

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

***Subject: - Propagation and Antenna (EX653)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Derive a relation for the field intensity for the array of two elements isotropic radiators in various conditions. Show the condition for broad side and end fire array with necessary diagrams. [5+6]
2. Explain any five parameters of antenna. [5]
3. Compare Yagi antenna with log periodic antenna. Explain the working principle and design of log-periodic antenna. [2+8]
4. A parabolic reflector antenna having antenna efficiency 85% is designed for 3 GHz resonant frequency with 2.5 dB waveguide loss. Find out the antenna diameter if effective isotropic radiated power (EIRP) is calculated 46 dBW and transmitting power is 500 W. [8]
5. Write down the factors which affect the space wave communication. Explain the major characteristics of MW and SW radio propagation. [5+6]
6. With a mathematical relation of refractive index of ionospheric layer derive a relation of critical frequency and maximum usable frequency (MUF) of radio waves with necessary explanation. Consider the earth is not curved. [8]
7. How do you get Friis transmission equation and path loss in case of free space wave propagation? [4+3]
8. Explain the working principle and design of (a) Marconi antenna (b) Rhombic antenna. [5+5]
9. Explain the construction, light propagation mechanism and application of different types of optical fiber. [10]

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1. Define antenna. Describe the operation of infinitesimal dipole with the help of mathematical relations and the field pattern. [2+8]
2. Explain the following antenna parameters: [2+2]
  - a) Half Power Beamwidth
  - b) Directivity
3. State the principle of pattern multiplication. Use the principle to obtain a wave pattern for array of two short dipoles for following cases where (d) = dipole separation and ( $\alpha$ ) = current phase difference. [2+3+3]
  - a) Dipoles aligned perpendicular to the array axis with  $d = \lambda/2$ ,  $\alpha = 0$
  - b) Dipoles aligned perpendicular to the array axis with  $d = \lambda/2$ ,  $\alpha = \pi$
4. Explain the working principle of Rhombic antenna. [4]
5. Derive the relation for flare angle and length of a pyramidal horn antenna. [5]
6. Explain the construction, working principle and design feature of Log Periodic Antenna. [10]
7. With a neat diagram, explain the designation of radio waves according to the path they follow during propagation. Also, compare the propagation characteristics for different radio bands. [4+6]
8. a) Describe knife edge diffraction phenomenon. [5]  
b) Explain the effect of space wave propagation on the ground of plane and actual earth. [5]
9. Where are optical fibres most widely used? Explain the various advantages and disadvantages of optical fibers over metal wire communication. [10]
10. What is an acceptance angle? Derive an expression to calculate the acceptance angle. [2+7]

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Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Propagation and Antenna (EX653)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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- ✓ Assume suitable data if necessary.

1. Explain the characteristics of  $\lambda/2$ ,  $\lambda$  and  $1.28\lambda$  length dipoles where  $\lambda$  is the wavelength of operating frequency. [6]
2. Explain the mechanism by which the electric line of forces are detached from the dipole antenna to form the free space waves. [4]
3. Explain the following antenna parameters; (a) Antenna efficiency (b) Polarization. [4]
4. Define antenna arrays and also derive a mathematical expression for the array of two element isotropic radiators. [6]
5. Explain the construction, working principle and design of an Yagi antenna. [10]
6. Explain the fundamentals as well as importance of ground and ground system construction in vertical monopole antenna. [8]
7. In case of radio wave propagation define surface, ground reflected, direct and sky waves. Also, compare the propagation characteristics of different bands of radio frequencies. [4+8]
8. Derive an expression for the path loss in case of radio wave propagation. [12]
9. Explain the advantages and disadvantages of optical fibre communication over the metallic wire communication system. [12]
10. Explain the dispersion and attenuation properties of an optical fibre. [6]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Communication System I (EX652)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Differentiate between noise and interference. What are the limitations posed by them in communication system? [3+3]
2. Define linear time invariant system. What is the significance of such system in communication engineering? [2+3]
3. List out any three the properties of autocorrelation function. Mention the autocorrelation function of white noise. [3+3]
4. How is SSB different from conventional full carrier AM? Describe how ring modulator can be used to generate DSB-SC. [2+5]
5. What is vestigial side band modulation? What is the motivation behind using VSB? Why is VSB suitable for television transmission? [2+2+2]
6. The amplitude modulated signal is given by  $x(t) = 50 \cos(2\pi \times 10^6 t) + 15 \cos(2\pi \times 10^6 t) \cos(2\pi \times 10^3 t) + 20 \cos(2\pi \times 10^6 t) \cos(4\pi \times 10^2 t)$ . [3+2+2]
  - a) Draw the spectrum.
  - b) Find the total modulated power.
  - c) Find the net modulation index.
7. Explain envelope detector. Include in your explanation how the values of capacitor and resistors be chosen so that the output of detector is the envelope of the signal as its input. [6]
8. How can synchronous demodulator be used to detect DSB-SC wave? Explain mathematically, the effects of phase error and frequency error in local oscillator while demodulating DSB-SC. [3+3]
9. How is the spectrum of Narrow band FM similar to and different from the spectrum of conventional AM? Explain how NBFM is generated by using Armstrong's method. [2+5]
10. Explain with necessary mathematical relations, the demodulation of FM wave using non-synchronous method. [6]
11. What are the requirements for a good radio receiver? Explain the operation of a superheterodyne receiver. [3+5]
12. Write short notes on: [5+5]
  - a) FDM Telephone Hierarchy
  - b) Distortionless Transmission

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Communication System I (EX652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define modulation and explain the reasons for modulation. Compare noise, distortion and interference. [2+4]
- b) Differentiate between energy spectral density function and power spectral density function. Derive the expression of power spectral density function of a arbitrary signal  $z(t)$  [2+6]
2. a) Compare various types of AM systems in terms of transmission power and transmission bandwidth. Explain any one method generating DSB-FC AM. [2+4]
- b) Given the modulated wave,  $u(t)=[20+2\cos 3000\pi t+10\cos 6000\pi t] \cos 2\pi f_c t$  where  $f_c=10^5$  Hz. [2×4]
  - i) Sketch the spectrum of the signal
  - ii) Find power contained in each frequency component
  - iii) Calculate efficiency
  - iv) Transmission bandwidth of the system
3. a) Derive the expression for SSB wave modulated by a low pass signal  $m(t)$ . [6]
- b) What is the limitation of square law detector for DSB-AM detection? Explain the operation of envelope detector with required diagrams and conditions. [2+6]
4. a) Derive the expression for signal tone modulated FM signal in term of Bessel coefficients. [6]
- b) Explain the role of amplitude limiter used in limiter discriminator method. Prove that PLL can be used as FM demodulator. [2+6]
5. a) Why pre-emphasis and de-emphasis circuits are required in commercial FM broadcasting? Explain the functional block diagram of stereo encoder. [2+4]
- b) In an FM system a baseband signal band limited to 10 KHZ modulates 100 MHZ carrier wave so that the frequency deviation is 75 KHZ. [4+4]
 

Find:

  - i) Carrier frequency swing in the FM signal and modulation index
  - ii) The practical bandwidth of the fm signal
6. Short notes on: (any two) [2×5]
  - i) Distortionless Transmission
  - ii) Frequency Division Multiplexing (FDM)
  - iii) Superhetrodyne Receiver

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Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Communication System I (EX652)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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- ✓ Assume suitable data if necessary.

1. What are the main components of analog communication system? Describe briefly about each component. Find the transfer function for distortionless system. [2+5+3]
2. Define energy and power spectral density functions. Find power spectral density and average power for the periodic signal defined by  $g(t) = A \cos(2\pi f_c t + \theta)$ . [4+6]
3. What do you understand by modulation? Why modulation is needed? Find the time and frequency domain expressions for standard AM wave for single tone message signal. [2+2+6]
4. An AM wave is represented by  $S_{AM}(t) = 10 (1 + 0.8 \cos 25132.74t) \cos (9424777.96t)$  volts. [2×5]

Find:

- i) Amplitude of all frequency components
  - ii) Modulation index
  - iii) Maximum and minimum amplitude of AM wave
  - iv) Bandwidth of the signal
  - v) Power spectrum of the modulated signal.
5. Describe how envelope detector can be used for demodulation of standard AM wave. Explain why DSB-SC and SSB can not be demodulated using envelop detector. [6+4]
  6. Find the time domain expression for signal tone FM modulated wave, in terms of Bessel coefficients. Derive the expression for estimating practical bandwidth of a FM signal. [6+4]
  7. A sinusoidal modulating signal  $m(t) = 5 \cos 18849.55t$  is applied to an FM modulator that has a frequency sensitivity of 9KHz/V. The amplitude of the carrier is 25V and the frequency is 88.7Mhz. Compute: [2×5]
    - i) Peak frequency deviation
    - ii) Modulation index
    - iii) Frequency swing
    - iv) Carson's bandwidth and
    - v) Total power delivered in  $10\Omega$  resistor.
  8. Describe the principle of frequency division multiplexing (FDM) with its standard hierarchy in telephony system. [4+6]

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Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:-** Communication Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt All questions.
  - ✓ The figures in the margin indicate Full Marks.
  - ✓ Assume suitable data if necessary.
1. Draw and explain the functional block diagram of analog communication system. Define modulation and justify its use in communications. (4+4+2)
  2. Express the single side-band modulated signal in-terms of the band-limited modulating signal  $m(t)$  and its Hilbert transformation. Briefly discuss filtering method of generating SSB signal. (6+4)
  3. Differentiate between FDM and TDM. Draw spectral details and explain various standard groups of FDM telephone hierarchy. (4+6)
  4. With examples, differentiate between distortion, noise and interference. Briefly explain any four types of noise encountered in communication. (6+4)
  5. Evaluate the maximum data rate that can be transmitted error free through a channel with a bandwidth of 1 Mhz and a minimum of 10 dB SNR at the input of the channel decoder. (10)
  6. Define information. Derive the expression for evaluating the average amount of information contained in a statistically independent long sequence of symbols. (4+6)
  7. Derive the expression for the impulse response of a matched filter for an arbitrary input signal  $z(t)$ . (10)
  8. Write short notes on: (5+5)
    - a) Threshold effect in FM
    - b) Convolutional coding

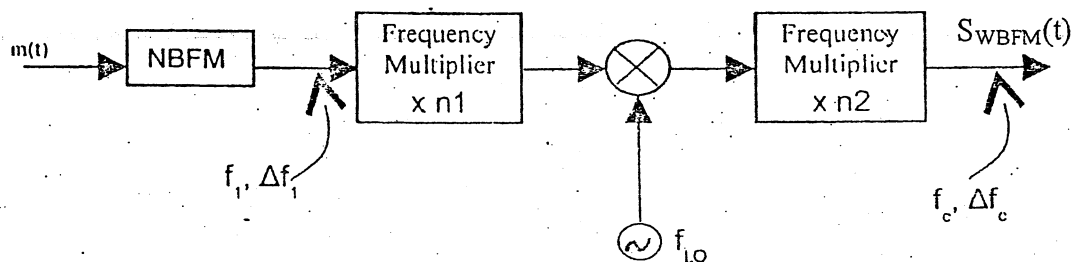
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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Communication System I**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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- What major elements does a communication system contains? "Communication over long distance is impossible without modulation. Modulation is must to mitigate several constraints in transmission." Justify. [4+4]
- Define Band pass signal and Band Limited signal with example. Write the properties of LTI system. [4+4]
- Derive the expression for double side band full carrier amplitude wave where the message contains a single tone frequency component. Also find the expression for modulation index. [6+2]
- Determine the percentage power saving of SSB modulated wave for modulation depth equal to: (i) 100%, and (ii) 50%. [4+4]
- Explain the effect of phase and frequency error in local oscillator in demodulating DSB and SSB using PLL. [8]
- Express the sinusoidal angle modulated wave in terms of Bessel function,  $J_n(\beta)$  of first kind of order  $n$  and argument  $\beta$ . [8]
- For the following Armstrong FM transmitter, compute maximum frequency deviation and the carrier frequency  $f_c$  if,  $f_1 = 200\text{kHz}$ ,  $f_{LO} = 10.8\text{MHz}$ ,  $\Delta f_1 = 24\text{Hz}$ ,  $n_1 = 65$  and  $n_2 = 50$ . [8]



- Define white noise with PSDF and auto correlation function. State the properties of auto correlation function. [4+4]
- Explain any one method of demodulating DPSK signal. [8]
- Write short notes on: [2×4]
  - Filter and oscillator requirement in FDM
  - Satellite Communication

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**Subject: - Communication Systems I**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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- ✓ Assume suitable data if necessary.

1. Define modulation. Explain the reasons for modulation. Draw the functional block diagram of analog communication system and briefly explain each block. (2+4+4)
2. Derive the equation for Single Side-Band modulated signal in terms of Hilbert Transformation of modulating signal  $m(t)$ . Briefly discuss any one method of generating SSB signal. (6+4)
3. A harmonic signal  $m(t) = 20 \cos(2\pi 2000 t)$ , Volt is used to frequency modulate the carrier signal  $c(t) = 50 \cos(2\pi 10^7 t)$ , Volt. Assuming the frequency sensitivity of the frequency modulator to be 200 Hz/Volt, calculate: (2.5×4=10)
  - a) peak frequency deviation
  - b) modulation index
  - c) bandwidth of modulated signal for over 98% of FM power
  - d) total modulated signal power
4. Define energy spectrum and power spectrum density functions. Briefly explain the operation of analog spectrum analyzer. (4+6)
5. With functional block diagrams and spectral details, explain the operation of stereo encoder and decoder. (5+5)
6. Define FDM. Explain FDM hierarchy used in telephony. (4+6)
7. Define unipolar, polar, bi-polar, unipolar RZ and Manchester line codes (5×2=10)
8. Write short notes on: (5+5)
  - a) Autocorrelation function and its properties
  - b) Phase Locked Loop

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**Subject: - Communication System I**

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1. Define with examples periodic and non-periodic signals. Prove that for a linear time invariant system, the output is the convolution of the input and the impulse response of the system. (4+6)
2. State and explain the following properties of Fourier Transform: (2x5)
  - a) Modulation
  - b) Duality (symmetry)
  - c) Time shifting
  - d) Scaling
  - e) Convolution
3. Define Amplitude Modulation. With block diagram and necessary derivations, show that switching modulator can be used to generate Double Sideband Full Carrier AM signal. (2+8)
4. Derive the expression for the USB – SSB signal in terms of the carrier  $c(t) = A_c \cos(\omega_c t)$  and a random band limited signal  $m(t)$ . (10)
5. A modulated signal has the expression: (2x5)
 
$$Z(t) = 50 \cos \{98.6 \times 10^6 \times 2\pi t + 15 \sin (2 \times 10^3 \times 2\pi t)\}, \text{ volts}$$
 Determine: a) type of modulation, b) frequency deviation, c) frequency sensitivity of the modulator d) modulation index and e) power delivered to a 50 Ohms impedance transmitting antenna.
6. With block diagram and necessary derivations, prove that PLL can be used to demodulated FM signal. (10)
7. Derive the expression for power spectral density function (psdf) for a power type signal. Give the interpretation of psdf. (6+4)
8. Write notes on: (5+5)
  - a) FDM telephone hierarchy
  - b) Analog spectrum analyzer

