BEI

III/I

Question BanK

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

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

Subject: - Filter Design *(EX 606)*

- ✓ 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.*
- ✓ ***Necessary table is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What is the importance of normalization and denormalization in filter design? Derive element scaling equation. [2+5]
2. Derive the relation to calculate the order n of a Butterworth approximation. Use the formula to calculate the order of Butterworth having following specification α_p = 0.5dB, α_s =20dB, ω_p = 1000 rad/s, ω_s = 2000 rad/s. Determine transfer function and show pole locations. [4+3+3]
3. What is the importance of all pass filter in filter design? Find the transfer function of 3rd order Bessel Thomson low pass filter. [1+4]
4. How frequency transformation reduces the design steps required to design a filter? Design a band stop filter having center frequency 2000 rad/s and bandwidth 400 rad/s from a 3rd order Butterworth low pass filter. (Refer Table) [1+4]
5. Which of the following is valid lossless function? State with reason. Pick one of the valid LC lossless functions and synthesize it using Foster II and Cauer II methods. [3+3+3]

   (i) $Z(s) = \dfrac{(s^2+4)(s^2+5)}{(s^2+2)(s^2+10)}$

   (ii) $Z(s) = \dfrac{s^4+4s^2+3}{s(s^2+2)}$

   (iii) $Z(s) = \dfrac{s^6+4s^4+8s^2}{s^3+3s}$

6. Define zeros of transmission in two port network. What is zero shifting by partial removal of pole? Explain with suitable example. [1+3]
7. Describe the significance of reflection coefficient. Derive the 3rd order Butterworth low pass filter resistively-terminated lossless network with unequal termination of $R_1 = 1\Omega$ and $R_2 = 4\Omega$. [2+5]
8. Differentiate active and passive filter. Realize the following transfer function using non-inverting op-amp configuration. [2+3]

   $T(s) = \dfrac{4(s+2)}{s+1}$

9. Draw the circuit diagram of Tow-Thomas Biquad circuit and derive its transfer function. Design a low pass filter using Tow Thomas Biquad circuit with poles at -450 ± j 893.03 and dc gain of 1.5. The final circuit should contain practically realizable values. [8]

10. What information do you get when the sensitivity of y with respect to x is 0.1? Perform sensitivity analysis for center frequency ωo of Tow Thomas low pass filter with respect to all the resistors and capacitors present in the circuit. [1+3]

11. What is FDNR? How can you use FDNR to avoid the inductor in filter design? Explain. Design third order Butterworth low pass filter having half power frequency 4000 rad/s using FDNR. (Refer Table) [4+6]

12. Why resistors are replaced by switched capacitors in IC technology? How summer, inverting integrator and non-inverting integrator can be realized using switched capacitor? Explain with necessary diagrams and expressions. [2+4]

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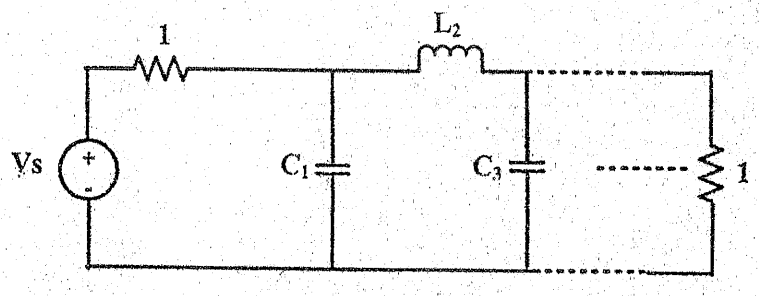
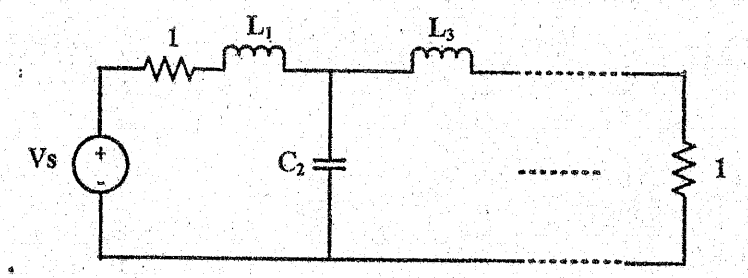
Table:

Elements values for doubly terminated Butterworth filter normalization to half power frequency of 1 rad/s.



