aspects of a project.
- It is the process and steps through which an opportunity becomes a project in which the entrepreneur is willing to invest his time, money and other resources.

19. Illustrate the need for project formulation. (U)

- Knowledge About Government Regulations
- Absence of External Economies
- Non-Availability of Technically Qualified Personnel.
- Resource Mobilization
- Selection of Appropriate Technology

20. What are the elements of project formulation? ®

- Feasibility Analysis
- Techno-Economic Analysis
 - Estimation of demand or market potential
 - Selection of Technology
- Project Design and Network Analysis
- Input Analysis
- Financial Analysis
- Social Cost Benefit Analysis
- Pre-investment Appraisal

21. What are the stages/process of project formulation/development? (R)

- General information
- Project Description
- Market Potential
- Capital Costs and sources of finance

- Assessment of working capital requirements
- Other financial aspects
- Economic and social variables
- Project implementation

22. What is techno-economic feasibility of the project? (R)

- Techno-economic feasibility makes an analysis of the market and technology
- The choice of technology itself will be based on the demand potential and aid in project design.
- Techno-economic feasibility analysis gives to the project an individuality and sets the stage for detailed design development.

23. What the contents of feasibility report? (R)

- Objectives and scope of the report
- Product characteristics, i.e. specifications, uses and application, standards, quality etc.
- Market position and trends
- Raw material requirements, prices, sources and properties of raw materials
- Manufacturing processes, selection of process, production schedules and techniques.
- Requirement of land area, building, construction schedule
- Financial implications, i.e. fixed and working capital investment, project cost and profitability
- Marketing channels, their trading practices and marketing strategies.

24. Summarize the factors to consider while preparing feasibility report.

(U)

- ***Technical considerations***

- Employment, ecology, infrastructure demands, capital services, balance of payments
- Description of product, selected manufacturing process
- Determination of plant size and production schedule
- Selection of machinery and equipment
- Identification of plant location and design

- ***Economic considerations***

- Identifying the market potential in terms of current demand
- Cost and project at different price levels
- Competitors both direct and indirect to be analyzed
- Data related to per capita income, level of consumption expenditure, inventories, new orders etc.

- ***Financial considerations***

- Assessment of total cost, initial capital requirements and cash flows
- Financial analysis showing return on investment, return on equity
- Details regarding equity shares, preference shares, debentures, long term loans, bank loans etc.

- ***Managerial competence***

- Activity analysis involving anticipated work flow and activities involved in project
- Grouping of activities into tasks which employees perform

- ***Implementation Schedule***

- Helps when to apply for term loans, procurement of land site, construction of factory shed, getting water and power connections, purchase of plant, recruitment of human resources, trial production etc.

25. What is a project report? (R)

- A project report may be defined as a document with respect to any investment proposal based on certain information and factual data for the purpose of appraising the project.
- Project report is an essential document for procuring assistance from financial institutions and for fulfilling other formalities for implementation of the project.

26. What are the objectives of project report? (R)

- It facilitates business planning and planning the future course of action.
- It enables an entrepreneur to compare different investment proposals and select the most suitable project.
- It provides a SWOT analysis, wherein the strengths, weaknesses, opportunities and threats involved in the projects as shown
- The project report enables the entrepreneur to ensure that he is proceeding in the right direction.
- It facilitates project appraisal

27. Importance of project report. (E)

- It helps the entrepreneur in establishing techno-economic viability of the project.
- It helps in getting term loan from banks and financial institutions
- It helps in approaching bank for getting working capital loan
- It helps in securing supply of scarce raw materials also

28. What are requisites of an ideal project report? (R)

- Project report should be prepared with the help of an expert team
- Assumptions in the project report should avoid extremities.
- Project report is the means and not the end

- Product demand, capital resources, raw material availability, labour resources etc. must be estimated properly after considering varied factors.
- The end result should be to receive finance and to get the project implemented.
- Complete satisfaction of the entrepreneur/promoter should be ensured before the report is submitted to the financial institutions.