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1. Define energy type and power type signals. Find whether the signal  $x(t) = A\cos 2\pi ft$  is energy type or power type signal. [2+6]
2. Show how can a square law modulator be used to generate DSB-AM signal, explain with neat diagrams. What are the basic characteristics of DSB-AM? [6+2]
3. Explain the working principle of the super heterodyne AM receiver with the help of block diagram. Why standard AM is used in AM radio broadcasting? [6+2]
4. Show that the output of the balanced modulator is DSB-SC modulated wave. Draw DSB-SC modulated wave for sinusoidal modulating signal. [6+2]
5. How can you generate FM wave using Armstrong modulator (Indirect method)? Explain with the help of block diagram. Why pre-emphasis and de-emphasis networks are used in FM? [6+2]
6. A modulating signal  $m(t) = 3\cos(2000t)$  modulates the carrier signal  $c(t) = 9\cos(70000t)$  to produce the modulated signal  $s(t) = 9\cos(70000t + 16\sin 2000t)$ . Calculate: the total modulated signal power, modulation index, peak frequency deviation and the bandwidth of modulated signal. [2+2+2+2]
7. Explain stereo FM transmitter and receiver with the help of block diagrams. If mono FM receiver is used to receive the signal from stereo FM transmitter, what will be the output of FM receiver? Explain. [6+2]
8. Explain the working principle of Analog spectrum analyzer with the help of block diagrams. [8]
9. Explain ASK and FSK modulators and demodulators with the help of block diagrams. Can PSK wave be detected using envelope detector? Explain. [6+2]
10. Write notes on: [4+4]
  - a) FDM in Telephony
  - b) Phase Modulation

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**Subject: - Communication System I**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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- 1a) Explain how can you classify systems according to their basic properties. Show that an ideal LPF is non-casual. (4+4)
- b) Explain in detail with a neat functional block diagram of a superheterodyne receiver used in a commercial standard AM radio. Why Standard AM is used in AM radio broadcasting? (6+2)
- 2a) Show how can a ring modulator be used to generate DSB-SC signal, explain with neat diagrams. What are the basic characteristics of DSB-SC? (5+3)
- b) Explain how frequency modulated signals can be generated by direct method using a varactor diode. What are the disadvantages of such a method? (6+2)
- 3a) Why do we use shift keying technique in communication system? Distinguish between ASK, FSK and PSK. (3+5)
- b) Show how DSB-AM signal can be detected using an envelope detector in details. Why envelope detector cannot be used to demodulate DSB-SC wave? (5+3)
- 4a) Derive a general expression for an energy spectral density of an energy signal with an example of an ideal BPF. Mention basic properties of the energy spectral density. (5+3)
- b) A low frequency signal  $m(t)=2\cos(5000t)$  modulates the carrier signal  $c(t)=10\cos(100,000t)$  to produce the modulated signal  $u(t)=10\cos(100,000t+10\sin 5000t)$ . Calculate: the total modulated signal power; modulation index; peak frequency deviation; the bandwidth of modulated signal. (4×2).
- 5a) Discuss a block diagram of an analog communication system. Explain FDM system with neat diagrams, assuming three different message signals are to be transmitted simultaneously. (4+4)
- b) Show that PLL can be used to demodulate FM signal with a neat diagram. What are the basic uses of PLL? (6+2)

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INSTITUTE OF ENGINEERING  
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, B.Agr.	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Engineering Economics (CE655)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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- ✓ Assume suitable data if necessary.

- Scarcity is an emerging issue in engineering field. How does the study of economics help to engineers in decision making process? Discuss. [5]
- What is effective and nominal interest rate? Evaluate FW at the end of 10 years with 8% interest rate compounded continuously of a cash flow of Rs. 500 at the beginning of each year for first 5 years. [2+4]
- Initial Investment = Rs. 100,000 [6+5+5]  
Salvage Value = 0  
Annual O&M Cost = Rs. 20,000  
Useful Life = 5 years  
Annual Benefit = 60,000 at the end of first year, thereafter decreases by 4,000 each year for the remaining years.  
  - Draw U/B diagram.
  - Evaluate conventional BCR using PW formulation. Take salvage value = 10,000.
  - Evaluate Discounted Payback Period. Take standard (cut off) Payback Period = 3 years.
- Use IRR method to select best project. MARR = 12%. [8+4]

	A	B	C	D
Initial Investment	1100	1500	2750	2000
Annual Income	500	700	1200	950
Useful Life	4	4	4	4
Salvage Value	250	500	800	1000
MARR	15%			

Select the best combination if A, B and C are mutually exclusive.

- Explain about the reasons for replacement of asset. The Annual Equivalent Cost (AEC) of the defender and challenger are given in the table below. What is the best replacement strategy? Use MARR = 12%. The planning horizon of the project is 8 years. [4+8]

End of Year (n)	1	2	3	4	5	6
(AEC) <sub>D</sub>	5300	5250	5400	5750	6200	6550
(AEC) <sub>C</sub>	7700	6150	5700	5600	5675	5800

6. What are the sources of risk in engineering projects in Nepal? A real-state developer seeks to determine the most economical height for a new office building which will be sold after five years. The relevant net annual revenues and net resale values are as given below.

[4+8]

	Height	
	4 Floors	5 Floors
First Cost	125,000,000	200,000,000
Annual Revenues	19,910,000	37,815,000
Net Resale Value	200,000,000	300,000,000

The developer is uncertain about the interest rate  $i$  to use, but is certain that it is in the range of 5 to 30%. For each building height, find the range of values of  $i$  for which that building height is the most economical. Draw sensitivity diagram to support your answer.

7. An asset has installed value of 45,000.  $S_5 = 0$ . It is classed as a 5 year property. Determine approximate MACRS depreciation schedule. Over 6 years it is estimated to generate revenue of Rs. 23,000 per year with annual operating cost 7300. Required rate of return = 15% after tax. Tax rate = 40%. Evaluate after tax IRR with annual worth method.
8. The annual fuel cost required to operate a small solid waste treatment plant are projected to be Rs. 200000 without considering any future inflation. The best estimate indicates that the annual inflation free interest rate  $i'$  will be 6% and the general inflation rate,  $f$ , will be 5%. If the plant has the remaining useful life of four years, what is the present equivalent of its fuel costs? Use actual dollar analysis.

[6+6]

[5]

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**Subject: - Engineering Economics**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
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- ✓ Assume suitable data if necessary.

1. a) Differentiate between nominal and effective interest? Calculate both nominal and effective annual interest if you deposit now, Rs 1,00,000 and you can draw Rs 1000 per month for ever. [6]
- b) A machine cost Rs 20 million with no salvage value. Rs 8 million revenues per year can be gained. Given: useful life = 4 years. Tax rate = 50%, MARR = 10%. Use straight line depreciation method to evaluate (i) PW (ii) IRR [10]
2. a) Explain decision tree analysis. [6]
- b) Select the best project using IRR method. Useful life of all projects are 15 years. MARR = 10%. [10]

Particulars	Project A	Project B	Project C
Initial investment	7500,000	5500,000	4000,000
Annual revenue	960,000	720,000	600,000
Salvage value	7500,000	5500,000	4000,000

3. a) What are the drawbacks of IRR method? How does ERR method eliminates some of these drawbacks. [6]
- b) Perform cost variance analysis. [10]

	Standard (Rs)	Actual (Rs)
Production (Units)	9,000	8,000
Direct Labour (Hours)	72,000	60,000
Direct Labour cost (Rs.)	756,000	600,000
Fixed overhead cost (Rs.)	900,000	810,000
Variable overhead cost (Rs.)	684,000	630,000

4. a) Explain the methods for assessing risk/uncertainty. [6]
- b) Perform sensitivity analysis over a range of  $\pm 30\%$  in (i) initial investment (ii) annual net revenue (iii) useful life. [10]

Initial Investment = Rs. 100,000	Salvage value = Rs 10,000
Annual benefits = Rs 25,000	Annual expenses = Rs 3,000
Useful life = 10 years	MARR = 10%

Draw sensitivity diagram and interpret the result.



5. a) Evaluate the modified B/C ratio for the problem in Q 4(b). [6]

b) Select the best project. Required study period is 5 years. [10]

	Project P	Project Q
Initial Investment(Rs.)	5,00,000	3,50,000
Annual net revenue (Rs.)	2,00,000	1,75,000
Salvage value(Rs.)	50,000	35,000
Useful life (Years)	6	5
MARR	10%	10%

6. a) Define engineering economics. Explain capitalistic OR Socialistic economy. [6]

b) Evaluate ERR. MARR = 10% E=8% [8]

EOY	0	1	2	3	4	5
Cash inflow	-	+40,000	+150,00	+120,000	+800,000	+200,000
Cash outflow	-480,000	-80,000	-50,000	-500,000	-200,000	-400,000

c) What are the elements of cost? [2]

7. Write short notes: (any 4) [4×4]

- Sources of uncertainty
- Market research
- Continuous compounding
- Job and process costing
- Statistic approach to demand analysis

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, BEL BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Engineering Economics**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) "Engineers play the important role in making the economic decision". Do you agree with this statement? Discuss. [6]

- b) The information given below shows the records of a manufacturing company comparing the actual data with the data from the standard cost card. Calculate all the variances. Also indicate the favorable and adverse variances. [10]

	Production (Units)	Direct Material (Kg.)	Direct Material cost (Rs.)	Working Days	Fixed Overheads (Rs.)	Variable overheads (Rs.)
Standard	10	50	10000	12	5000	25000
Actual	8	45	9000	10	6000	20000

2. a) Mr. Kumar has inspected his yearly household expenses for the last 10 years. Cost averages were steady at Rs 100000 per year for the first 5 years, but have increased consistently by Rs 15000 per year for each of the last 5 years. Calculate total present worth in year zero. Use gradient formula. [8]

- b) Use discounted payback period method to select the best option: [8]

	Initial Investment	Annual Income	Useful Life	Salvage Value
Option A	Rs. 1000000	Rs 15000	10 yrs	Rs 20000
Option B	Rs 150000	Rs 20000	12 yrs	Rs 40000

3. a) Find the IRR of the following cash flow of a project. If MARR = 20%, comment on the acceptability of the project. Show investment balance diagram. [8]

End of Year	Net Cash flow in RS.
0	-20000
1	+8000
2	+17000
3	+19000
4	+18000
5	-10000

- b) Three mutually exclusive alternatives are to be compared by the rate of return method and are describe below. MARR is 10%. Salvage value is 20% of first cost. Which option has the highest IRR and what is it? Recommend the best alternative. [8]

	X	Y	Z
First cost, Rs.	70,000	60,000	100,000
Annual income, Rs.	15000	10000	18000
Economic life, years	8	8	8

4. a) The total purchase price of a three room set furniture is Rs. 50000. However after a down payment of Rs 10000, two year series end month payment of 2200 will have to be made. Determine the nominal and effective interest rate. [3+3]

- b) Find the acceptability of a project using both types of B/C ration. (Use AW method)

[10]

Initial investment = Rs. 180000	Annual Benefits = 53000 at the end of first year and decreases by Rs. 2000 each year
Annual Expenses = Rs. 16000	Salvage value = Rs. 40000
Useful life = 10 years	MARR = 10%

5. a) Select the best project from the following two projects. (Use Repeatability and PW method).

[8]

	Project A	Project B
Initial Cost (Rs)	150000	180000
Annual Expenses (Rs)	35000	31000
Annual Revenues (Rs)	8500	10500
Salvage Value (Rs)	50000	80000
Useful Life	6 years	9 years
MARR	15%	

- b) Two types of power converters, alpha and beta are under consideration for a specific application. An economic comparison is to be made at an interest rate of 12% and the following cost estimates have been obtained. Select the best option by calculating present worth of both the projects if it will be operated for 4 years only.

[8]

	Alpha	Beta
Purchase price Rs	750000	2000000
Annual operating cost, Rs.	200000	100000
Estimated service life, years	5	9
Salvage value, Rs.	0	400000

6. a) Following table shows the demand of meat when the price is shown in Rs. Make the hypothesized regression equation and find the consumption if the price is set to be Rs. 35 per kg.

[6]

SN	Price of meat per kg	Consumption in kg
1	25	80
2	38	70
3	28	78
4	30	73
5	27	78
6	40	68
7	42	65
8	32	74

- b) The purchase of a rental property is being considered in a neighborhood where real estate prices are increasing rapidly. The following estimates have been developed for a preliminary before-tax analysis:

[10]

First cost, Rs	Annual income from rent, Rs.	Annual Maintenance, Rs.	Investment Period	Resale value	MARR
140000	30000	7500	6 yrs	1,50,000	10%

Construct sensitivity chart for joint variation within a  $\pm 30\%$  range of annual income and MARR. Indicate the acceptance and rejection zones.

7. Write short notes on: (any four)

[4×4]

- Drawbacks of IRR method
- Capital recovery cost
- Decision tree analysis
- Declining balance method of depreciation
- Methods of demand analysis

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject - Engineering Economics**

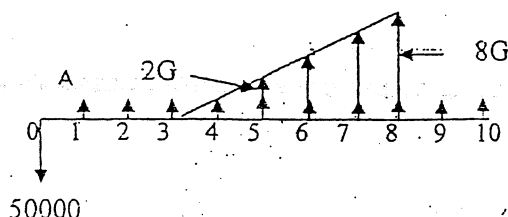
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define economic system. Write advantages of socialistic economy. [1+3]
- b) Explain overhead cost and opportunity cost. [4]
- c) The following information has been obtained from the records of a manufacturing company using standard costing system. [8]

	Estimated	Actual
Production Units	1	600
Cement (bags)	5	3,600
Cement Cost (Rs.)	3,500	2,16,000
Skilled Labour (mason) Days	2	900
Skilled Labour (mason) Cost Rs.	300 per day	325 per day
Fixed Overhead (Rs)	10,000	15,000

Find all the variances (Including all its components)

2. a) Mr. Basnet purchases a car which cost Rs. 20,00,000. He pays 40% as down payment. Remaining amount will be paid on installment basis and wishes to pay Rs. 25,000 per month for next five years. What annual interest rate will he be paying? At the end of 3rd year, what lump sum amount should he pay to clear all his dues? [4+4]
- b) Find the value of A and G if  $i = 10\%$ .  $A = 3G$  [8]



3. a) Describe any two drawbacks of IRR. [4]
- b) Use ERR method to evaluate the project with following cash flow.  $MARR = e = 10\%$ . [6]

Year	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
Cash flow	-8,00,000	2,00,000	2,00,000	-50,000	4,00,000	4,00,000

- c) A preliminary estimate of a multipurpose hydropower project produced the following data. [6]

Initial Investment	Annual Power sales	Annual irrigation benefit	Annual recreational benefit	Annual operation and maintenance	Life of the project	Salvage value
Rs. 50 crore	Rs. 8 crore	Rs. 1 crore	Rs. 2 Crore	Rs. 1.5 crore	50 yrs	Rs. 40 crore

Give your suggestion to the government about the implementation of the project. Take  $MARR = 8\%$ .