n	C_1	L_2	C_3	L_4	C_5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L_1	C_2	L_3	C_4	L_5



TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

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

Subject: - Filter Design *(EX 606)*

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- ✓ *Attempt **All** questions.*
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1. What are the characteristics of idea filter? What is the importance of scaling in filter design? Derive the necessary expressions to determine the new values of circuit elements in the case of magnitude and frequency scaling. [7]
2. What is approximation in filter design? Derive an expression to calculate the order of Inverse Chebyshev low pass filter. Use this formula to estimate the order of Chebyshev low pass filter with the following specifications; [1+5+3]

   $\omega_p = 100$Krad/s, $\omega_s = 140$ Krad/s

   $\alpha_{max} = 0.25$ dB, $\alpha_{min} = 18$ dB
3. What is constant delay filter? Find the transfer function of 3rd order constant delay filter. [5]
4. Describe the frequency transformation from low pass filter to band pass filter with a suitable example. [5]
5. What are the properties of LC driving point impedance function? Which of the following function is valid LC driving point impedance function? State with reason. [3+3+3]

$$Z(s) = \frac{8s^3 + 10s}{s^4 + 6s^2 + 5}, \qquad Z(s) = \frac{(s^2+4)(s^2+9)}{(s^2+16)(s^2 25)}$$

   Find the Cauer second form of valid driving point impedance function.
6. Define zeros of transmission. How can zeros of transmission be realized in the circuits? Explain with suitable diagrams. [5]
7. What information do you get when the value of reflection coefficient is zero? Design a third order Butterworth low pass filter using Resistively terminated lossless ladder with equal termination of 1Ω. (Refer Table:1) [1+6]
8. Design circuit of the transfer function $T(s) = \frac{s+8}{s+2}$ using non inverting op-amp configuration. [4]
9. Derive the transfer function of low pass sallen-key biquad filter (Refer Table :1) The half power frequency should be 10 KHz. Make the largest capacitance 0.01μF and overall gain be 1. [4+4]
10. Explain the importance of sensitivity analysis in the design of filter and perform the sensitivity analysis of w_0 of lowpass sallen-Key biquad. [7]

11. Design the 4th order Butterworth LPF in doubly-terminated network using Leapfrog simulation. The necessary information is listed in the given table below: [8]

Order(n) =4 and LPF	R_1=1	L_1=0.7654	C_2=1.848	L_3=1.848	C_4=0.7654	R_2=1

12. What is Switch capacitor filter? Design a switched capacitor filter to realize the transfer function. [6]

$$T(s) = \frac{(s+200)(s+800)}{(s+400)^2}$$

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Table 1:

Pole location for Butterworth low pass filter with half power frequency 1 rad/s

n=2	n=3	n=4	n=5
- 0.7071068 ± j 0.7071068	- 0.50 ± j 0.86603	- 0.3826834 ± j 0.9238795	- 0.809017 ± j 0.5877852
	- 1.0	- 0.9238795 ± j 0. 3826834	- 0.309017 ± j 0. 9510565
			-1.0

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Year / Part	III / I	**Time**	3 hrs.

Subject: - Filter Design *(EX 606)*

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- ✓ *Assume suitable data if necessary.*

210

1. What is the significance of normalization and denoramlization in filter design? Derive elements scaling equations. [2+5]
2. What are the characteristics of chebyshev magnitude response? Derive an expression to calculate the order (n) of a Chebyshev filter for given lowpass specifications. Determine the minimum order n of chebyshev filter for following specifications.

   α_p =1 dB, α_s= 25 dB and ($\omega s/\omega p$) = 1.5, where the symbols have their usual meanings. [3+4+3]
3. What is a constant delay filter? What is its significance? Derive a transfer function of a second order constant delay filter. [1+1+3]
4. What are the applications of frequency transmission in filter design? How can you obtain a high pass filter from a given low pass filter? Explain with a suitable example. [1+4]
5. What are the properties of RC impedance function? Synthesize the given RC impedance in Foster and Cauer form.