29. What are the problems faced in the preparation of project report? (R)

- Strict condition of promoter's contribution may dampen the enthusiasm of entrepreneurs.
- All lending institutions demand a lot of documents before credit is granted.
- Problems regarding working capital assessment due to unrealistic assumptions
- Time overrun will lead to cost overrun.
- Lending institutions expect strict specifications with regard to size of the land, buildings, sources of machinery, their costs etc.
- A number of clearances have to be obtained from the government departments. This causes strain and wastage among entrepreneurs.

30. What is project appraisal? (R)

- Project appraisal means the assessment of a project
- It is made for both proposed and executed projects
- In case of former, project appraisal is called '**ex-ante analysis**' and in case of latter '**post-ante analysis**'
- Appraisal helps to select the best project among available alternative projects.

31. What are the methods of project appraisal? (R)

- Economic analysis
- Financial analysis
- Market analysis
- Technical feasibility
- Management competence

32. What the various forms of ownership in small scale enterprises? (R)

- Sole Proprietorship
- Partnership
- Company
 - Private Limited company
 - Public Limited company
- Co-operative

33. What are the criteria for selection of an appropriate form of business ownership? (R)

- Nature of business
- Area of operations
- Degree of control
- Capital requirements
- Extent of risk and liability
- Duration of business
- Government regulations

34. What is sole-proprietorship? (R)

- Oldest form of business ownership
- The enterprise is owned and controlled by one person
- It is simplest and easiest to form

- It does not require legal recognition and attendant formalities.

35. List the main features of company form of ownership? (Az)

- Artificial legal person
- Separate legal entity
- Common seal
- Perpetual existence
- Limited liability
- Transferability of shares
- Separation of ownership from management
- Number of members

36. What is co-operative ownership? (R)

- Co-operative form of organization is based on the philosophy of self-help and mutual help.
- Aims at rendering services in place of earning profits
- It is a society which has its objectives of promotion of economic interests of the members in accordance with cooperative principles.

37. What is market research? (R)

- The systematic objectives and exhaustible search for the study of facts relevant to any problem in the field of marketing.
- It is the careful and objective study of product design, markets and such transfer activities as physical distribution, warehousing, advertising and sales management.

UNIT IV – FINANCING AND ACCOUNTING

1. Justify the classifications of financial needs. (E)

Based on Performance

- Fixed Capital
- Working Capital

Based on period of use

- Long term capital
- Short term capital

2. What are the sources of Finance? (R)

- Internal sources
- External sources

3. What is internal source of finance? (R)

Internal sources of finance are funds found and raised inside the organization. Examples are owners own money (capital) also called as equity, partners or directors loan or deposit etc.

4. Why entrepreneurs need finance? (R)

- To start an Industry.
- For acquiring Fixed Assets.
- Developing Product.
- Developing Men and Machine at Work.
- Encourage Management to make Progress.

5. Name the institutions providing financial support to entrepreneurs. (R)

- National Small Industries Corporation Limited (NSIC)
- Small Industries Development Organization (SIDO)
- Small Scale Industries Board (SSIB)
- State Small Industries Development Corporation (SSID)
- Small Industries Service Institutes (SISI)
- District Industries Centres (DICs)

- Industrial Estates
- Specialized Institutions
- Technical Consultancy organizations (TCOs)

5. Functions of National Small Industries Corporation Limited (NSIC) (Az)

- Provides financial assistance by way of hire-purchase scheme for purchase of machinery and equipment, required for the setting up industries.
- Provides various equipments on lease basis
- Assists in marketing of the products of SSIs.
- Helps in the development and upgradation of technology and modernisation of the industries.
- Undertakes construction of industrial estates.