4. a) Recommend which one is best out of the following three mutually exclusive projects. Study period is 10 years-MARR = 12%. [8]

Project	A	B	C
Initial Investment	5,00,000	6,00,000	7,00,000
Annual Revenues	1,50,000	1,50,000	1,70,000
Annual cost	25,000	25,000	25,000
Salvage value	1,00,000	1,00,000	70,000
Useful life	4	6	8

- b) Define capitalized worth. How much money should Mr X should deposit now in a bank which gives 12% interest annually, so that he can draw (i) Rs 3000 per month plus Rs. 20,000 annually and Rs. 50,000 in every five years for infinite period. [2+6]
5. a) Explain mutually exclusive and independent projects. [4]
- b) Select the best alternative using incremental IRR methods. Useful life is 10 years and salvage value is 25% of initial investment. MARR = 10%. [12]

Project	A	B	C	D
Initial Investment	600	500	800	700
Annual Revenues	150	125	175	160
Annual Cost	40	25	30	35

6. a) What will be the impact of change in value of present worth of the following project if changes occurs in (i) initial investment (ii) net annual income and (iii) Useful life by  $\pm 25\%$ ? Draw necessary graph also. [10]

Initial Investment	Rs. 4,00,000
Net Annual income	Rs. 60,000
Useful life	12 years
MARR	15%

- b) Based on the following data, forecast the demand of CFL for next five years. [6]

Year	2007	2008	2009	2010
Demand (Nos.)	1,00,000	1,25,000	2,00,000	3,00,000

7. Write short notes on: (any four) [4×4]

- Taxation system in Nepal
- Methods of calculating depreciation
- Decision tree analysis
- Market Research
- Factors affecting demand

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Engineering Economics**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain the terms, socialistic economy and cash flow diagram. [4]

b) In the standard card, it is observed that one unit of product 'X', requires fixed overhead of 2 hrs at the rate of Rs. 15/hr. During the month of February, 800 units are produced at the actual fixed overhead of Rs. 18/hr in 1800 hours. Budgeted fixed overhead is Rs. 30,000. Perform cost variance analysis. [6]

c) Evaluate both type of B/C ratio using PW. [6]

Initial cost = Rs. 25 lakh  
Salvage value = Rs. 5 lakh  
Useful life = 10 years  
Annual benefits = Rs. 10 lakh  
Annual O & M = Rs. 5 lakh  
MARR = 8%

2. a) Explain incremental analysis or break-even analysis. [4]

b) Select the best project using, ERR method. MARR = 18%. E = 12%. [8]

Year	0	1	2	3	4	5
Project A	-40,000	-38,000	+35,000	+35,000	+35,000	+35,000
Project B	-60,000	+25,000	+40,000	-50,000	+50,000	+75,000

c) Fixed cost = Rs. 60 million, Variable cost/unit = Rs. 50,000, Selling price/unit = Rs. 8,000. Find BEP volume. What would be the effect on profit/loss when  $S_p$  increases by 20%. [4]

3. a) How much money should Mr Ram deposit now in a bank so that he and his successor can draw Rs 5000 bimonthly for infinite period? Interest rate is 12 % per year. [6]

b) Select the best combination of the project where A is independent and B is contingent on C. [10]

Project	A	B	C
Initial Investment	40,000	70,000	50,000
Annual Revenues	15,000	20,000	20000
Annual cost	2,500	3,500	0
Useful life (Yrs.)	8	8	8

The Investment is limited to Rs. 120,000. MARR = 10%.

4. a) Panchakanya has recorded the sales of its products in different years as below. Forecast the sales for year 2020. [8]

Year	2001	2002	2003	2004	2005	2006	2007
Sales (Rs. in Million)	500	550	575	675	650	700	780

- b) Write short notes on any two: [2×4]

- Advantages of Payback Period
- Depreciation Methods
- Job and Process Costing

5. a) Explain repeatability and cotermination assumptions. [8]

b)

Project	Initial Investment (NRs.)	Annual Revenue (NRs.)	Annual Expenses (NRs.)	Salvage Value	N	MARR
P	5000	3000	2000	1000	8 year	12%
Q	3500	2000	800	350	4 year	12%

Select the best (i) if study period is 10 years (ii) using capitalized worth method. [8]

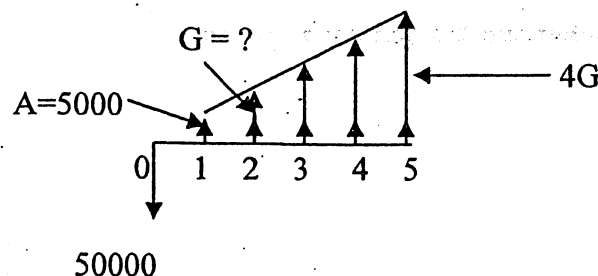
6. a) Explain tax and depreciation or decision tree. [4]

- b) A machine costs Rs. 20 million and expect to save Rs. 4 million/year, Tax rate = 50%, MARR = 10%. Evaluate the PW. [4]

- c) Perform sensitivity analysis over  $\pm 30\%$  is initial cost and useful life. Draw sensitivity diagram and interpret the result for the problem no 1(c). [8]

7. a) Define 'Capital Recovery Cost'. Mr. Fox purchased a motorbike which cost Rs. 2,00,000. He pays 30% as down payment. Remaining amount will be paid on installment basis and wishes to pay Rs. 10,000 per month for 20 months. What annual interest rate is he paying? [2+6]

- b) Find the value of G if  $i = 10\%$  [8]



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Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Engineering Economics**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Take MARR = 10% if not specified.
- ✓ Draw necessary cash flow diagrams.
- ✓ Assume suitable data if necessary.

1. Select the best project.

[16]

	Project A	Project B
Initial investment (Rs.)	3,50,000	5,00,000
Annual revenues (Rs.)	1,90,000	2,50,000
Annual expenses (Rs.)	64,500	1,38,000
Useful life (years)	4	8
Salvage value at the end of useful life	0	0

Use

- a) Repeatability assumption
- b) Study period is 4 years
- c) Infinite project life

2. a) Recommend the best using ERR' method
- $\epsilon = 20\%$

[12]

ERR	Project	End of the cash flows (in Rs. '000)						
		0	1	2	3	4	5	6
28.3%	A	-640	262	290	302	310	310	260
26.4%	B	-680	-40	392	380	380	380	380
28.5%	C	-755	205	406	400	390	390	324

- b) Recommend the best using payback period for the problem no. 2(a).

[4]

3. a) Explain the mutually exclusive project, independent projects and contingent with suitable examples.

[6]

- b) Forecast the sales for year 2010.

[10]

Year	2000	2001	2002	2003	2004	2005	2006	2007
Sales Rs. '000	416	287	307	268	378	523	457	587

4. a) Calculate variance for the following:

[8]

	Standard	Actual
Production units	9,300	10,500
Direct labour hours	102,300	136,500
Fixed overhead (Rs.)	21,483,000	28,392,000
Variable overhead (Rs.)	15,345,000	17,199,000

- b) Perform sensitivity analysis over  $\pm 30\%$  (varying in increment of 10%) in (i) initial investment (ii) annual net revenue (iii) useful life. Draw sensitivity diagram and interpret the result. [8]

Initial investment = Rs. 20,000

Useful life = 10 years

Revenues/Year = Rs. 6,000

Expenses/Year = Rs. 2,000

5. a) Find the required annual receipts 'A' for the following investment proposal:- [8]

Initial investment = Rs. 10,00,000

Salvage value = Rs. 1,00,000

O & M expenses/year = Rs. 50,000

End of year	1	2	3	4	5
Benefits	A+70,000	A+80,000	A+90,000	A+100,000	A+110,000

- b) Find the modified B/C ratio for the problem no. 5(a) [8]

6. a) Explain the economic system. [8]

- b) Find IRR and show the unrecovered investment balance in the graphical and tabular form. [8]

Investment (First) Cost = Rs. 2,50,000

Revenues/Year = Rs. 1,00,000

Expenses/Year = Rs. 30,000

Salvage Value = Rs. 50,000

Useful life = 5 years

7. a) Explain the uncertainty and its sources. Differentiate between nominal interest rate and effective interest rate. If monthly interest rate is 1%, what will be the quarterly interest rate? [4+4]

- b) Explain tax and depreciation with suitable examples. Find BEP volume for the following project: [4+4]

Fixed cost = Rs. 24 lakh

Selling price = Rs. 800 per unit

Variable cost = Rs. 500 per unit

What would be effect on BEP, when fixed cost increases by 10% and variable decreases by 20%?

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04 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2065 Chaitra

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Engineering Economics**

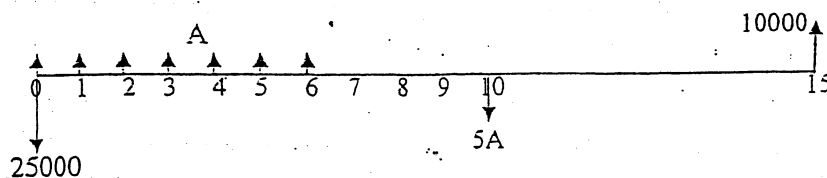
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define economic system. Discuss briefly on the characteristics of capitalistic economy. [2+2]
- ✓ b) What are the elements of cost? Discuss briefly on the prime cost and overhead costs. [2+2]
- c) The following information has been obtained from the records of a manufacturing company using standard costing system [8]

	Standard	Actual
Production (Unit)	3000	2500
Working days	27	25
Fixed overhead variance	14000	12500
Variable overhead variance	10000	11000

Find all the variances (Including all its components).

2. a) Find the value of A if  $i = 15\%$  [8]



- b) Mr. X receives a loan of Rs 120,000 from a bank at an interest rate of 12 % per year.
  - i) He wishes to repay the loan in monthly installment with Rs. 3000 per month. How many installments are necessary to complete his payment? [4]
  - ii) What annual interest rate is he paying if the Bank asks him to pay Rs 5000 per month for 30 times. [4]
3. a) A construction company needs an equipment which costs Rs 10,00,000 and has salvage value of Rs. 1,00,000 at the end of 10 years. The equipment supplier is also willing to provide the equipment on hire for Rs 1,25,000 per year for 10 years. What will you do? Purchase or Hire. MARR = 12% [6]
- b) Find IRR of the following project with initial investment of the Rs 5,00,000 and Salvage value of Rs 1,00,000 at the end of 5 year. The Annual benefit and Operation and Maintenance cost are as following. [10]

End of Year	Benefit	Operation and Maintenance
1	105000	5000
2	115000	10000
3	125000	15000
4	135000	20000
5	145000	25000

Draw unrecovered investment balance diagram also

Created with

4. a) From the following four mutually exclusive projects recommend the best one using Payback Period, ERR and BCR methods. The study period is 5 years and  $MARR = e = 15\%$ . [16]

Project	A	B	C	D
Initial investment	500000	400000	700000	600000
Net annual revenue	125000	110000	170000	135000

Salvage Value is 20 % of the initial investment.

5. a) What is breakeven value? Discuss with suitable example. [6]  
 b) Nepal Airlines is planning to purchase a Jet plane. The estimate on two types of plane under consideration are; [10]

Project	Plane A	Plane B
First investment cost	25,00,00,000	30,00,00,000
Annual O & M	1,50,00,000	1,00,00,000
Useful Life	4 years	6 years
Salvage value	5,00,00,000	6,00,00,000
MARR = 12 %		

Which plane is the best one if it is believed that the plane will be used for i) 4 years and ii) infinite period?

6. a) Define the concept of certainty, Uncertainty and Risk. [4]  
 b) Perform sensitivity analysis of a following project over a range of  $\pm 30\%$  in i) Initial investment ii) Net annual cash flow using annual worth formulation. [6]

Initial Cost	Rs. 5,00,000
Annual revenue	Rs. 75,000
Annual maintenance cost	Rs. 10,000
Useful life	10 years
Salvage value	Rs. 50,000
MARR	10%

- c) Following data shows the demands for fish when the prices are as shown. Calculate the hypothesized regression equation. What shall be the demand if the price is set to be Rs. 60 per kg? [6]

S.N	Price per kg.	Quantity (tones.)	S.N	Price per Kg.	Quantity (tones.)
1	64	65	5	82	51
2	53	75	6	59	65
3	67	56	7	67	63
4	52	69	8	71	55

7. Write short notes on any four [4x4]  
 a) Job and process costing  
 b) Drawbacks of IRR  
 c) Depreciation  
 d) Factors affecting demand  
 e) Methods of demand analysis

21 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Signal Analysis (EX6541)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define energy and power signal with examples. Describe time shifting, time scaling of a signal. (7) [3+4]
2. Derive convolution integral for continuous time LTI system. (3) [8]
3. State and prove Parseval's Relation for Continuous Time Periodic Signal. (5) [6]
4. Explain aliasing that may occur in any arbitrary band-limited signal  $x(t)$  with band-width 'W'. (3) [5]
5. Derive the expression for continuous time Fourier series in exponential form. (7) [7]
6. Explain the convolution properties of continuous time Fourier transform. (6) [6]
7. Discuss the following properties of continuous time Fourier series. (a) Time shifting (b) Time scaling (c) Conjunction. (6) [6]
8. Derive the expression of Fourier transform for continuous time signal. (7) [8]
9. Derive the expression for impulse response of ideal low pass filter and discuss. (5) [5]
10. Find the Fourier Transform of a continuous time unit step signal. (4) [5]
11. Discuss different methods to reconstruct a signal. Determine the Nyquist rate for a continuous time signal  $x(t) = \frac{1}{2\pi} \cos(200\pi t) \cos(300\pi t)$ . (6) [4+4]
12. Convolve the signals  $x[n] = \{1, 2, 1\}$  and  $h[n] = \{1, 2, 3, 1\}$ . (6) [6]
13. If the signal is periodic, find the fundamental period of the signal  $x[n] = \cos\left(\frac{\pi}{2}n\right) \cdot \cos\left(\frac{\pi}{4}n\right)$ . (3) [3]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BEL	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Signal Analysis (EX651)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Find the energy and power of the signal  $x[n] = e^{j\omega n} u[n]$ .  $u[n]$  is unit step function. What is the period of signal  $x[n] = \cos\left(\frac{41\pi}{7}n\right)$ ? [6]
2. Plot the signal  $x(t) = t(u(t+3) - u(t-3))$ . [2]
3. Find Fourier series coefficients for periodic rectangular pulses with unity amplitude. Draw the magnitude spectrum. [5+1]
4. Derive the expression for discrete time Fourier series representation of the signal  $x[n]$  periodic with period of  $N$ . [7]
5. Determine the expression of Fourier Transform for continuous time aperiodic signal. [7]
6. Perform the convolution and draw output  $y[n]$   $x[n] = \{1 \ 2 \ 2 \ 3\}$  and  $h[n] = \{1 \ 4 \ 3\}$ . [7]  

$\uparrow$
7. State and prove Parseval's theorem for continuous time aperiodic signal. [2+4]
8. What is aliasing effect and how can we overcome it? Determine the Nyquist rate for a continuous time signal  $x(t) = 6 \cos 50 \pi t + 20 \sin 300 \pi t - 10 \cos 100 \pi t$ . [3+3]
9. Find convolution between two signals  $x(t) = \begin{cases} e^{0.5t} & \text{for } 0 < t < 5 \\ 0 & \text{otherwise} \end{cases}$  and  $h(t) = \begin{cases} 1 & \text{for } 1 < t < 3 \\ 0 & \text{otherwise} \end{cases}$ . [7]
10. Derive the expression for impulse response and step response of ideal low pass filter. [4+4]
11. For the LTI system, describe following properties: (a) linearity (b) causality (c) stability (d) time invariance. [6]
12. If the impulse response of continuous time linear time invariant system is  $h(t) = e^{-t}u(t-3)$  and input to the system is  $x(t) = u(t-2)$ , determine the output  $y(t)$  of the system. [8]
13. Describe bode plot with example. [4]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Signal Analysis (EX651)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Calculate the total energy and total average power of the signal given below:

$$x(t) = (3+4j)e^{2t}u(-t)$$

Also state whether the signal is energy signal, power signal or neither.