   $Z(s) = 3(s+2)(s+4)/(s(s+3))$ [3+3+3]
6. What is zero shifting by partial removal of a pole? Explain with a suitable example. [5]
7. What is transmission coefficient? What information do we get from it? Derive the expression for reflection coefficient for a resistively terminated LC ladder network. [2+5]
8. Design a second order low pass filter with poles at -10000 ± j 17320.51 and Dc Gain of 2.5 using a Tow Thomas Biquad Circuit. Your final circuit should have capacitors of value 0.001uF. [6]
9. How is the excess gain compensated in Sallen-Key circuit? Explain with necessary derivations and diagrams. [5]
10. What is frequency dependent negative resistar (FDRN) ? How can it be realized? Realize the following passive filter using FDNR, having wo =25000 rad/s and practical element values in your final circuit. [1+3+5]

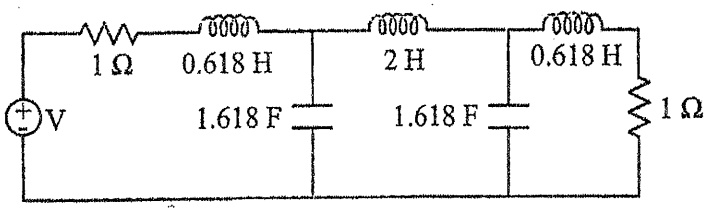

Fig: Butterworth filter at normalized frequency.

11. What is the importance of sensitivity analysis in filter design? Perform the sensitivity analysis of Wo of sallen-key lowpass biquad filter. [2+4]
12. Why do we need switched capacitor to simulate resister in MOS technology? How can you simulate a resister using switched capacitor? Explain with necessary derivations. [2+4]

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TRIBHUVAN UNIVERSITY
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2079 Bhadra

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Year / Part	III / I	Time	3 hrs.

Subject: - Filter Design *(EX 606)*

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- ✓ ***Necessary tables are attached herewith.***
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1. What are the significance of normalization and denormalization in filter design? Derive equation to calculate the new values of resistors, inductors and capacitors that will change the half-power frequency of a low pass filter from ω_0 rad/s to ω_n rad/s. [3+4]
2. What are the characteristics of Butterworth response? Derive an expression to estimate the order (n) of low pass Butterworth filter. Use this formula to estimate the order of Butterworth filter with the following specifications: [3+4+3]
   $\omega_p = 2000$ rad/sec; $\alpha_{max} = 1$ dB
   $\omega_s = 3000$ rad/sec; $\alpha_{min} = 12$ dB
3. What is the importance of all pass filters in delay equalization? Find the transfer function of third order Bessel-Thomson low pass filter. [2+3]
4. What is frequency transformation? Design a band stop filter having center frequency 2000 rad/s and bandwidth 400 rad/s from a third order Butterworth low pass filter. [Refer Table 2] [1+4]
5. What are the properties of LC driving point impedance function? Which of the following function is LC driving point impedance function? Explain with reason. [3+2+3]

$$Z(s) = \frac{8s^3 + 10s}{s^4 + 6s^2 + 5}$$

$$Z(s) = \frac{s^4 + 5s^2 + 4}{s^3 + 9s}$$

6. What are the zeros of transmission? How can they be realized in a network? Explain with suitable examples. [2+4]
7. Define reflection coefficient. Realize the third order Butterworth low pass filter using resistively terminated lossless ladder with $R_1 = 1\ \Omega$ and $R_2 = 4\ \Omega$. [Refer Table 2] [1+5]
8. Realize an active filter using non-inverting op-amp configuration with a zero at s = -4 and a pole at s = -8 having high frequency gain of k = 2. [5]
9. What is Quality factor and center frequency of low pass biquad filter? Explain with suitable diagram. Realize following low pass filter transfer function using Tow Thomas biquad circuit. [3+5]

$$T(s) = \frac{-2000}{s^2 + 500s + 1000000}$$

10. Why is sensitivity analysis important in filter design? Perform the sensitivity analysis of ω_0 in Tow Thomas low pass filter. [1+4]
11. What is Bruton transformation? Design the 4th order Butterworth low pass filter with half power frequency 20,000 rad/s and practically realizable elements using FDNR. [Refer Table 2] [3+5]