6. Functions of Small Industries Development Organization (SIDO). (Az)

- To formulate policies regarding the promotion and development of SSI at national level.
- To coordinate the activities of all departments, institutions and agencies involved in promoting the SSI.
- To render all way support and encourage the entrepreneurs to set up and sort out the hurdles.
- To conduct regular and *ad hoc* training courses through SISI's, Branch SISI's and extension/production centers;
- To secure reservations of certain products to be manufactured only by SSI's.

7. Functions of District Industries Centres (DICs) (Az)

- Acts as the focal point of the industrialisation of the district.
- Opportunity guidance to entrepreneurs.

- Manpower assessment with respect to skilled, semi-skilled workers.
- Assessment of availability of infrastructure facilities like quality testing, research and development, transport, prototype development, warehouse etc.
- Provides information about various government schemes, subsidies, grants and assistance available from the other corporations set up for promotion of industries.
- Acts as a link between the entrepreneurs and the lead bank of the district.

8. What is an industrial estate? (R)

An industrial estate is a place where necessary infrastructural facilities are made available to entrepreneurs. Industrial parks, industrial zone, industrial area, industrial township are some of the other terms used to denote industrial estates.

9. Determine the objectives of industrial estate. (E)

- Ensuring well planned and structured industrial development.
- To provide the necessary infrastructure.
- To provide common facilities to a number of industries.
- To promote development of clusters.
- To enable small units to source products from one another.
- To enable dispersal of industries.
- To promote balanced regional development.

10. What is term loan? (R)

Loan which has to be repaid in regular intervals over a predefined time limit and also has a fixed or a floating rate of interest.

11. What is capital structure? (R)

It is defined as the composition of debt and equity by which the organization funds its overall operations. Simply it is the mix or composition of debt and equity in the firm's capital.

12. What is optimum capital structure? (R)

It is defined as the best debt equity mix/ratio/composition of a firm which maximizes the value of the organization. It will change based on the business conditions.

13. Justify the factors determining capital structure. (E)

- a. Firm's Size
- b. Nature of the business that the enterprise deals with
- c. Leverage effect
- d. Cash Flow
- e. Tax rate
- f. Reasons for financing
- g. Future usage.

14. What are sources of term loans? (R)

- Issue of debentures
- Issue of shares
- Loan from financial institutions
- Loan from commercial banks
- Public deposits
- Retention of profits.

15. What are the types of term loans? (R)

- Short term loans
- Long term loans.

16. What is Long term loan? (R)

Long terms loans are taken for long period of time (over one year) to match the financial needs of the firm.

17. What are the types of shares? (R)

- Preference share
- Equity share.

18. What is preference share? (R)

Preference shares are given priority over the ordinary share holders while paying dividends.

19. What is Equity share? (R)

Equity share is not given any priority. The dividend and capital of equity share holders are paid only after the payment of preference shares.

20. What is debenture? (R)

- A debenture is a medium to long-term debt instrument.
- It is used for raising funds from the public.
- Debenture includes debenture stocks, bonds and any other securities of the firm.

21. What are the categories of institutional finance? (R)

- Commercial banks
- Other financial institutions.

22. What is working capital? (R)

Working capital is the capital of the firm which is required and used to carry out the day-to-day business operations.

23. What are the factors influencing working capital? (R)

- Character of business
- Size and volume of business
- Length of processing period
- Turnover
- Terms of purchase and sales
- Seasonal variation
- Importance of labor
- Cash Flow

- Stock
- Cyclical fluctuation

24. What are two concepts of working capital? (R)

- Net working capital
- Gross working capital.

25. What is Net working capital? (R)

Net Working capital= Current Assets- Current Liabilities.

Net Working capital of a firm is arrived by subtracting current liabilities from current assets.

26. What is gross working capital? (R)

Gross Working capital is the aggregate value of all the current assets.

Gross Working Capital=Total current assets.