[3+1]

2. Determine whether the signal  $x[n] = 5\sin\left(\frac{3\pi}{8}n - \frac{\pi}{2}\right) - 2\cos\left(\frac{7\pi}{12}n\right)$  is periodic or not. If the signal is periodic, calculate its fundamental period and fundamental frequency.

[4]

3. How could you represent a signal  $x(t)$  with harmonically related exponentials? State and prove conjugation and conjugate symmetry property of CTFS.

[4+4]

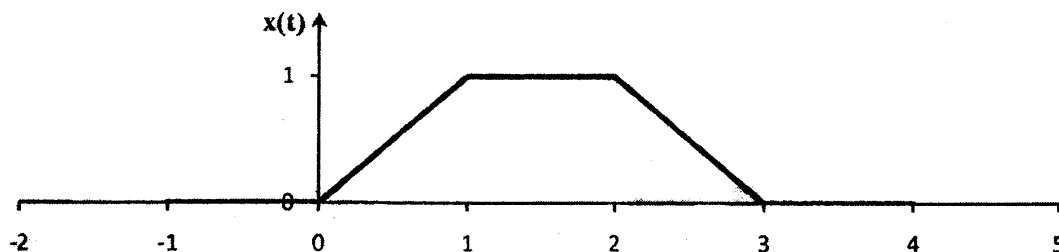
4. Find the Fourier series coefficients of the signal

[6]

$$X[n] = 1 + \sin(2\pi/N)n + 3\cos(2\pi/N)n + \cos(4\pi/N)n$$

5. Find the Fourier transform of a trapezoidal signal shown below:

[8]



6. How can you generate Fourier transform for discrete time periodic signals? Explain.

[3]

7. State and prove Parseval's relation for discrete time Fourier transforms.

[5]

8. Compute 4-point DFT of a signal  $x[n] = \{2, 1+j, 1-j\}$  and plot its magnitude and phase spectrums.

[4+2]

9. State and prove sampling theorem for low pass signals.

[6]

10. The impulse responses of two LTI systems are given by  $h_1(t) = e^{-\frac{t}{2}}u(t)$  and  $h_2(t) = u(t) - u(t-5)$ . Determine the equivalent impulse response if these two systems are connected in cascade. Also sketch the graph of equivalent impulse response.

[8+2]

11. Derive the impulse response for ideal low pass filter with cutoff frequency  $\omega_c$ .

[5]

12. Given a system  $Y[n] = 0.5y[n-1] + x[n] + x[n+1]$ . Find out its impulse response and frequency response.

[7]

13. What are the properties of LTI system? Show that the output of an LTI system is stable if the impulse response is absolutely summable.

[8]

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Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis (EG634EX)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

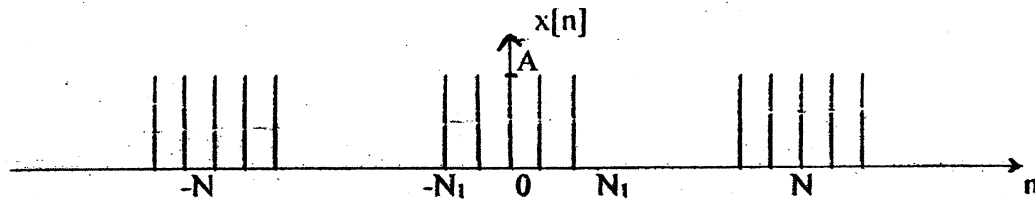
1. Define deterministic and random signal. Determine whether the given signal is energy signal or power signal or neither. [2+4]

$$x(t) = 5 \cos(\pi t) + \sin(5\pi t), -\infty < t < \infty$$

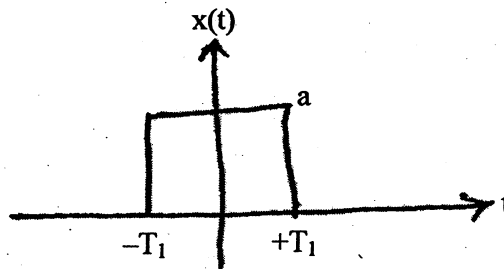
2. Find the fundamental period of the discrete-time signal given below. [4]

$$x[n] = 1 + e^{j(4\pi/7)n} - e^{j(2\pi/5)n}$$

3. How can you represent a signal  $x(t)$  with harmonically related exponentials? State and prove conjugation and conjugate symmetry property of continuous time fourier series. [3+5]
4. Determine the Fourier series coefficients of the periodic signal shown in figure below. [6]



5. Determine the Fourier transform of the rectangular pulse shown in figure below: [6]



6. State and prove multiplication property of Fourier transform. [4]
7. What is an ideal lowpass filter? Determine the response of RC lowpass filter to a unit step input signal. [2+6]
8. Define DFT. Compute DFT of the following sequence: [2+6]
- $$x[n] = u[n] + u[n-1] - u[n-2] - u[n-4]$$
9. What is FFT? How it differs with DFT? Explain Radix-2 algorithm. [8]
10. A continuous-time signal  $x(t)$  is applied to the input of a continuous-time LTI system with impulse response  $h(t)$ . Find the output  $y(t)$  given that  $x(t) = e^t u(-t)$  and  $h(t) = u(t-4)$ . [7]
11. Consider the two sequences [9]

$$x[n] = \begin{cases} 1, & 0 \leq n \leq 4 \\ 0, & \text{Otherwise} \end{cases} \quad \text{and} \quad h[n] = \begin{cases} a^n, & 0 \leq n \leq 6 \\ 0, & \text{Otherwise} \end{cases}$$

12. What are the recursive and non-recursive systems? Explain with example. [6]

Exam.	Regular	
Level	BE	Full Marks 80
Programme	BEL, BEX	Pass Marks 32
Year / Part	III / II	Time 3 hrs.

**Subject: - Signal Analysis (EX651)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

3 ✓ 1. What do you understand by periodic and aperiodic signals? Explain with the help of examples. [4]

2. Determine whether the following signals are energy or power signals. [4]

a)  $f(t) = 3 \cos(2\pi t)$

b)  $x[n] = \cos\left(\frac{n}{6}\right)$

5 ✓ 3. What is the information provided by Fourier series coefficients of a signal? State and prove time shifting and conjugation properties of continuous time Fourier series representation. [1+6]

4 ✓ 4. Find out Fourier series coefficients of a periodic discrete time signal described over a period as [5+2]

$$x[n] = \begin{cases} 2; & |n| \leq 1 \\ 0; & 1 < |n| \leq 1 \times 3 \end{cases}$$

Using the Fourier series coefficients calculated above; find the Fourier series coefficients of the signal  $e^{j\frac{4\pi}{7}n} x[n]$ .

5 ✓ 5. Given the relationship  $y(t) = x(t)*h(t)$  and  $g(t) = x(3t)*h(3t)$  and given that  $x(t)$  has the Fourier transform of  $X(j\omega)$  and  $h(t)$  has Fourier transform  $H(j\omega)$ , use Fourier transform properties to show that  $g(t)$  has the form  $g(t) = Ay(Bt)$ . Determine the values of A and B. [8]

3 ✓ 6. Explain the linearity and time shifting properties of continuous time Fourier transform. [4]

5 ✓ 7. Find the Fourier transform of continuous time unit impulse and rectangular pulse. Discuss the result. [6]

7 ✓ 8. Find the Fourier transform of everlasting sinusoid  $X(t) = \cos\omega_0 t$ . [4]

6 ✓ 9. What do you mean by aliasing? Explain with the help of frequency domain analysis for impulse-train sampling. [1+5]

5 ✓ 10. What are the properties of systems? Determine whether the given system is time-variant or not:  $y(t) = \sin[x(t)]$ . [2+3]

5 ✓ 11. Let  $x(t)$  be the input to an LTI system with unit impulse response  $h(t)$ , where,  $x(t) = e^{-at} u(t)$ ,  $a > 0$  and  $h(t) = u(t)$ . Verify commutative law of LTI system. [5]

12. What is distortionless transmission? Derive the expression for unit step response of ideal low pass filter. [5]

13. A discrete time LTI system has an impulse response as shown below. [6+2]



If the input to the given system is  $x[n] = \{-0.25, 0.5, 1, -0.5, 0, 0.25\}$ , calculate and plot the output of the system.

14. Define systems with memory and memory-less systems with examples. Explain the causality property of discrete time LTI systems. [3+4]

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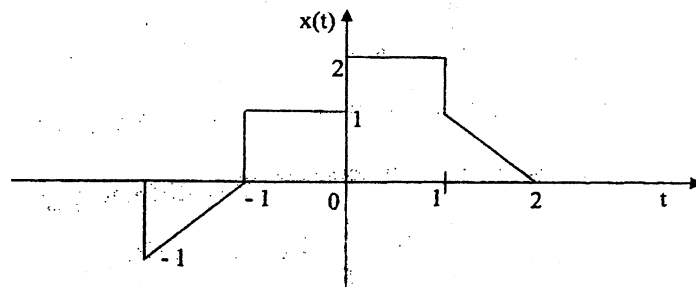
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Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Signal Analysis (EX651)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define energy and power type signal with suitable examples. Sketch and label the signal  $y(t) = \{x(t) + x(-t)\}u(t)$  for given signal  $x(t)$  depicted below. [3+5]



2. Derive the expression for Fourier series representation of a signal  $x(t)$  periodic with period T. [8]
3. Find the Fourier series representation of the signal  $x[n] = \sum_{\ell=-\infty}^{\infty} \delta[n - \ell N]$ . [6]
4. State and prove Parseval's theorem for continuous time aperiodic signal. [4]
5. ALTI system has input  $x(t) = e^{-t}u(t)$  and impulse response  $h(t) = e^t u(-t)$ . Find output  $y(t)$  of the system using Fourier transform of  $x(t)$  and  $h(t)$ . [8]
6. Compute discrete time Fourier transform of the discrete time signal  $x[n] = \left(\frac{1}{2}\right)^{-n} u[-n-1]$  [5]
7. Find circular convolution of the signal  $x[n] = \{1, 0, 0, 1\}$  and  $y[n] = \{2, 0, 2\}$ . [5]
8. What is sampling. How are spectrum of continuous time signal and its sampled version related? Illustrate with diagram. [6]
9. Write about the following properties of continuous time system: (a) Linearity (b) Causality (c) Memory (d) Stability (e) Time invariance. [5]
10. Derive the expression for impulse response and step response of first order continuous time system described by the differential equation  $\tau \frac{dy(t)}{dt} + y(t) = x(t)$ . [5]
11. If the impulse response of continuous time linear time invariant system is  $h(t) = u(t) - u(t-3)$  and input to the system is  $x(t) = u(t+4) - u(t)$ , determine the output  $y(t)$  of the system. [5]
12. Find output of a LTI system using convolution sum, if the input signal is  $x[n] = \delta[n] + 2\delta[n-1] - \delta[n-3]$  and impulse response of the system is  $h[n] = 2\delta[n+1] + 2\delta[n-1]$ . [7]
13. For a system characterized by Linear constant coefficient difference equation  $y[n] = 0.5y[n-1] + x[n]$ , find the frequency response  $H(e^{j\omega})$  and impulse response  $h[n]$ . Also plot the frequency response magnitude  $|H(e^{j\omega})|$ . [8]



Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Find the energy and power of the signal  $x(t) = e^{-10t} \cos(30\pi t)u(t)$ . What is the period of signal  $x(t) = \cos\left(\frac{t}{7} + \frac{\pi}{4}\right) + \cos\left(\frac{t}{11} + \frac{\pi}{3}\right)$  [6]
2. If compact trigonometric Fourier series representation of periodic signal  $x(t)$  with period  $T$  is  $x(t) = c_0 + \sum_{n=1}^{\infty} c_n \cos(n\omega t - \theta_n)$  where  $c_0, c_n, \theta_n$  are representation parameters, then derive expression for exponential Fourier series representation of the signal from the given compact trigonometric Fourier series representation. [6]
3. If periodic signal  $x(t)$  with period  $T = 4$  is defined over a period as [6]
$$x(t) = \begin{cases} 1 - |t|, & |t| \leq 1 \\ 0, & |t| \leq 2 \end{cases}$$
then find the Fourier series coefficients of the signal.
4. A discrete time signal  $x[n]$  periodic with period  $N = 4$  has Fourier series coefficients given by  $a_k = \cos\left(\frac{3\pi k}{2}\right)$ , find the expression for signal  $x[n]$  over a period. [6]
5. Determine the expression of Fourier Transform for continuous time aperiodic signal  $x(t)$ . For given Fourier Transform,  $x(j\omega) = \delta(\omega + 4) + \delta(\omega + 2) + \delta(\omega) + \delta(\omega - 2) + \delta(\omega - 4)$ , find its inverse Fourier Transform  $x(t)$ . [4+4]
6. If  $x(t)$  is real with Fourier transform  $X(\omega)$  and  $x_o(t)$  is odd component of  $x(t)$  then find Fourier transform of  $x_o(t)$  in terms of  $X(\omega)$ . [6]
7. Determine the impulse response and step response of series RLC circuit with input voltage  $V(t)$  and output capacitor voltage  $V_c(t)$ . [7]
8. Convolve the signals  $x_1[n] = 0.5^n u[n]$  and  $x_2[n] = u[n] - u[n - 5]$ . [7]
9. If the impulse response of LTI system is  $h(t) = e^{-t} u(t + 2)$  and input to the system is  $x(t) = u(t) - u(t - 4)$  then determine the output of the system  $y(t)$ . [5]
10. What do you mean by distortionless transmission line? [3]
11. If system  $y(t) = x(2t + 2)$  where  $y(t)$  is output and  $x(t)$  is input to the system. Is the system (a) linear (b) time invariant (c) casual (d) memory-less (e) stable? [5]
12. Find the discrete Fourier transform of the signal  $x[n] = [1, -1, 1, -1]$  using decimation in frequency Fast Fourier Transform algorithm. [7]
13. Find the system function  $H(z)$  of the system characterized by difference equation  $y[n] = 0.9y[n - 1] + x[n]$ . Plot the frequency response magnitude  $|H(e^{j\omega})|$  and find the impulse response  $h(n)$  of the system. [8]

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define power and energy signals with example. Determine whether the signal  $x(t) = e^{-2t} u(t)$  is power or energy signal and calculate the corresponding measure. [6]

2. Find the Fourier series coefficients of periodic signal  $x(t)$  defined over a period of

$$T = 6 \text{ as } x(t) = \begin{cases} \text{rect}\left(\frac{t}{4}\right) + 2\delta(t-2) + 3\delta(t+2), & |t| \leq 2 \\ 0, & 2 < |t| \leq 3 \end{cases}, \text{ where } \text{rect}\left(\frac{t}{\tau}\right) = \begin{cases} 1, & |t| \leq \frac{\tau}{2} \\ 0, & |t| > \frac{\tau}{2} \end{cases}$$

$$\text{and } \delta(t) = \begin{cases} 1, & t = 0 \\ 0, & \text{otherwise} \end{cases} \quad [10]$$

3. Determine the Fourier transform of the signal  $x(t)$  given by, [8]

$$x(t) = (t-2)\{u(t-2) - u(t-3)\} - (-t-2)\{u(-t-2) - u(-t-3)\} \text{ where } u(t) = \begin{cases} 1, & t \geq 0 \\ 0, & t < 0 \end{cases}$$

4. Write the conjugation and conjugate symmetry property of Fourier transform. [6]

5. For linear time invariant system consisting of resistor  $R$ , capacitor  $C$  input  $v_g(t)$  connected in series, if the output of the circuit is capacitor voltage  $v_c(t)$ , determine the impulse response and step response of this system. [8]

6. Determine the 4-point DFT of the signal  $x(n) = [u(n) + u(n-1) - u(n-3) - u(n-4)]$ . How FFT is efficient? Explain. [6+2]

7. Show that the energy spectral density of energy signal is the Fourier transform of its autocorrelation function. [5]

8. Find impulse response of ideal LPF for distortionless transmission. Is this system practically realizable or not? [5+2]

9. Find the circular convolution of signals  $x_1[n] = [1, 0, 0, 1]$  and  $x_2[n] = [2, 0, 2]$ . [5]

10. If the impulse response of system is  $h(t) = e^{-t} u(t)$  and input to the system is  $x(t) = u(-t-1)$ , determine the output of the system  $y(t)$  where  $u(t) = \begin{cases} 1, & t \geq 0 \\ 0, & t < 0 \end{cases}$ . [5+1]

11. Define FFR and IFR system with examples for the system given [2+4]

$$y[n] - \frac{3}{4} y[n-1] + \frac{1}{8} y[n-2] = 2x[n]$$

Find out the impulse response.