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1. What are the significance of normalization and denormalization in filter design? Derive equation to calculate the new values of resistors, inductors and capacitors that will change the half-power frequency of a low pass filter from ω_0 rad/s to ω_n rad/s. [3+4]
2. What are the characteristics of Butterworth response? Derive an expression to estimate the order (n) of low pass Butterworth filter. Use this formula to estimate the order of Butterworth filter with the following specifications: [3+4+3]
   $\omega_p = 2000$ rad/sec; $\alpha_{max} = 1$ dB
   $\omega_s = 3000$ rad/sec; $\alpha_{min} = 12$ dB
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4. What is frequency transformation? Design a band stop filter having center frequency 2000 rad/s and bandwidth 400 rad/s from a third order Butterworth low pass filter. [Refer Table 2] [1+4]
5. What are the properties of LC driving point impedance function? Which of the following function is LC driving point impedance function? Explain with reason. [3+2+3]

$$Z(s) = \frac{8s^3 + 10s}{s^4 + 6s^2 + 5}$$

$$Z(s) = \frac{s^4 + 5s^2 + 4}{s^3 + 9s}$$

6. What are the zeros of transmission? How can they be realized in a network? Explain with suitable examples. [2+4]
7. Define reflection coefficient. Realize the third order Butterworth low pass filter using resistively terminated lossless ladder with $R_1 = 1\ \Omega$ and $R_2 = 4\ \Omega$. [Refer Table 2] [1+5]
8. Realize an active filter using non-inverting op-amp configuration with a zero at s = -4 and a pole at s = -8 having high frequency gain of k = 2. [5]
9. What is Quality factor and center frequency of low pass biquad filter? Explain with suitable diagram. Realize following low pass filter transfer function using Tow Thomas biquad circuit. [3+5]

$$T(s) = \frac{-2000}{s^2 + 500s + 1000000}$$

10. Why is sensitivity analysis important in filter design? Perform the sensitivity analysis of ω_0 in Tow Thomas low pass filter. [1+4]
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Subject: - Filter Design (*EX 606*)

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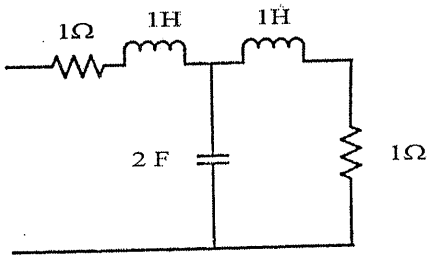
1. What is Normalization and De-Normalization in filter design? The circuit given below is a Butterworth lowpass filter with half power frequency of 1 rad/s. Convert its half power frequency to 100 Hz using capacitor of 0.01μF. [2+4]



2. Derive the expression of order n for Chebyshev Low pass filter, Use this expresion to find the order from the given ω_p = 2000 rad/s and ω_s = 3500 rad/s.specifications: a_{max} = 0.5 dB, a_{min} = 20 db. [4+3]
3. What is delay equalization? What is its importance? Explain. [4]
4. What is frequency transformation? Design a bandstop filter having center frequency 2000 rad/s and bandwidth 400 rad/s from a third order Butterworth lowpass filter. [1+4]

   [Refer Table 1]
5. What are the properties of LC driving point impedance function? Which of the following is valid lossless impedance function and why?

   a) $Z(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$

   b) $Z(s) = \frac{(s+4)(s+6)}{(s+3)(s+5)}$

   c) $Z(s) = \frac{(s^2+1)(s^2+4)}{s(s^2+9)}$

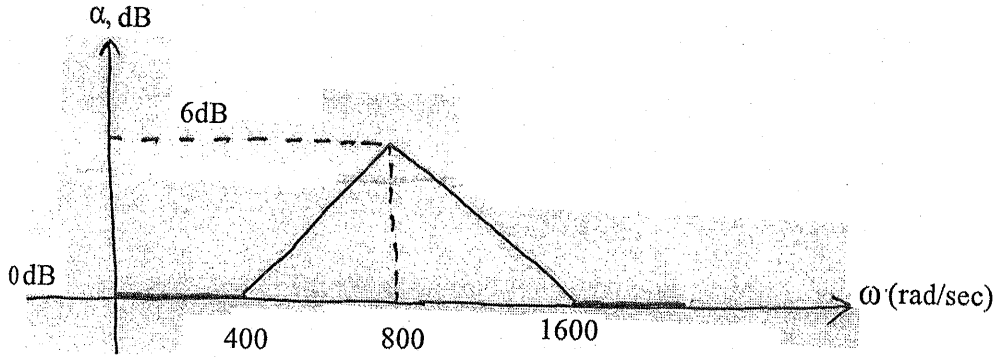
   Also, find the Foster I form of valid lossless impedance function. [3+3+3]
6. What is transmission zeros in two port network? How can you realize in a two port network? Explain with suitable example. [1+4]
7. What information does the transmission coefficient revels in a system? Describe a second order Butterrworth low pass filter using lossless ladder with equal termination of 1Ω (i.e put R1 = 1Ω and R2 = 1Ω). [1+5]
8. Design a 4th order Butterworth LPF using cascade of two Sallenkey biquads having half power frequency of 10 kHz, using 0.1 μ F capacitors. Perform gain compensation if necessary. [8]
9. Explain the gain enhancement procedure in Sallen and Key biquad circuit. [4]