27. What is break even analysis? (R)

- **Break even analysis mentions** the position of the firm, at which there is neither profit nor loss.
- Breakeven point is point is one at which the firm's Total Revenue and Total cost are equal.
- It is a tool of financial analysis whereby the impact on profit position of the changes in volume, price, costs and mix can be estimated definitely and accurately.

28. Classify the advantages of Break-Even analysis. (U)

- It helps to take investment decision
- It serves as a useful tool for cost controls
- It assists in the formulation of price policies
- It is useful for determining costs and revenue at different levels of activity

29. What is the basis of charge of income tax? (R)

- Income tax is an annual tax on income
- Income of previous year is taxable in the next following assessment year
- Tax rate are fixed by the annual finance act
- Annual finance act shall be amended every year
- Tax is charged on every person
- Tax is charged on total income of every person

30. What is an allowance? (R)

- Allowances means 'any amount or sum allowed regularly'
- Allowances are given in cash along with salary by the employer

31. What are the classifications of allowances? (R)

- ***Fully exempted allowances***
 - Foreign Allowance
- ***Fully taxable allowances***
 - Dearness Allowance
 - City Compensatory Allowance
 - Lunch Allowance
 - Tiffin Allowance
 - Marriage Allowance
- ***Partially Taxable Allowance***
 - House Rent Allowance
 - Helper Allowance
 - Academic Allowance
 - Conveyance Allowance
 - Travelling Allowance
 - Entertainment Allowance

32. What are the components of income? (R)

- Profits and gains
- Dividends
- Value of any benefit or amenity whether convertible into money or not
- Any capital gain
- Profits and gains of any business
- Any sum received by the assessee as his employees contributions to any provident fund etc.

33. What are the pre-requisites taxable for all employees on income? (R)

- Rent free house
- Concessional Rent house
- Obligation of employee met by employer
- Amounts paid by employer club bill, gas and electricity, education bill of children

34. What are the pre-requisites exempted for all employees on income? (R)

- Free medical facilities
- Free refreshments
- Free recreational facilities
- Provision of telephone
- Free meals
- Free education, training or refresher course
- Goods sold at concessional rates
- Rent free house given to an officer of parliament
- Conveyance facilities to judges of supreme court or high court

35. Estimate how gross total income computed? (C)

- Gross total income means aggregate of income computed under the following five heads.

- Income from salaries
- Income from houseproperty
- Profit and gains of business or profession
- Capital gains
- Income from other source

36. What is salary? (R)

- Salary includes the following amounts received by an employee from its employer. It includes:
 - Wages
 - Any annuity or pension
 - Encashment of earned leave
 - Compensation for retirement
 - Any gratuity
 - Any fees, commission, bonus, allowances perquisites or profit in lieu of salary
 - Any advance salary
 - Provident Fund

37. What are four kinds of provident fund? (R)

- Statutory Provident fund
- Recognized Provident Fund
- Unrecognized Provident Fund
- Public Provident Fund

38. List out the various deductions under section 16. (Az)

- Standard deduction
- Entertainment deduction
- Tax on employment

39. What is capital gain? (R)

- Any profit earned from the transfer of a capital asset.

40. What the types of capital gains? (R)

- Short term capital gain – Capital asset held by an assessee for not more than 36 months immediately before the date of transfer
- Long term capital gain – Means a capital asset held by an assessee for more than 36 months preceding the date of retirement.

41. What is a sales Tax? (R)

- Sales tax is a levy either on purchase or sales of goods under the basic scheme of taxation of India.
- State Government will get revenue from Sales Tax including Tax on inter-state purchase or sales of goods, excise on liquor and tax on agricultural income.

42. What is excise duty? (R)

Excise duty is any duty or tax levied upon the manufacture or sale or consumption of commodities within the country.