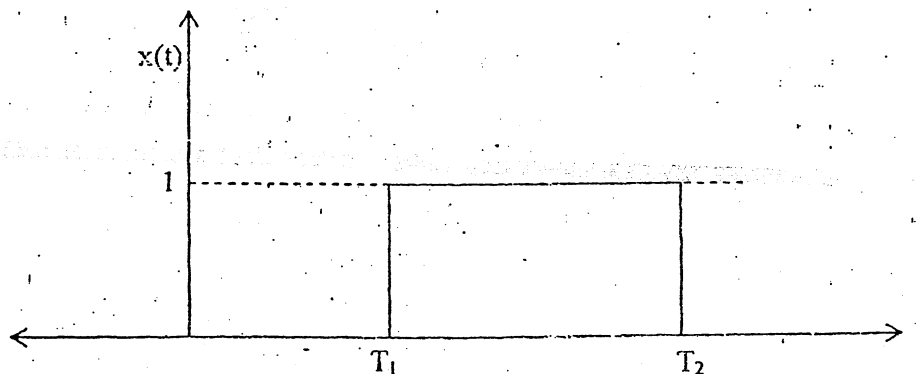
12. Let a given system be  $y(t) = x(t + t_0)$ ,  $t_0 > 0$  where  $y(t)$  is output and  $x(t)$  is input to the system. Is the system (a) linear (b) time invariant (c) causal (d) memory less (e) stable? [5]

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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- Define time variant and invariant system. Determine whether the system. [4+2+2]
  - $y[n] = nx[n] + (1 - n)x[n]$  is time-variant or time invariant
  - $y[n] = x[0] + x[-1] + nx[n]$  is linear or non linear
- Show plot of the signal  $\sum_{k=-\infty}^{\infty} \delta(t - kT)$ . Is this signal discrete time or not? If it is discrete time signal, how can it be converted to continuous time; and if not in what respect it differ from it's discrete time counterpart? [2+4]
- Prove that output of continuous time LTI system is convolution of input signal and its impulse response. [7]
- Given a signal  $x(t) = u(t)$ , where  $u(t)$  is casual unit step signal. Find out its total energy and total average power. Is this signal energy type or power type? [5+1]
- State and verify distribute property of convolution of discrete time signals using convolution formula taking examples of three signals  $x[n]$ ,  $y[n]$  and  $z[n]$ . [1+5]
- Consider a signal as shown in figure below. [4+6]



Find its Fourier transform and show it's magnitude and phase spectrum for

- $T_1 = 0$  and  $T_2 = T$  (constant value)
  - $T_1 = T/2$  and  $T_2 = 3T/2$
  - $T_1 = T/2$  and  $T_2 = 5T/2$
- Show, with necessary mathematical derivations, that "continuous time Fourier transform is the limiting case of continuous time Fourier series". [7]

8. Give a signal  $X(k) = \{0, 1, 2, 3\}$  repeating every 4 points. Assume this as Discrete Fourier Transform of a discrete time signal  $x[n]$ , determine  $x[n]$  and show its plot for  $n = -3$  to 7.
9. Using FFT algorithm, find the  $X(3)$  of the input sequence  $x(n) = \{0, 1, 2, 3, 3, 2, 1, 0\}$ .
10. Define recursive and IIR system. Highlight the difference between them.
11. Given an system in difference equation  $y[n] = 0.5y[n-1] + 0.3y[n-2] + 0.8x[n-1] + 0.6x[n]$  find out its impulse response and also draw direct form I structure of this system.
12. The ideal low pass filter is that filter whose output is exactly identical with input signal except some constant multiplier in amplitude and some shift in time domain. Prove that this will be possible only if transfer function of the filter is constant amplitude and linear phase. Also defined as Determine impulse response of ideal low pass filter. Is this causal or non causal? Discuss.

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Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt All questions.

✓ The figures in the margin indicate Full Marks.

Assume suitable data if necessary.

Define time variant and invariant system. Determine whether the system.

[4+2+2]

a)  $y[n] = nx[n] + (1 - n) x[n]$  is time-variant or time invariant

b)  $y[n] = x[0] + x[-1] + nx[n]$  is linear or non linear

2. Show plot of the signal  $\sum_{k=-\infty}^{\infty} \delta(t - kT)$ . Is this signal discrete time or not? If it is discrete

time signal, how can it be converted to continuous time; and if not in what respect it differ from it's discrete time counterpart?

[2+4]

Prove that output of continuous time LTI system is convolution of input signal and its impulse response.

[7]

Given a signal  $x(t) = u(t)$ , where  $u(t)$  is casual unit step signal. Find out its total energy and total average power. Is this signal energy type or power type?

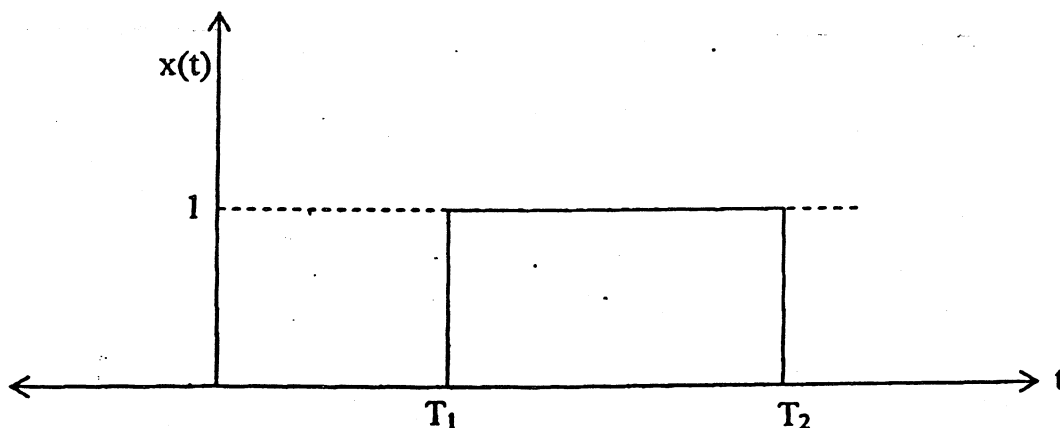
[5+1]

State and verify distribute property of convolution of discrete time signals using convolution formula taking examples of three signals  $x[n]$ ,  $y[n]$  and  $z[n]$ .

[1+5]

6. Consider a signal as shown in figure below.

[4+6]



Find its Fourier transform and show it's magnitude and phase spectrum for

a)  $T_1 = 0$  and  $T_2 = T$  (constant value)

b)  $T_1 = T/2$  and  $T_2 = 3 T/2$

c)  $T_1 = T/2$  and  $T_2 = 5 T/2$

Show, with necessary mathematical derivations, that "continuous time Fourier transform is the limiting case of continuous time Fourier series".

[7]

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8. Give a signal  $X(k) = \{0, 1, 2, 3\}$  repeating every 4 points. Assume this as Discrete Fourier Transform of a discrete time signal  $x[n]$ , determine  $x[n]$  and show its plot for  $n = -3$  to 7. [4+1]
9. Using FFT algorithm, find the  $X(3)$  of the input sequence  $x(n) = \{0, 1, 2, 3, 3, 2, 1, 0\}$ . [7]
10. Define recursive and IIR system. Highlight the difference between them. [4+2]
11. Given an system in difference equation  $y[n] = 0.5y[n-1] + 0.3y[n-2] + 0.8x[n-1] + 0.6x[n]$ , find out its impulse response and also draw direct form I structure of this system. [4+2]
12. The ideal low pass filter is that filter whose output is exactly identical with input signal except some constant multiplier in amplitude and some shift in time domain. Prove that this will be possible only if transfer function of the filter is constant amplitude and linear phase. Also defined as Determine impulse response of ideal low pass filter. Is this casual, anti-casual or non casual? Discuss. [4+2]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What do you understand by energy and power signals? Explain with suitable examples. Find total energy and average power of the following signals. [4+2+2]

a)  $x(t) = e^{-4t} \cdot u(t)$

b)  $x[n] = \{3, 1, 0, 2 + 2j, 7\}$

2. Find the convolution of the two signals given in figures 2(a) and 2(b). [5+2]

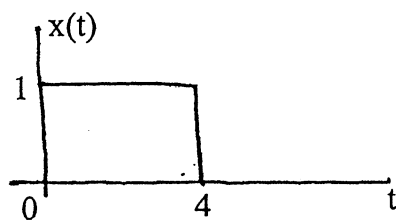


Figure 2(a)

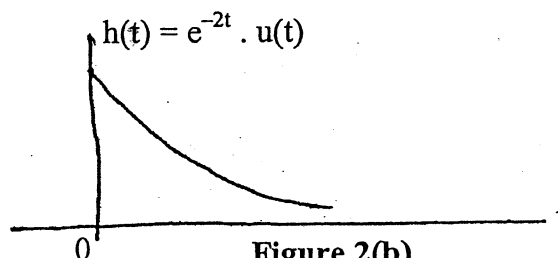


Figure 2(b)

If  $x(t)$  is advanced by 1 unit and  $h(t)$  is delayed by 1 unit, find the convolution of the new signals giving appropriate reasons.

3. A discrete time signal  $x[n]$  (shown in figure 3(a)) is applied to an LTI system to produce an output  $y[n]$  (shown in figure 3(b)). [6]

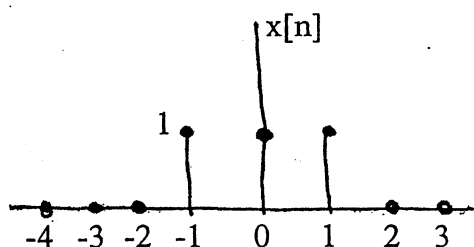


Figure 3(a)

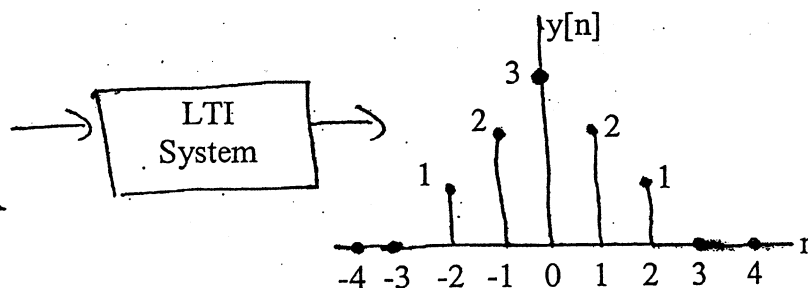


Figure 3(b)

Find the output of the same system, if signal  $w[n]$  as shown in figure 3(c) is applied to it.

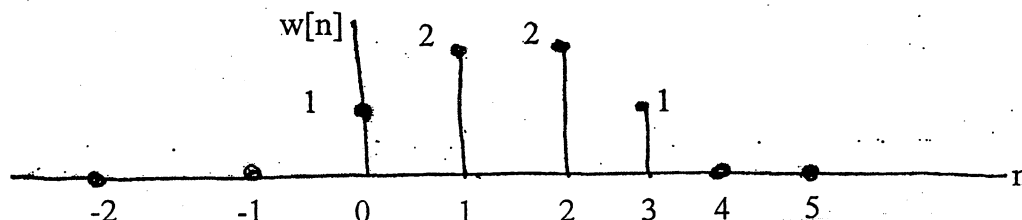
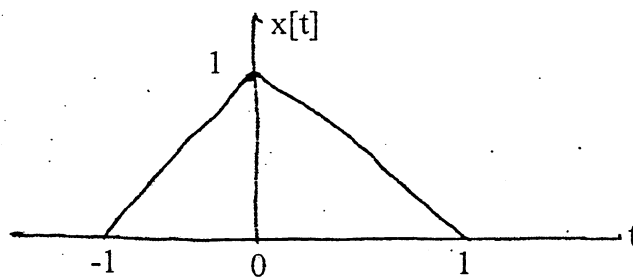


Figure 3(c)

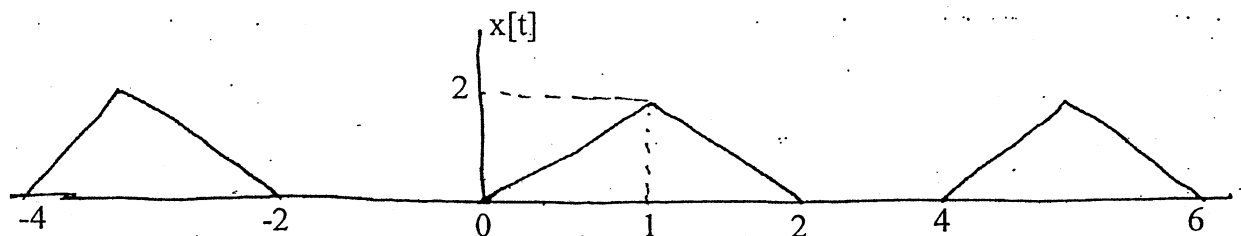
4. Find the Fourier transform of the continuous time aperiodic signal given below. [8]



5. What is the importance of FFT? Find 4-point DFT of the sequence,  $x[n] = \{1, 7, 4, 3\}$  using FFT structure. [2+5]

6. Differentiate between FIR and IIR systems using suitable examples. An LTI system is defined by the system function,  $H(z) = \frac{\alpha(1+z^{-1})(3-2z^{-1})}{3(1-z^{-1})(1-3/5z^{-1})(1+5/3z^{-1})}$ . Realize the system using Direct Form II structure. [4+5]

7. Find the Fourier series coefficients of the continuous time periodic signal shown in figure below. [10]



8. Define distortion. What do you understand by ideal distortionless transmission line? Differentiate it from a practical transmission line. [2+6+1]
9. Prove that the discrete Fourier transform of circular convolution of two discrete time sequences is equal to the product of discrete Fourier transforms of individual sequences. [8]
10. Prove Parseval's theorem for continuous time periodic signals. What is its significance? [7+1]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What do you understand by energy and power signals? Explain with suitable examples.  
Find total energy and average power of the following signals. [4+2+2]
  - a)  $x(t) = e^{-4t} \cdot u(t)$
  - b)  $x[n] = \{3, 1, 0, 2 + 2j, 7\}$
2. Find the convolution of the two signals given in figures 2(a) and 2(b). [5+2]

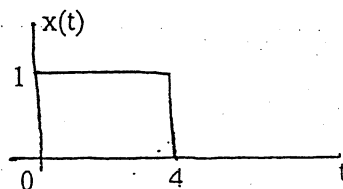


Figure 2(a)

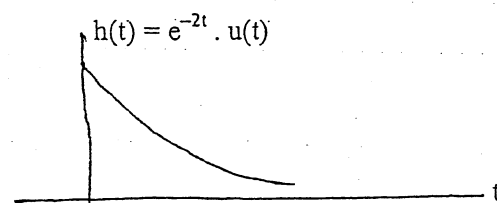


Figure 2(b)

If  $x(t)$  is advanced by 1 unit and  $h(t)$  is delayed by 1 unit, find the convolution of the new signals giving appropriate reasons.