10. What information do you get when sensitivity of y with respect to x is 10? Perform sensitivity analysis for center frequency (w_0) of sallen Key lowpass filter with respect to all the resisters and capacitors present in the circuit. [1+4]

11. What is GIC? How GIC can be used to simulate the floating inductor in the passive filter? Explain. [5]

12. Design a fourth order Butterworth low filter having half power frequency of 16000 rad/s using FDNR. [Refer Table 1] [5]

13. Design a switched – capacitor MOS filter from the given Bode Plot: [6]



14. What are the merits and demerits of active filter as compared with passive filter? Explain. [5]

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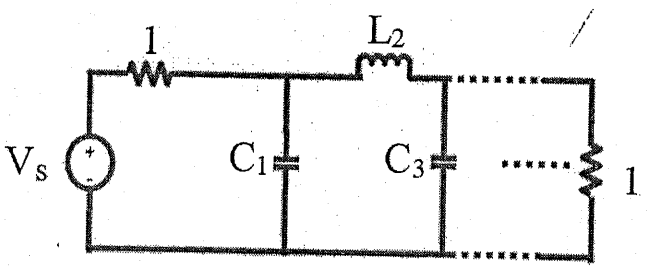
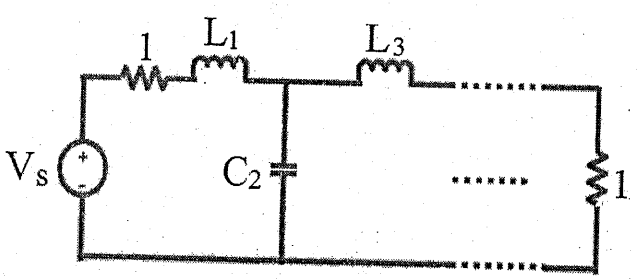
Table 1:

Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s.



n	C_1	L_2	C_3	L_4	C_5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L_1	C_2	L_3	C_4	L_5



TRIBHUVAN UNIVERSITY
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2078 Bhadra

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

Subject: - Filter Design *(EX 606)*

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1. What is filter? Why do we need filter in communication system? Explain the types of filter with their magnitude responses. [1+1+5]
2. Derive an expression to calculate the order of Chebyshev lowpass filter. Find the order of Chebyshev lowpass filter having following specifications: [4+3]

   $\alpha_{max} = 0.25$ dB, $\alpha_{min} = 18$ dB

   $w_p = 1000$ rad/s, $w_s = 1650$ rad/s
3. What is constant delay filter? What are the steps involved in designing a constant delay filter? Explain with suitable example. [1+5]
4. What is frequency transformation? How can you obtain Bandpass filter from given standard lowpass filter? Explain with example. [1+4]
5. How can you assure that the following function is a valid LC impedance function?

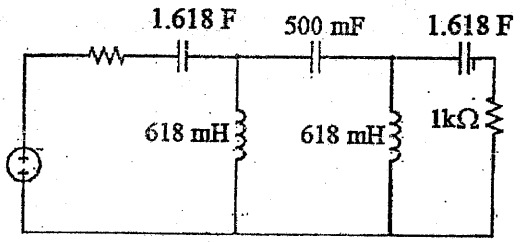
   $$Z(s) = \frac{8s^3+10s}{5+6s^2+s^4}$$

   Synthesize it using Foster I and Cauer II form. [2+3+3]
6. What do you mean by zero shifting? How can it be used for synthesis of two-port networks? Explain. [5]
7. What is reflection coefficient? Design a third order Butterworth lowpass filter using resistively terminated lossless ladder with unequal termination of $R_1 = 1\ \Omega$ and $R_2 = 4\Omega$. [Refer Table 1] [1+5]
8. Derive the transfer function of Tow-Thomas band pass biquad and design it with centre frequency of 1000 rad/sec, bandwidth of 200 rad/sec and a maximum gain of 1. [5+4]
9. Design an active filter using non-inverting op-amp configuration with following transfer function. [5]

   $$T(s) = \frac{(s+8)}{(s+2)}$$
10. What is the importance of sensitivity analysis in filter design? Perform the sensitivity analysis of Tow Thomas low pass filter. [1+4]

11. What is generalized impedance converter (GIC)? How can you simulate the grounded inductor in the passive filter using GIC?