43. List the kinds of excise duty. (Az)

- Basic Excise duty
- Special duties of Excise
- Additional Excise Duty in lieu of Sales tax
- Less of excise duties leviable on certain specified commodities under various act

UNIT V – SUPPORT TO ENTREPRENEURS

1. What is Industrial Sickness? (R)

Any industrial company (being a company registered for not less than five years) which has, at the end of any financial year, accumulated losses equal to, or exceeding, its entire net worth and has also suffered cash losses in such financial year and the financial year immediately preceding such financial year.

2. What is a sick unit? (R)

A sick unit is that which has incurred a cash loss for one year and is likely to continue incurring losses for the current year as well as in the following year and the unit has an imbalance in its financial structure.

3. List the process of industrial sickness? (Az)

- Normal Unit
- Tending towards sickness
- Incipient Sickness

4. What are the important signals of industrial sickness? (R)

- Decline in capacity utilization
- Shortages of liquid funds to meet short term financial institutions
- Inventories in excessive quantities
- Non-submission of data to banks and financial statements
- Irregularity in maintaining bank accounts
- Frequent breakdown in plants and machinery
- Decline in technical deficiency
- Frequent turnover of personnel in the industry

5. What the important symptoms which characterize industrial sickness?

(R)

- Persisting shortage of cash
- Deteriorating financial ratios
- Widespread use of creative accounting
- Continuous tumble in the prices of the shares
- Frequent request to banks and financial institutions for loans
- Delay and default in the payment of statutory dues

6. Inspect the various causes/factors of industrial sickness? (Az)

- External causes (or) Exogenous factors
- Internal causes (or) Endogenous factors

7. What are the external causes influencing industrial sickness? (R)

- Changes in industrial policies framed by government time to time
- Inadequate availability of necessary inputs like raw materials, power, transport and skilled labor
- Lack of demand of the product
- Recessionary trends prevalent in the economy
- Shortage of industrial resources especially working capital
- Natural calamities like drought, floods etc.

8. What are the various consequences of industrial sickness? (R)

- Huge financial loss to the banks and the financial institutions
- Loss to employment opportunities
- Emergent of industrial unrest
- Adverse effect on prospective investors and entrepreneurs
- Wastages of scarce resources
- Loss of revenue to the Government

9. What are the various corrective measures to curb industrial sickness?

(R)

- Identification and detection of sickness at the incipient stage is the first and foremost measure to detect and reduce industrial sickness.
- In view of limited resources at the disposal, a fewer number of sick units may be picked up for revival/rehabilitation and a larger number of weak units may be combined together to prevent sickness.
- The attitudes of three different sets of a unit-management, financial institutions and labour do not converge as they view the problems of industrial sickness quite differently.
- It will be better to open a separate division in **BIFR** (Board for Industrial and Financial Reconstruction) to deal with sickness in small-scale industries because small-scale industries are characterized by different sets of problems and prospects as compared to medium and large-scale industries.
- Provide for managerial efficiency, marketability of products, adequate availability of power and raw material in the rehabilitation programmes.
- Banks and financial institutions should periodically review the accounts of small-scale industries borrowers to identify units which are becoming sick or are prone to sickness.
- Necessity to impart necessary knowledge to the entrepreneurs in various functional areas through the training programmes like Entrepreneurship Development Programmes (EDPs).

10. What is a business incubator? (R)

- A **business incubator** in business speak is a company that helps new and startup companies to develop by providing services such as management training or office space.

- It is an organization designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services.

11. Determine the benefits of business incubators. (E)

- Creating jobs and wealth
- Community revitalization
- Identifying potential opportunities
- Encouraging women or minority entrepreneurship
- Business creation and retention
- Accelerating growth and local industry clusters
- Diversifying local economies
- Technology commercialization

12. Classification of business incubators (Az)

On the basis of type of sponsorship

- Government Sponsored
- Non-profit organization sponsored
- University of academic institutions sponsored
- Privately sponsored

On the basis of Objectives:

- General purpose incubators
- Technology incubators
- Specialist incubators

13. Identify the various services provided by business incubators. (A)

- Help in project report preparation
- Provide the following business advice

- Developing business idea
- Business and strategic planning
- Proactive support
- Financial and legal advice
- Management
- Provide the following business services
 - Book Keeping and word processing
 - Photocopier, fax and postage services
 - Conference and meeting rooms
 - Reception and telephone answering
 - Secretarial services
- Provide an environment where small business are not alone; thereby reducing the anxiety of starting a new venture.