3. A discrete time signal  $x[n]$  (shown in figure 3(a)) is applied to an LTI system to produce an output  $y[n]$  (shown in figure 3(b)). [6]

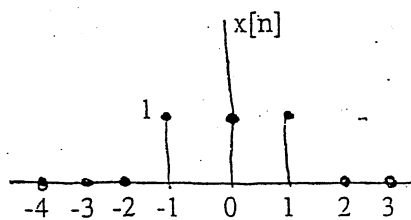


Figure 3(a)

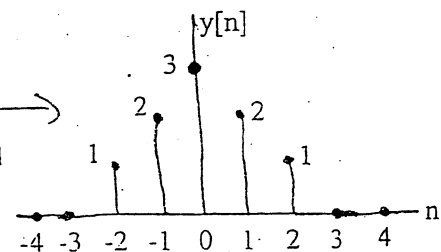
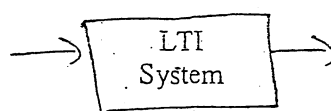


Figure 3(b)

Find the output of the same system, if signal  $w[n]$  as shown in figure 3(c) is applied to it.

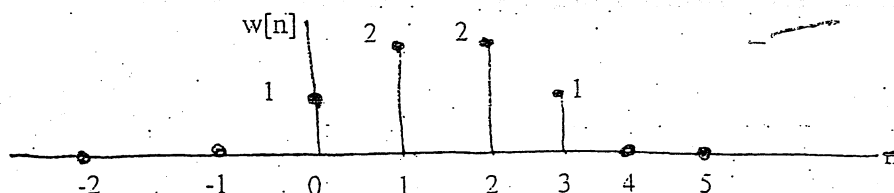
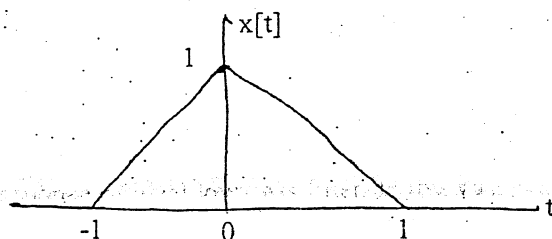


Figure 3(c)

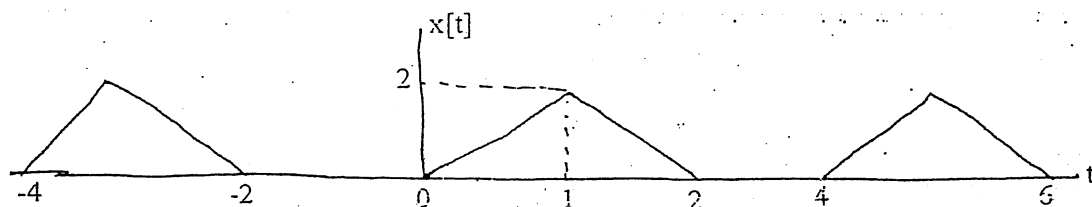
4. Find the Fourier transform of the continuous time aperiodic signal given below. [8]



5. What is the importance of FFT? Find 4-point DFT of the sequence,  $x[n] = \{1, 7, 4, 3\}$  using FFT structure. [2+5]

6. Differentiate between FIR and IIR systems using suitable examples. An LTI system is defined by the system function,  $H(z) = \frac{\alpha(1+z^{-1})(3-2z^{-1})}{3(1-z^{-1})(1-3/5z^{-1})(1+5/3z^{-1})}$ . Realize the system using Direct Form II structure. [4+5]

7. Find the Fourier series coefficients of the continuous-time periodic signal shown in figure below. [10]



8. Define distortion. What do you understand by ideal distortionless transmission line? Differentiate it from a practical transmission line. [2+6+1]

9. Prove that the discrete Fourier transform of circular convolution of two discrete time sequences is equal to the product of discrete Fourier transforms of individual sequences. [8]

10. Prove Parseval's theorem for continuous time periodic signals. What is its significance? [7+1]

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Exam.	Regular/Back		
Level.	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Discuss scope of signals and systems. Define continuous time unit step signal. Determine total energy and total average power of this signal. [3+6]
2. Show the graph (plot) of the signal defined as "1 – (full wave rectified sin signal with amplitude 1V and frequency 100Hz)". Find out its complex Fourier series coefficients and show line spectrum. [2+5+3]
3. Discuss alternate forms of Fourier series representation. Show relations between different forms of Fourier series coefficients. [5]
4. Define inverse Fourier transform. What happens in the frequency domain representation of signal  $x(t)$  when its time axis is scaled by real constant  $a$  ( $x(at)$ )? Discuss and verify. [2+5]
5. Find out Fourier transform of a shifted rectangular pulse and show its spectrum. [4+4]
6. Find the impulse of RC low pass filter? Find out response of this RC low pass filter to a step signal input. [3+5]
7. Define power of a signal. Show that total average power of a continuous time periodic signal can also be determined from complex Fourier series coefficients. [7]
8. Define convolution of discrete time signals. Verify commutative property of convolution using the signals  $\{1,2,3,4\}$  and  $\{2,1,2,1\}$ . [2+4]
9. What is the condition for preventing time domain aliasing in DFT calculation? Discuss. Explain DFT computation as linear transformation with example. [2+4]
10. Find out DFT of the signal  $\{1,2,3,4,1\}$  using FFT algorithm. [6]
11. Define recursive and non-recursive systems. Give examples of each. Find out impulse response of the recursive system you discussed in above example. [5+3]

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

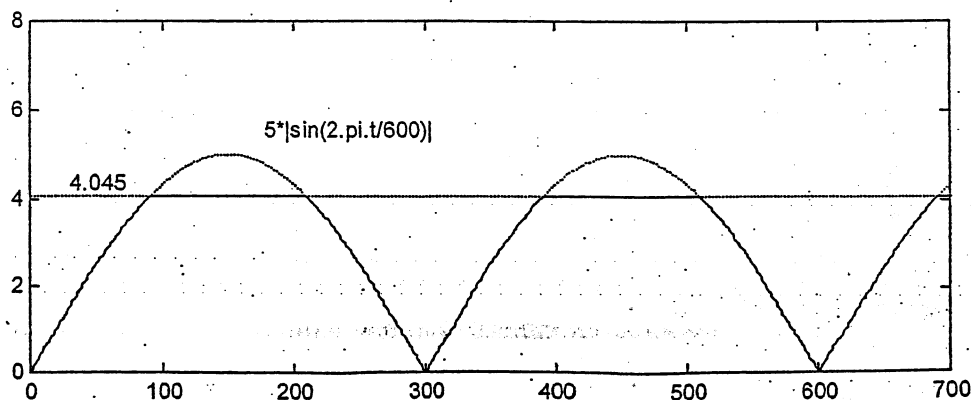
**Subject: - Signal Analysis**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define signal and system. Discuss various characteristics of systems. (4+6)
2. Define causal system. Give an example of a causal system and discuss why it is causal (2+4)
3. Find out the convolution of the signals (8)

$$x(t) = \begin{cases} \exp(0.5t) & \text{for } 0 < t < 5 \\ 0 & \text{otherwise} \end{cases} \quad \text{and} \quad y(t) = \begin{cases} 1 & \text{for } 1 < t < 3 \\ 0 & \text{otherwise} \end{cases}$$

4. Define energy and power of a signal. Consider a periodic signal represented by the sequence {1, 2, 0, 5, 3, 7, 0, 9} repeating in a period of  $N = 8$ . Find its total average power and total energy. (4+5)
5. Consider a periodic signal  $x(t) = 5 \sin(2\pi t/600)$  as shown in the figure where vertical axis is the signal value and horizontal axis is the time (t) in seconds. Waveform is clipped at voltage level 4.045.



Find out its Fourier series coefficients using continuous time Fourier series analysis equation. Show plot the corresponding magnitude spectrum. (6+3)

6. State and prove multiplication property – time domain multiplication of two signals - of DTFT (discrete time Fourier transform) (7)
7. Distinguish between DFT and FFT. Explain linear transformation method of DFT calculation with a suitable example. (3+5)
8. Given a system  $y[n] = 0.5 y[n-1] + 0.3 y[n-2] + 0.8 x[n] + 0.6 x[n-1]$ , find its impulse response and determine whether it is causal or not. (5+2)
9. What are the characteristics of FIR system? Give an example of FIR system and discuss its characteristics that make it distinct from IIR system (4+4)
10. What are the characteristics of ideal channel for signal transmission? Also find the step response of ideal filter. (3+5)

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Communication System I (EX652)**

✓ Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt All questions.

✓ The figures in the margin indicate Full Marks.

✓ Assume suitable data if necessary.

1. Define noise, interference and distortion? What will be their effects in communication? Explain briefly thermal and high frequency noise. [3+1+3]
2. Define LTI system. Find the expression (in time domain) for the output of a LTI. [2+3]
3. What do you understand by Energy Spectral Density (ESD)? Find ESD and total energy for sinc pulse defined by  $g(t) = A \text{ sinc}(2Wt)$ . [2+3+2]
4. a) What do you understand by modulation? Why modulation is needed? Find the frequency domain expression for standard AM wave for single tone message signal. [2+2+3]  
 b) With the help of block diagram and expression explain the phase shift method for generation of SSB-AM wave. [6]  
 c) An AM wave is represented by  $S_{AM}(t) = 20(1 + 0.8 \cos 2\pi 1000 t) \cos (9424777.96 t)$  volts. Find [2×4]  
 i) Amplitude of all frequency components  
 ii) Modulation index  
 iii) Maximum and minimum amplitude of AM wave  
 iv) Frequency of USB and LSB
5. a) Draw the circuit diagram and the waveforms and describe how envelope detector can be used for demodulation of standard AM wave. [5]  
 b) Describe the operation of PLL and show that it can be used to demodulate AM. [6]
6. a) Find the time domain expression for single tone FM modulated waves in terms of Bessel coefficients. [6]  
 b) Describe the limiter-discriminator method for demodulation of FM wave. [7]  
 c) A modulating signal  $m(t) = 5 \cos 18849.55 t$  is applied to an FM modulator that has a frequency sensitivity of 9 KHz/V. Compute (i) peak frequency deviation, (ii) modulation index, (iii) frequency swing and (iv) Carson's bandwidth. [2×4]
7. Describe the principle of frequency division multiplexing (FDM). Briefly explain SCPC and DAMA types of FDMA. [2+4]

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10/08

35 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Communication System I (EX652)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Draw the block diagram of communication system and explain each component briefly. [6]
2. Define Hilbert transformation. State and explain the properties of LTI system. [2+4]
3. Define white noise. Establish relation between psdf and the AC function of a white noise. [3+3]
4. What are the advantages of SSB-AM over DSBFC-AM? Derive the expression for SSB signal. [2+4]
5. Explain the generation of DSB-FC AM using switching modulator with the help of diagrams and expressions. [8]
6. Show the effect of phase error in coherent detection of DSB-SC AM. Explain the demodulation of AM using PLL. [4+4]
7. Explain the operation of FM super heterodyne radio receiver. [8]
8. The equation of an angle modulation voltage is  $E = 10 \sin(10^8 t + 3 \sin 10^4 t)$ . Calculate the carrier and modulating frequency, modulating index and power dissipated in  $100 \Omega$  resistor. [2+2+2+2]
9. Explain demodulation of FM using limiter-discriminator method. Why pre-emphases is needed in FM during transmission? [6+2]
10. Define FDMA. Write about FDM in telephone hierarchy. [2+6]
11. Write short notes on: [4+4]
  - a) Stereo encoder
  - b) Distortion and interference

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10/06 D,

45 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Magh

Exam.	OLD Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Communication Systems (EG679CT)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Discuss linear, non linear, causal and time invariant systems used in communication. Prove that the output of any system is given by convolution of input and impulse response of the system. [4+4]
2. What do you mean by square law approximation? How can you use it for the modulation of DSB-AM? [2+6]
3. Compare DSB-AM, DSB-SC and SSB in terms of complexity, power and bandwidth efficiency. [8]
4. Derive the general expression for frequency modulation. Explain with the block diagram how you generate FM using phase modulator. [3+5]
5. State any four properties of the Fourier Transform. Derive the expression for the Rayleigh Energy Theorem. [4+4]
6. Derive the expression for the SQNR of uniformly quantized PCM. What is the relation between SQNR value and bit used for coding? [6+2]
7. Prove that signaling rate for time division multiplexing of 24 voice channels is equal to 1.544 Mbps. [8]
8. An audio signal given as  $15 \sin 2\pi (1500t)$  and amplitude modulates a carrier given as  $60 \sin 2\pi (100,000t)$  determine the following: [2×4]
  - a) Sketch the audio signal
  - b) Construct the modulated wave
  - c) Determine the modulation index and percent modulation
  - d) What frequencies would present in a spectrum analysis of modulated wave?
9. State the Shannon Channel Capacity Theorem. Discuss the implication of this theory in communication system. [8]
10. Write short notes on: [2×4]
  - a) Convolutional codes
  - b) Threshold effect in demodulation of FM

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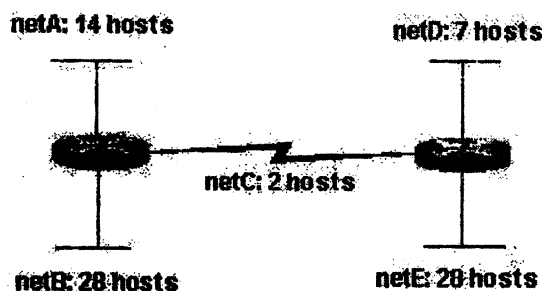


Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Computer Network (CT657)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What is Internetwork? What are the layer design issues? Explain about connection oriented and connection less service. [2+3+3]
2. Define transmission media. Why now a day all communication media like twisted pair, co-axial pair even wireless media are replaced by optical fibre? Justify your answer with necessary diagram, working principle and transmission mechanism. [8]
3. What is pure ALOHA and slotted ALOHA? Consider the delay of both at low load. Which one is less? Explain sliding window protocol. [3+2+3]
4. What is dynamic routing? Explain distance vector routing? What is count to infinity problem? [1+5+2]
5. Given the class C network of 204.15.5.0/24, subnet the network in order to create the network in Figure below with the host requirements shown. [8]



6. Describe connection establishment, data transfer and connection release in TCP protocol. [8]
7. What is the importance of DNS? Explain POP3 and IMAP in detail. [3+5]
8. Why IPV4 address is going to replace by IPV6 address? Is IPV6 address 2002::3A03::01:BFF5 valid address? Justify your answer. [8]
9. What is Digital Signature? Explain about any public key encryption algorithm with example. What security mechanism is used in transport layer? [2+4+2]
10. What is SSL? Explain the different types of firewall those can be implemented to secure the network. [2+6]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Computer Network (CT657)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

405  
45-

1. Can we implement OSI model in any type of communication? Describe TCP/IP model with reference to OSI model. [2+6]
2. What is transmission media? Describe the following: [2+6]
  - a) Twisted pair
  - b) Co-axial
  - c) Satellite
3. Explain different types of flow control mechanism in data link layer. [8]
4. What is link state routing? Describe the working process of OSPF with an example. [2+6]
5. A large number of consecutive IP addresses are available starting at 193.122.2.1. Suppose that four organizations Pulchok, Thapathali, WRC and ERC request 6000, 2000, 4000 and 2500 addresses respectively. Design the network and find the first valid IP address, last IP address and mask in w.x.y.z/s notation for each organization. [8]
6. "TCP uses a three way handshake to establish a connection". Justify. Explain how flow control is addressed by TCP. [4+4]
7. Describe the following algorithms [4+4]
  - a) SMTP
  - b) HTTPS
8. "IPv4 and IPv6 coexistence" what does this mean? Explain header translation approach with an appropriate figure. [4+4]
9. Explain RSA algorithm and describe it with example. [8]
10. What is SSL? How can SSL be used to secure http protocol? Explain. [2+6]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Computer Network (CT657)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why it is necessary to have network software's in layered architecture? Compare TCP/IP and OSI reference model. [3+5]
2. Compare the different types of transmitting media with appropriate figures. [8]
3. What are the differences between error control and flow control? Describe Cyclic Redundancy Check with example. [3+5]
4. What is routing? Explain about BGP protocol and clarify how routing works in the internet. [2+6]
5. A large number of consecutive IP addresses as are available at 202.70.64.0/19. Suppose that four organization A, B, C and D request 100, 500, 800 and 400 addresses respectively, how the subnetting can be performed so, that address wastage will be minimum? [8]
6. What is congestion control? Describe Token Bucket and Leaky Bucket algorithms. [2+6]
7. Explain the Mail transfer and Mail access protocol. Show how the email is transferred from one domain to another domain. Illustrate your answer with an appropriate figure. [3+5]
8. Describe Tunneling and Dual stack to transit from IPV4 to IPV6. [4+4]
9. What is encryption? How can Diffie Helamn algorithm be used to negotiate a shared key between the receiver and transmitter. Explain. [2+6]
10. What are the desirable properties of secure communication? Explain how wireless network can be secured. [3+5]

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35 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division.**  
2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Computer Network (CT657)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why are network software designed with layers stacked on top of one another? What are the factors to be considered while designing these layers and the interfaces in-between. [2+6]
- ✓ 2. Explain different types of multiplexing used in communication system. Differentiate between circuit switching and packet switching. [5+3]
- ✓ 3. What are the different methods of farming? Compare IEEE 802.3, 802.4 and 802.5 standards. [3+5]
- ✓ 4. What are the major functions of network layer? Explain BGP in detail. [3+5]
- ✓ 5. Design a network for the Institute of Engineering, Pulchowk campus having 5 departments having 45, 35, 40, 23 and 30 computers in their respective network by allocating public IP to each computer with minimum losses. Assume IP by yourself. [8]
- ✓ 6. Why multiplexing is requirement in transport layer. Draw the segment structure of TCP and compare TCP with UDP. [2+3+3]
- ✓ 7. What is HTTP? Explain the protocol with reference to the request and response header structure. [2+6]
- ✓ 8. Draw the frame format of IPV6. Explain about tunnelling in IPV6. [4+4]
- ✓ 9. Why network security is very important? Explain different types of firewall that can used to secure the network. [2+6]
- ✓ 10. What are PGP and SSL? Encrypt the message "ATTACK" using RSA algorithm. [2+2+4]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What is a switching? Differentiate between packet switching and circuit switching. [2+6]
2. What are types of twisted pair cable? Calculate the efficiency of slotted Aloha. [4+4]
3. What is a virtual LAN? Design a network which consists of two VLAN named student and department. Explain with necessary diagram, IP addresses and configurations. [2+6]
4. What is a logical address? You are given the IP address block 200.10.80.32/25. If there are five departments which require 5, 40, 28, 12, 6 hosts respectively. Design the subnet. [2+6]
5. What are the functions of transport layer? Draw the segment structure of TCP. [3+5]
6. What is a fragmentation and re-assembly? Explain about any intra-AS routing protocol. [3+5]
7. What are the advantages of IPV6? The maximum payload segment is 65495 byte. Why was such strange number chosen? [4+4]
8. What is the function of proxy server? Explain about electronic mail. [3+5]
9. What is a secure socket layer? Encrypt the message "DANGER" using RSA algorithm. [2+6]
10. Compare x.25 and frame relay network. A bit string 011110111110111110 needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing? [6+2]

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Networks**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why network software should be in hierarchical form? Explain in detail about OSI layer. [3+5]
2. If you are assigned to design a LAN for Pulchowk Campus having 5 departments. Each department will have 100 computers locating in 5 rooms each equipped with 20 computers. Make your own justification while selecting connecting devices and accessories. [6+2]
3. What do you mean by ISDN and what is its contribution in the field of data communication? Explain various types of multiplexing mechanism used in communication. [3+5]
4. Describe what you understand by switching along with various types of switching mechanism. Explain the fault tolerance mechanism of FDDI. [4+4]
5. Why access control of channel is essential? Compare operating details of IEEE 802.4 and IEEE 802.5. [2+6]
6. Explain along with the packet format about the virtual circuit connection of X.25. [4+4]
7. Why routing is essential in computer networking? Compare working of distance vector routing algorithm with link state routing algorithm. [2+6]
8. Explain in detail about IP frame format. [8]
9. If you need to assign IP addresses to all computers of question no. 2 making each department as network. What will be your approach? Explain with IP address ranges you are suggesting. [8]
10. How the protocol SMTP does operate? Explain the procedures to make your network secured. [3+5]

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**Examination Control Division**  
**2068 Chaitra**

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why are the network softwares defined with distinct layers stacked on top of one another? What are the factors to be considered when designing these layers? [2+6]
2. Why do we need RAID in the computer networks? Define and discuss the differences between RAID 0, RAID 1 and RAID 5. [2+6]
3. What is a telephone? With a simple diagram of a telephone network explain how the system works. [2+6]
4. Why channel access mechanism is important in computer networking? Explain the operation of IEEE 802.5 with its frame format. [3+7]
5. Differentiate: [2×5]
  - a) Distance vector and link state routing algorithm
  - b) Circuit switching and packet switching
6. What is X.25? Explain the format of X.25 packet in detail. [3+5]
7. What are the differences between TCP and UDP services? Explain the TCP datagram format in detail. [3+5]
8. Suppose there are 4 departments A, B, C and D. The department A has 23 hosts, B has 16, C has 28 and D has 13 hosts. You are given a networks 202.70.64.0/24. Perform the subnetting in such a way that the IP address wastage in each department are minimum and also find out the subnet mask, network address, broadcast, and unable host range in each department. [10]
9. Write short notes on: [2×5]
  - a) Network Security
  - b) Router and Gateway

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Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define network and protocol for network. Explain peer-to-peer network process with example. [2+6]
2. Describe guided and unguided media used in computer network with their advantages. [8]
3. Explain the operation of pure ALOHA system. How CSMA/CD works? [4+4]
4. List the functions of Data Link Control Layer. Explain any two sliding window protocols with the advantages of piggybacking. [5+3]
5. Describe the policies that help in preventing the congestions within the network? Differentiate between leaky bucket and token bucket algorithm with their operation and working of token bucket. [4+6]
6. What do you understand by virtual circuit switching? Explain the X.25 virtual circuit switching. [2+6]
7. Explain the seven layers of OSI model with their example protocols. [8]
8. Briefly describe ICMP error and informational message types in IPv4 network infrastructure. [8]
9. How can we maintain the security within the communication network? Explain any one cryptography algorithm with example. [2+6]
10. Write short notes on (any two): [3+3]
  - a) UDP and its application
  - b) Network Devices: Hubs, Switches and Routers
  - c) IPv4 Header Structure

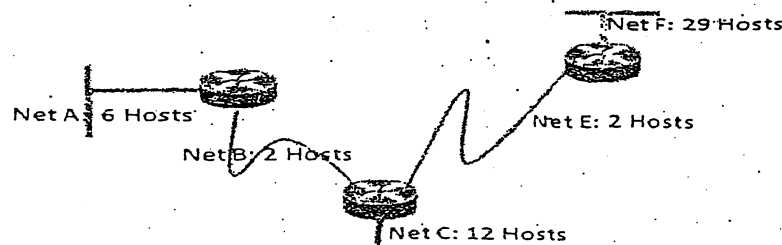
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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	TV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Why do communication process within computer network is divided into layers? How the process of data encapsulation occurs in transmission mode described by seven layers of OSI model. Compare OSI model with TCP/IP model. [2+2+4]
- b) What is client/server networking? Explain Active Networking model framework comparing with traditional legacy network. [3+5]
2. a) What are the services provided by data link layer? Explain any one methods of framing and flow control. [2+3+3]
- b) Calculate SNR and maximum channel capacity of a cat6 channel having bandwidth 300 MHz with 2mW and 200  $\mu$ W as signal and noise power respectively. [4+4]
3. a) Describe the 802.3 Ethernet standard for CSMA/CD and compare it with 802.4 token bus technology. Explain how DSSS technique is applied in wireless transmission. [5+3]
- b) Differentiate between circuit switching and packet switching technology. Explain the operation how switched virtual circuit in frame relay network is established, maintained and teardown. [2+6]
4. a) What is unicast and multicast routing? Describe the concept of optimality principle. Describe how the routers in its link state routing come into fully adjacency state. [2+6]
- b) What are the factors that cause congestion within WAN? Propose your best traffic shaping approach to manage congestion in packet switched network. [2+6]
5. a) Give the reason why the current world is moving to IPv6 addressing mechanism. Describe the IPv6 address types with its representation format. You are given the IPv4 address block 203.71.53.0/26; assign the IP subnet for the following network. [2+2+6]



- b) Write short notes on (any two) [3+3]
  - i) TCP Sliding Window Protocol
  - ii) Secrete Key Algorithm: DES
  - iii) ISDN Signaling and ATM AAL
  - iv) ICMP Message Types

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Networks**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain five instances of how networks are a part of your life today. Though we have MAC address, why we use IP address to represent the host in networks? Explain your answer. [5+3]
2. What are headers and trailers, and how do they get added and removed? Explain with appropriate figure. [5]
3. Explain the working principle of different types of network devices Repeater, HUB, Bridge, Switch, and Router. [10]
4. Both UDP and TCP use port numbers to identify the destination entity when delivering a message. Give two reasons for why these protocols invented a new abstract ID (port numbers), instead of using process IDs, which already existed when these protocols were designed. [3]
5. Why the telephone companies developed the ISDN? Explain the working principle of ISDN with its interface and the functional group. [2+8]
6. Suppose we have 4 departments A, B, C and D the department A has 23 hosts, B has 16, C has 28 and D has 13 hosts. You are given a network 202.70.91.0/24. Perform the subnetting in such a way that the IP address wastage in each department is minimum and find out the subnet mask, network address, broadcast, and usable host range in each department. [14]
7. When the congestion occur in the network? Explain the different approach of the congestion control algorithm. [3+7]
8. Explain the Major IP services in the computer networks? [10]
9. Explain the working principle of FTAM protocol. [10]



Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Networks**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. What are the reasons for using layered protocols? Explain the layers of OSI Reference Model with appropriate figure. [2+8]
2. Why do we need the network servers? Explain briefly the different types of Network servers. [2+4]
3. Why we need RAID in the computer networks? Define and discuss the difference between RAID 0, RAID 1, and RAID 5. [2+6]
4. List two advantages and two disadvantages of having international standards for network protocols. Compare and explain the different types of transmitting media with appropriate figure? [3+8]
5. Consider the delay of pure ALOHA versus slotted ALOHA at low load. Which one is less? Explain your answer. [3]
6. Explain the working principle of FDDI with FDDI specifications, FDDI devices, and FDDI fault tolerance. [10]
7. Suppose the network 200.168.10.0/24 is subnetted to create 7 subnetworks and an IP address 200.168.10.177 is assigned to a host computer. Determine the subnet mask, network address, broadcast address, usable host range and in which subnet the given host lies. [10]
8. Explain the Datagram Format of IP V4 with the appropriate figure. What is the minimum header length of IP datagram format? [10 +2]
9. Explain the working principle of Message Handling System (MHS) X.4000 protocol. [10]



Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Networks**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Draw a diagram of OSI model and explain the network functions performed in layer 3 and layer 4. [3+5]
2. List the indicated network hardware devices: one operating in layer 1, one in layer 2, one in layer 3 and other layer 4; and explain each of them. [1+7]
3. Explain briefly the indicated transmission media: coaxial cable, line-of-sight, and satellite. [8]
4. What is the fundamental difference between peer-to-peer priority and non-priority systems of communication protocols? Discuss briefly peer-to-peer priority protocols. [2+6]
5. Explain and distinguish between Permanent Virtual Call and Virtual Call channel options of X.25 network. What are the purposes of LCGN and LCN fields of data packet header? [5+3]
6. Suppose an IP address 202.70.91.145 is assigned to a network that is subnetted to create 6 subnetworks. Determine the subnet mask, network address and host address range for each subnetworks. [8]
7. Differentiate between router, gateway and bridge. What are the functions of bridge and how is bridge table maintained? [3+5]
8. What is the difference between static and dynamic routing? Explain the distance vector routing with appropriate example. [3+5]
9. Explain encryption with private and public keys. Discuss with example, how monoalphabetic version of Caesar cipher works? [4+4]
10. Write short notes on: [4×2]
  - a) ISDN
  - b) ALOHA