14. List the various government policies for development and promotion of small scale industries. (Az)

- Industrial Policy Resolution (IPR) 1948
- Industrial Policy Resolution (IPR) 1956
- Industrial Policy Resolution (IPR) 1977
- Industrial Policy Resolution (IPR) 1980
- Industrial Policy Resolution (IPR) 1990

15. What is Industrial Policy Resolution (IPR) 1948? (R)

- This policy accepted the importance of small-scale industries in the overall industrial development of the country.
- Particularly suited for the utilization of local resources and for creation of employment opportunities.

16. What is Industrial Policy Resolution (IPR) 1956? (R)

- IPR 1956 provides continuing policy support to the small sectors.
- During this period 'Rural Industries Projects' and 'Industrial Estates Projects' were started to strengthen the small-scale sector in the country.
- IPR 1956 for small-scale industries aimed at "Protection plus Development."
- Also initiated the modern SSI in India.

17. What is Industrial Policy Resolution (IPR) 1977? (R)

- This new industrial policy will be on effective promotion of cottage and small-scale industries widely dispersed in rural areas and small towns.
- Provide self-employment on a large scale especially on cottage and small scale industries
- Provides reservation of 504 items for exclusive production in small-scale sector.
- Set-up 'District Industry Centre' (DIC) to serve as a focal point of development for small-scale and cottage industries.

18. What is Industrial Policy Resolution (IPR) 1980? (R)

- IPR 1980 facilitates an increase in industrial production through optimum utilization of installed capacity and expansion of industries.
- Introduces the concept of nucleus plants which promotes the maximum small-scale industries there.
- Promotion of village and rural industries to generate economic viability in the villages.

19. What is Industrial Policy Resolution (IPR) 1990? (R)

- Gives increasing importance to small-scale enterprises to serve the objective of employment generation.

- 836 new items were reserved for exclusive manufacture in small- scale sectors.
- Improve the competitiveness of the products manufactured in the small-scale sector;
- Programs of technology up gradation will be implemented under the umbrella of an apex Technology Development Centre in Small Industries Development Organisation (SIDO).
- Gives greater emphasis on training of women and youth under Entrepreneurship Development Programme (EDP) and to establish a special cell in SIDO

20. What is new small enterprise policy 1991? (R)

- New Small Enterprise Policy is to impart more vitality and growth impetus to the sector to enable to contribute fully to the economy, particularly in terms of growth of output, employment and exports.

21. What the salient features of small enterprise policy 1991? (R)

- Increase the investment limit in plant and machinery of tiny enterprises from Rs. 2 lakh to Rs.5 lakh irrespective of the location of the enterprise.
- Introduce a limited partnership act.
- Introduce a scheme to integrated infrastructural development (including technological back-up services) for small scale industries
- Introduce of factoring services to help solve the problems of delayed payments to small sectors.
- Setting up of an Export Development Centre in the Small Industries Development Organization (SIDO).

22. What is Micro Small and Medium Enterprises Development (MSMED) Act, 2006? (R)

The **MSMED Act, 2006** defines the Micro, Small and Medium Enterprises

based:

1. On the investment in plant and machinery for those engaged in manufacturing or production, processing or preservation of goods and
2. On the investment in equipment for enterprises engaged in providing or rendering of Services.

23. What are the strategies used for the growth of small-scale enterprise? (R)

- Expansion
- Diversification
- Joint Venture
- Mergers and Acquisitions
- Sub-Contracting and 6. Franchising.

24. What is sub-contracting system? (R)

Sub-contracting system is a mutually beneficial commercial relationship between the two companies. This is known as Ancillarization in India and more generally as 'sub-contracting.'

25. Summarize the advantages of Sub-Contracting. (U)

- It increases production in the fastest way without making many efforts
- The contractor can produce products without investing in plant and machinery
- Sub-contracting is particularly suitable to manufacture goods temporarily.
- It enables the contractor to make use of technical and managerial abilities of sub-contractors.

26. Distinguish between Franchising, Distributorship and Agency (Az)

- **Distributorship and agency** – have the more traditional forms of distributing goods or services. Under these, the principal is not allowed to exert the real control over the distributor or agent.
- **Franchising** differs from the distributorship and the agency in the sense that it allows the franchisor to exercise a higher degree of control over the franchisee.

27. What are the types of franchising? (R)

- Product Franchising
- Manufacturing Franchising
- Business-Format Franchising

28. What are the reasons for the buyer to merge? (R)

- To increase the value of the enterprise's stock.
- To increase the growth rate and make a good investment.
- To improve the stability of its earnings and sales.
- To balance, compete or diversify its product line.
- To reduce competition.

29. What are the reasons for the seller to merge? (R)

- To increase the value of the owner's stock and investment.
- To increase the growth rate.
- To acquire resources to stabilize resources.
- To benefit from the tax legislation.
- To deal with top management succession problem.

30. List down the types if Mergers & Acquisitions (M & A) (Az)

- Horizontal M & A
- Vertical M & A
- Concentric M & A
- Conglomerate M & A

31. What is diversification? (R)

- Diversification is evolved to overcome the limitations of business growth through expansion
- Diversification may be defined as a process of adding more products/markets/services to the existing one.
- Diversification helps an enterprise make more effective use of its resources.

32. What are the types of diversification? (R)

- Horizontal Diversification
- Vertical Diversification
- Concentric Diversification, and
- Conglomerate Diversification

33. Discuss the various triggers to make joint ventures effective and successful. (C)

- Technology
- Geography
- Regulation
- Sharing of Risk and Capital
- Intellectual Exchange

PART B QUESTIONS

UNIT I - ENTREPRENEURSHIP

1. What is entrepreneurship? Distinguish between entrepreneur and entrepreneurship. **(R)**
2. Determine the various functions performed by entrepreneurs. **(E)**
3. Explain the salient characteristics of successful entrepreneurs. **(E)**
4. Who is an intrapreneur? How intrapreneur differs from an entrepreneur? **(R)**
5. Elaborate the various charms people found in becoming entrepreneurs. **(C)**
6. Classify the types of entrepreneurs. Which one do you think most suitable for India? **(Az)**
7. Outline an essay on the growth of entrepreneurship in India. **(U)**
8. Summarize the evolution and growth of industrial entrepreneurship in India. **(U)**
9. What is the meaning of social entrepreneur? Explain with examples how social entrepreneurs benefit society and humanity at large. **(R)**
10. What factors do influence the emergence and development of entrepreneurship? **(R)**
11. Explain the role of Government in promoting entrepreneurship in India. **(U)**

UNIT II - MOTIVATION

1. Define entrepreneurial motivation. Discuss the major themes of entrepreneurial motivation. **(R)**
2. Infer how achievement motivation can be developed? **(U)**
3. What are the various factors motivating people to become entrepreneurs? **(R)**
4. Summarize the various exercises and games used for developing achievement motivation. **(U)**
5. Examine the need and objectives of Entrepreneurship Development Program (EDP) in India. **(Az)**
6. Classify the various phases involved in an EDP. **(U)**
7. Develop course content and curriculum of an EDP. **(A)**