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why computer network is important? Differentiate between physical and logical topology. [5+3]
2. Explain the ring and bus topologies in computer network and compare it. [5+3]
3. Write brief notes on network server and network workstation. [5]
4. What are the characteristics of IEEE token bus LAN standard? Explain. [8]
5. Explain in detail about X.25 data link layer and X.25 data packet header. [9]
6. Why do you need adaptive routing? Compare it with flooding. [4+3]
7. What do you mean by congestion control? List and discuss some congestion control algorithms. [2+6]
8. Write diagram of IP header and explain the purpose of Fragment Offset, Time to Live and Protocol fields. [4+4]
9. What do you mean by IP source routing? What is its advantage? [4+2]
10. What type of protocol in UDP? Explain UDP header. [2+4]
11. What are the functions of Message Handling Systems (MHS)? Discuss briefly. What is difference between MHS and MTS? [5+2]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why computer network is important? Differentiate between physical and logical topology. [5+3]
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5. Explain in detail about X.25 data link layer and X.25 data packet header. [9]
6. Why do you need adaptive routing? Compare it with flooding. [4+3]
7. What do you mean by congestion control? List and discuss some congestion control algorithms. [2+3]
8. Write diagram of IP header and explain the purpose of Fragment Offset, Time to Live and Protocol fields. [7+1]
9. What do you mean by IP source routing? What is its advantage? [4+2]
10. What type of protocol in UDP? Explain UDP header. [2+4]
11. What are the functions of Message Handling Systems (MHS)? Discuss briefly. What is difference between MHS and MTS? [5+2]

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Exam.	Regular/Back		
Level	B.E.	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Differentiate connection oriented and connection less services. Which type of service is provided by OSI network and transport layers? [4+2]
2. Write brief notes on network hardware devices, NIC and Hub. [6]
3. What do you mean by circuit switching and virtual circuit switching? Discuss application areas of packet switching. [4+2]
4. Discuss different interfaces of ISDN. [4]
5. Explain in detail about IEEE 802.3 physical layer and medium access sublayer. [3+4]
6. Discuss different devices involved in FDDI. [6]
7. Discuss physical and data link layer of X.25 network. Explain the format of data packet header in X.25. [5+4]
8. Explain distance vector routing algorithm with an example of your own. What are the problems with this approach? [5+2]
9. Explain and compare two traffic shaping methods for congestion control. [6]
10. Draw a diagram of IP datagram format and explain. What are minimum values of IHL (header length) and why? [3.5+1.5]
11. Discuss difference in requirements of InterAS routing and IntraAS routing. What is the routing algorithm used by BGP? Explain. [4+3]
12. Discuss components of X.400 Message Handling System with diagram. [6]
13. Discuss directory services with a model of a directory indicating DSP and DAP. [5]

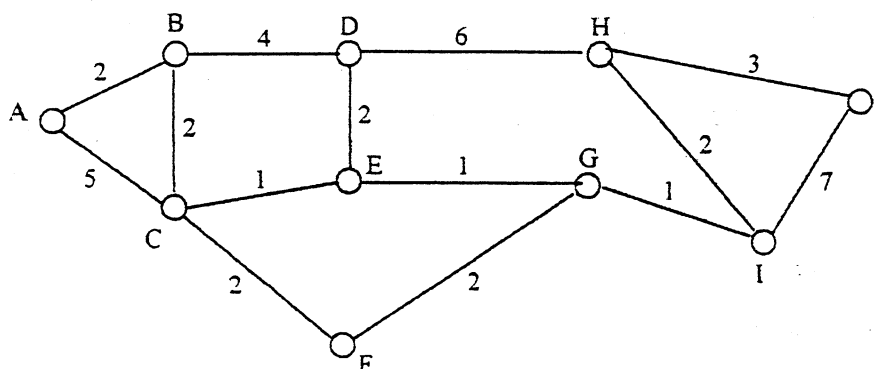
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Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Draw a neat diagram showing OSI reference model. What are the typical services provided by data link layer and transport layer? [3+4]
2. What are functions of network server and network workstation? [4]
3. Write and explain CSMA/CD frame. What are the functions performed by Media-Access management entity in CSMA/CD layers. [2+2]
4. Write brief notes on network transmission media; coaxial, fiber optic. [6]
5. Explain processes involved in digital transmission using in PCM. [4]
6. List and explain briefly peer to peer priority channel access methods. Discuss media access method in IEEE 802.5 standard. [6+3]
7. Explain access method in pure ALOHA. Show that its maximum channel utilization is only 18%. [4]
8. Discuss X.25 channel options with emphasis on PVC. Write and discuss octet 1 and octet 2 of non-data packet header. [4+4]
9. Given a network [6]



Where circles represent network nodes and values at the lines (links) between nodes represent cost of the links. Find shortest path from node A to node J using shortest path method (Dijkstra's algorithm)

10. Discuss IP address classes. In class B address if 7 bit subnetting is used, what is the subnet mask? [6+2]
11. Discuss features of TCP. What is the significance of URG and PSH flags in TCP segment? [4+3]
12. What is the purpose of FTAM? Discuss different attributes of FTAM. [2+4]
13. What are the major security violations? Discuss Data Encryption Standard. [2+5]

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Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1a) Why layered architecture is preferred in computer communication? Illustrate OSI Reference Model and the functions of each layer. (3+3)
- b) Explain how TDM be used to achieve circuit switching. Describe the transmission of packets using virtual circuit approaches. (3+4)
- 2a) Explain the operation of CDMA/CD with neat diagrams. Why cannot we use repeaters/hubs as many as we desire in the 802.3 networks? (6+3)
- b) Why EIA 449 is preferred over EIA-232 in some applications? Describe the electrical, mechanical and functional specifications of EIA-449. (2+5)
- 3a) Explain the data link control mechanism in primary/secondary polling system. Describe how does stop-and-wait protocol work. (4+3)
- b) Explain the operation of X.25. Describe the formats of data packets used to transmit user data in X.25 networks. (5+4)
- 4a) Explain how TCP ensures reliable data interchange despite the use of connectionless Internet protocol. What are the advantages of UDP over TCP? (6+3)
- b) Why IEEE 802.4 standard is more suitable for real-time application than IEEE 802.3? Describe 802.4 frame formats and its logical ring maintenance. (2+5)
- 5a) Why frame relay is used as WAN technology nowadays? Explain the frame relay layers in detail. (3+4)
- b) Discuss the components of SMTP. Explain how does electronic mail service using SMTP along with POP. (5+4)



Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Computer Network**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1a) What are the major transmission media used in computer networking? Explain their characteristics, uses, merits and demerits with neat diagram. (2+6)
- b) Suppose if there is heavy traffic on both 802.3 LAN and 802.5 LAN, a station on which system is more likely to wait longer to send a frame? Why? Give the detail explanation? (2+6)
- 2a) Discuss the operation of the distance vector routing protocol. How does a link-state routing protocol operate? (4+4)
- b) What are the factors that determine whether computer network is LAN, MAN or WAN? Illustrate various types of network topologies. (4+4)
- 3a) What are the differences between the OSI approach and the TCP/IP approach to the application layer in particular? Compare the X.400 protocol with SMTP. (4+4)
- b) State in which situations peer-to-peer network is preferred than client/server network. Show how does Network Interface Card play important role in internetworking. (3+5)
- 4a) What do you understand by TCP? Explain how TCP ensures reliable data interchange despite the use of connectionless Internet protocol. (2+6)
- b) Describe in detail one of the DTE-DCE interface standards specified by EIA. Which is more efficient circuit switching or virtual circuit switching and why? (5+3)
- 5a) Explain how can you compare X.25 layers with those of the OSI model. What kind of virtual circuits does X.25 use? (5+3)
- b) Explain what are the main functions of Media Access Control Sublayer. What is difference between the physical and logical addresses? (5+3)

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Embedded System (CT655)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) What are the common characteristics of embedded systems? How does a digital camera satisfy those characteristics? [4]  
 b) Briefly describe the kernel operating system services. [4]
2. Design a single-purpose processor that outputs Fibonacci numbers up to 'n' places. Start with a function computing the desired result, translate it into a state diagram and sketch a probable datapath. [8]
3. Briefly explain the criterion for selecting processor? Explain the data path operation and its instruction cycles. [4+4]
4. What do you mean by write ability and storage permanence of memory? Explain associative cache mapping. [3+5]
5. What is the difference between memory-mapped I/O and standard I/O. Explain the operation of peripheral to memory transfer without DMA, using vectored interrupt. [3+5]
6. Differentiate between multiprocessing and multi tasking in RTOS. Three processes with process IDs, P1, P2, P3 with estimated completion time 6, 4, 2 ms respectively, enters the ready queue together in order P1, P2, P3. Calculate waiting time and TAT(Turn Around Time) for each process and average waiting time and TAT. Assume there is no I/O waiting for the processes and RR (Round-Robin) algorithm with time slice = 2 ms. [2+6]
7. Differentiate between closed loop and open loop control system. With neat diagram write the steps for designing Closed loop control system. [3+5]
8. Discuss the advantages and disadvantages of Full-Custom IC technology. Explain the basic steps of photo lithography process. [3+5]
9. Draw the pin diagram of 8051 microcontroller and explain ports 1 and 2 only. Write a program using C-programming language to find the sum between two 8-bit BCD data stored in RAM locations 50H and 51H and store the BCD sum at RAM locations 52H and 53H. [3+5]
10. Write an algorithm and VHDL code for a custom processor that calculates Least Common Multiple (LCM) of two numbers. [3+5]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Embedded System (CT655)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Differentiate between single-purpose processors, general-purpose processors, and application-specific processors. Using the simplified revenue model, derive the percentage revenue loss equation for any rise angle, rather than just for 45 degrees. [2+2]
2. What is optimization? Explain optimization of single purpose processor in detail with suitable example. [8]
3. Describe the operation of general - purpose processor in terms of datapath and controller. [5]
4. Explain the testing and debugger. [3]
5. Describe ROM and introduce its types in detail. Sketch the internal design of a  $4 \times 3$  ROM. [6+2]
6. Explain different types of arbitration methods used in peripherals devices to gain control of system bus. Describe the significance of I<sup>2</sup>C serial communication protocol. [8]
7. Describe the context switching process in detail. Three processes with process IDs P1, P2, P3 with estimated completion times 6, 8, 2 milliseconds respectively enters the ready queue together. Process P4 with estimated execution completion time 4 milliseconds enters the ready queue after 1 millisecond. Calculate the waiting time and turn-around-time for each process and the average waiting time and turn-around-time in the non-preemptive shortest-job-first scheduling. [3+3]
8. Explain in detail the Coffman conditions that favor deadlock. Differentiate between user-level threads and Kernel-level threads. [3+3]
9. Explain the operation of a PID control with a clean block diagram. [5]
10. Define the following terms used in control system: Controller, Plant, Actuator. [3]
11. Describe the steps involved in manufacturing an IC. Show the top-down view of the circuit  $F = xz + y$  on an IC. [4+4]
12. Show the internal structure of the 8051 microcontroller. Provide a comparison chart of the 8051 family members. [4+4]
13. Write the code for BCD counter to display 0 to 9999 in seven segment using VHDL. [8]

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Exam.	Regular / Back •		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

**Subject:** - Embedded System Design Using ARM Technology (EG785EX)  
(Elective II)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

- 1) Describe the design metrics and design methodologies for designing and developing low-end and high-end mobile handsets. [5]
- 2) Differentiate between privileged mode vs. unprivileged mode. Explain Exception/Interrupts and Vector Table. [5]
- 3) Describe pipelining and explain the ARM instruction execution for Data Transfer instructions with data flow block diagram [10]
- 4) Write c program for recursive procedure that calculates factorial n and write the ARM assembly code for the following C statement. [5]  
g = h + A [8];  
A [12] = h + A [8];  
Assume A is an array of 100 words and that the compiler has associated the variables g and h with registers r1 and r2 and uses r5 as temporary register. Let's also assume that the starting address or base address of the array is in r3.
- 5) Explain leaf and nested procedure. Translate the following C program for leaf procedure that computes  $Y = (A+B) + (C+D) + (A*D)$  into ARM Assembly Code. [5]

Int leaf\_ad (int A, int B, Int C, Int D)

```
Int Y;  
Y = (A+B) + (C+D) + (A*D)  
Return Y;
```

The parameter variables A, B, C, and D correspond to the argument registers r0, r1, r2 and r3 and Y corresponds to r4. Use r7, r8, r9, and r10 as temporary variables for stack use.

- 6) (a) Explain ARM registers usage in both privileged and unprivileged mode and write ARM exceptions and its corresponding modes and functionalities. [10]  
(b) Write the single register store instructions for Half-word using different addressing mode using the following information for ARM instruction set. [6]

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

***Subject: - Embedded System (CT655)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- ✓ 1. What are the common characteristics of embedded systems? Explain. [4]
2. Design a processor that calculates the LCM of two numbers. Show the design of data path only and construct the diagram of controller. [8]
3. ✓ What are the programmer considerations? Explain the software development processes according to embedded systems. [2+6]
4. a) ✓ Explain the operations of storing and earsing the data in UV-EPROM. [6]  
b) ✓ Describe the cache write techniques. [2]
5. ✓ Explain arbitration systems that implemented to communicate with peripheral devices from the microprocessor. Differentiate between memory mapped I/O with standard I/O. [8]
6. ✓ Explain the basic functions of Real-time kernel. [6]
7. ✓ Describe the control switching mechanism. [4]
8. ✓ Define throughput of a system. [2]
9. ✓ What is PID tuning? Discuss on the practical issues related with computer based control. [8]
10. ✓ Define the photolithography. Explain the various steps involved in photolithography. [2+6]
11. Why 8051 microcontroller is used ? Write an assembly program to get data from P0 and send it to P1 and compare with corresponding C program. [3+5]
12. ✓ Write the VHDL code for processor (GCD) that calculates greatest common divisor of two integer data with its state diagram. [8]

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

**Subject: - Embedded System (Elective)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ **All** questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Define and describe embedded system with suitable example.
2. Justify "Processor is the heart of any embedded system." Also mention the structural units of a processor.
3. What is Direct Memory Access (DMA)? Why such circuitry is needed? Explain with its block diagram.
4. What is device driver? Explain its importance while connecting the peripherals in the system.
5. Describe the terms IRQ, ISR, IVT, PUSH, POP and Interrupt Latency used in Interrupt based designs.
6. Briefly explain RTOS (Real Time Operating System) with its services.
7. What is a scheduler? Describe its role in managing task states in detail.
8. In an RTOS environment, different tasks may share same variables and functions. Explain the problem(s) faced due to this type of sharing and also suggest the solutions.
9. Explain Spiral Model of Embedded Software Development Life Cycle.
10. Differentiate Microprocessor and Microcontroller highlighting its uses. Also explain the Addressing Modes of 8051 microcontroller.

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Propagation and Antenna (EX653)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1/ Derive a relation for the field intensity for the array of two elements isotropic radiators in various conditions. Show the condition for broad side and end fire array with necessary diagrams. [5+6]
2. Explain any five parameters of antenna. [5]
- 3/ Compare Yagi antenna with log periodic antenna. Explain the working principle and design of log-periodic antenna. [2+8]
4. A parabolic reflector antenna having antenna efficiency 85% is designed for 3 GHz resonant frequency with 2.5 dB waveguide loss. Find out the antenna diameter if effective isotropic radiated power (EIRP) is calculated 46 dBW and transmitting power is 500 W. [8]
- 5/ Write down the factors which affect the space wave communication. Explain the major characteristics of MW and SW radio propagation. [5+6]
- 6/ With a mathematical relation of refractive index of ionospheric layer derive a relation of critical frequency and maximum usable frequency (MUF) of radio waves with necessary explanation. Consider the earth is not curved. [8]
- 7/ How do you get Friis transmission equation and path loss in case of free space wave propagation? [4+3]
- 8/ Explain the working principle and design of (a) Marconi antenna (b) Rhombic antenna. [5+5]
- 9/ Explain the construction, light propagation mechanism and application of different types of optical fiber. [10]

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