UNIT III - BUSINESS

1. What is a micro enterprise? Justify the need for developing micro enterprises in our country. **(R)**
2. Interpret the various types of small scale industries. **(U)**
3. Elaborate the essentials, features and characteristics of small enterprises. **(C)**
4. Perceive the scope and objectives of micro enterprises. **(E)**
5. What do you mean by opportunity? Justify the need for and significance of opportunity identification and selection. **(R)**
6. Explain the various steps in setting up of a small business enterprise. **(U)**
7. What is the need and significance of the preparation of a project report for a small scale entrepreneur? Explain with example. **(R)**
8. Determine the essential elements of a good business plan. **(E)**
9. List out the various stages involved in formulation of a business plan. **(Az)**
10. Demonstrate the common errors made in writing a business plan that make it failure or poor. **(U)**
11. Recall how a project formulated? Give an overview. **(R)**
12. Justify the common errors made by the entrepreneurs in project formulation. **(E)**
13. What do you understand by project appraisal? Why is it done? **(R)**
14. Outline the need for and importance of project appraisal. **(U)**
15. Summarize the methods of project appraisal used to appreciate a proposed proposal. **(U)**

UNIT IV – FINANCING AND ACCOUNTING

1. Demonstrate the need for finance in a business enterprise. What are the various sources available to a small scale enterprise to raise funds? **(U)**
2. Classify the various sources used for raising term-loans for an enterprise. **(U)**
3. Define capital structure. What factors do determine the optimum capital structure? **(R)**

4. Influence the need for institutional finance for small enterprises. Which are the institutions providing institutional finance to small enterprises / entrepreneurs? **(E)**
5. Justify the need for institutional support to small scale industries. **(E)**
6. Define industrial estates. Appreciate the need for industrial estates and given an account of performance and problems of industrial estates in India. **(R)**
7. Determine the various tax benefits available to small scale entrepreneurs in our country. **(E)**
8. What is meant by the term 'working capital?' Distinguish between gross working capital and net working capital. Are the two concepts exclusive? **(R)**
9. What are the major determinants of working capital requirements of a small scale enterprise? **(R)**
10. 'Working capital is the lifeblood of an enterprise'. In the light of above statement appreciate the importance of working capital for successful functioning of a small enterprise. **(E)**
11. Outline the provisions of sales tax for entrepreneurs. **(U)**
12. Demonstrate the various excise duty provisions for small scale industries. **(U)**

UNIT V – SUPPORT TO ENTREPRENEURS

1. Define industrial sickness with special reference to small scale industry. Enumerate the signals and symptoms of industrial sickness. **(R)**
2. Relate the magnitude of sickness in small scale sector in India. **(U)**
3. What remedial measures do you think necessary to arrest the growing sickness in small scale industries in India? **(R)**
4. Determine the various causes and consequences of industrial sickness in India. **(E)**
5. Interpret the need for policy support to small scale enterprises. Give a

resume of government policy towards small scale industries through the different industrial policy resolutions (IPR). **(E)**

6. Examine the salient features of MSMED act, 2006. **(Az)**

7. “The main objective of various industrial policies of the Government of India has been to protect, develop and promote micro and small enterprises in the country.” Justify **(E)**

8. What are the various types of growth strategies adopted by business firms? **(R)**

9. Explain with short notes on: **(E)**

- Expansion
- Diversification
- Joint Ventures
- Merger and Acquisition
- Sub-contracting
- Franchising

ASSIGNMENT QUESTIONS

1. Interview five individuals who considered becoming entrepreneurs. What steps they took toward becoming entrepreneur and what obstacles they felt stood in their way. **(A)**

2. You are thinking about becoming an entrepreneur but need to understand whether you have the skills to start up a business on your own, or whether you should create a team with broader skills. Experiment a self-analysis of your current skills and either devise a personal development plan to gain the additional skills you might need to start a new venture, or indicate the skills you need in additional team members. **(A)**

3. What do you understand by Venture Capital? Mention its objectives. What is the Government of India’s Guidelines for the venture capital companies in the country? **(R)**