Realize the following passive filter to be active simulation of grounded inductors. Use frequency scale factor $K_f = 2000$ and also perform the magnitude scale to get practically realizable element values in your final circuit. [2+3+5]



12. What is switched capacitor filter? What are its applications? How can you simulate a resister using switched capacitor? Explain with necessary derivations. [1+1+5]

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Table 1 :

Pole location for Butterworth lowpass filter with half power frequency 1 rad/s

n=2	n=3	n=4	n=5
- 0.7071068 ± j 0.7071068	- 0.50 ± j 0.86603	- 0.3826834 ± j 0.9238795	- 0.809017 ± j 0.5877852
	- 1.0	- 0.9238795 ± j 0. 3826834	- 0.309017 ± j 0. 9510565
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TRIBHUVAN UNIVERSITY
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2076 Chaitra

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

Subject: - Filter Design *(EX 704)*

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1. What is all-pass filter? Where is it used since it passes all the frequency components? [2+2+4]
2. Derive an expression to calculate the order of Chebyshev low pass filter. Use this formula to estimate the order of Chebyshev low pass filter having following specifications: [4+3]
   $\alpha_{max} = 0.25dB$, $w_p = 1000rad/s$
   $\alpha_{min} = 20dB$, $w_s = 1500rad/s$
3. What is the importance of constant delay filter? Find transfer function of third order constant delay filter. [1+4]
4. What is frequency transformation? Design a bandstop filter having center frequency 2000rad/s and bandwidth 400 rad/s from a third order Butterworth lowpass filter.[Refer table 2] [1+4]
5. What are the properties of lossless one port network function? Which of the following function is LC one port driving point impedance function? Explain with suitable reason.[3+2+3+3]
   $Z(s) = \frac{(s^2+1)(s^2+9)}{s(s^2+4)}$, $Z(s) = \frac{s(s^2+4)(s^2+5)}{(s^2+3)(s^2+6)}$
   Realize a valid lossless one part function using Foster II & Cauer II methods.
6. What is transmission zeros in two port network? What are the steps involved in realizing transmission zeros in two port network? Explain with suitable example. [1+4]
7. Design a third order Butterworth low pass filter using a doubly terminated lossless ladder having $R_1 = 1\Omega$ and $R_2 = 4\Omega$. [Refer table 1] [6]
8. What are the advantages of active filter over passive filter? Realize an active filter having a pole at 100 and a zero at 1000 with a dc gain of 5. [3+3]
9. Derive the transfer function of Sallen-key low pass filter. Design a filter for $T(s) = \frac{1}{s^2+0.765s+1}$ using Sallen key low pass filter. In your final design the values of capacitors must be $0.01\mu F$ and feedback resistors should be equal. [4+4]
10. What is the importance of sensitivity analysis in filter design? Perform sensitivity analysis for w_o of sallen key low pass filter with respect to all the resistors and capacitors present in the circuit. [1+4]

11. What is GIC? How can you simulate a grounded inductor? Design a fourth order Butterwarth highpass filter having w_o=16,000 rad/s and practically suitable elements using simulated inductors. [Refer table 2] [1+3+4]

12. What is switched capacitor filter? How summer, inverting integrator and non-inverting integrator can be realzied using switched capacitor? Explain with necessary diagrams and transfer function. [1+5]

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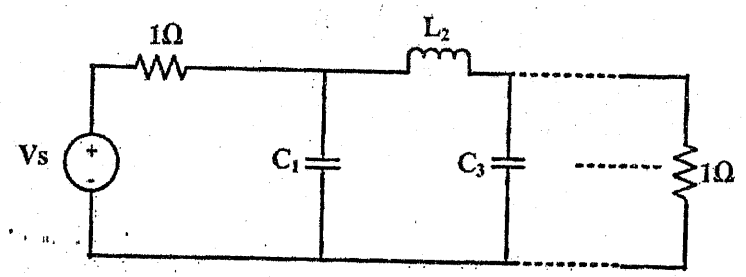
Table 1:

Pole Location for Butterworth Responses

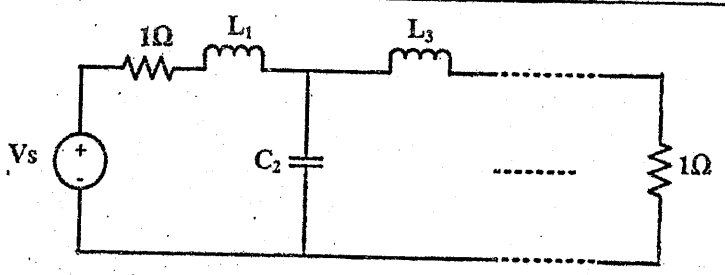
n=2	n=3	n=4	n=5
- 0.7071068 ± j 0.7071068	- 0.50 ± j 0.86603	- 0.3826834 ± j 0.9238795	- 0.809017 ± j 0.5877852
	- 1.0	- 0.9238795 ± j 0. 3826834	- 0.309017 ± j 0. 9510565
			-1.0

Table 2:

Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s.



n	C_1	L_2	C_3	L_4	C_5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L_1	C_2	L_3	C_4	L_5



TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

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

Subject: - Filter Design *(EX704)*

- ✓ 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 α_{max}, α_{min}, half power frequency, bandwidth, insertion loss and insertion gain with necessary figures. [6]
2. What are the characteristics of Butterworth filter? Derive an expression to estimate the order (n) of low pass Butterworth approximation. Use this formula to estimate the order of Butterworth filter with the following specifications:

   $\omega_p = 1000$ rad/sec; $\alpha_{max} = 1$ dB
   $\omega_s = 2000$ rad/sec; $\alpha_{min} = 20$ dB [2+4+2]
3. What is constant delay filter? Find the transfer function of third order constant delay filter. [2+3]
4. What is frequency transformation? What is its importance in filter design? Design a bandpass filter having $\omega_0 = 2000$ rad/s and B = 400 rad/s from a third order Butterworth lowpass filter. [Refer Table 1] [1+1+4]
5. What are the properties of RC driving point impedance function? Determine whether the following functions are lossless function or not? State with reason.

   $$Z(s) = 2\frac{S^4 + 9S^2 + 8}{(S^3 + 4s)} \qquad Z(s) = \frac{(S^3 + S)}{(S^4 + 12s^2 + 32)}$$

   $$Z(s) = \frac{(S^3 + 4s)}{(S^4 + 4S + 3)}$$

   Realize one of the valid lossless function using Foster Series method and Cauer II method. [3+3+3+3]
6. What are zeros of transmission? How can zeros of transmission be realized in circuit? Explain with examples. [5]
7. What information do you get from transmission coefficient and reflection coefficient? Design a second order Butterworth low pass filter using resistively terminated lossless ladder with equal termination of 1Ω. $T(S) = \frac{1}{S^2 + \sqrt{2}S + 1}$ [2+5]
8. Derive transfer function of Sallen-Key low pass filter? Design circuit for transfer function $T(s) = \frac{1}{s^2 + 0.765s + 1}$ using Sallen-Key biquad. In your final design the values of capacitor must be 0.01 μF and feedback resisters should also be equal. [4+4]

9. What is Sensitivity? What is the importance of sensitivity analysis in filter design? Perform sensitivity analysis of ω_0 in Sallen-Key low pass filter. [1+1+4]

10. What is gyrator? How can you simulate inductor using gyrator? Explain with necessary derivation. [1+4]

11. Design a fourth order Butterworth low pass filter having half power frequency of 4000 rad/s using Leapfrog simulation. [Use table 1] [6]

12. Why resistors are replaced by switched capacitors in IC technology? Design a switched capacitor filter to realize the magnitude response given below: [1+5]

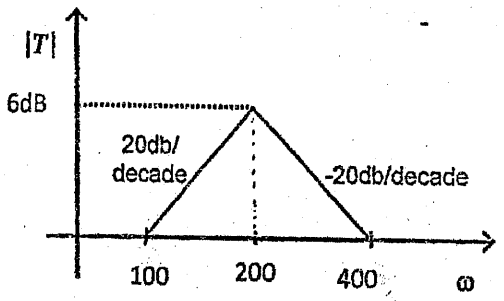
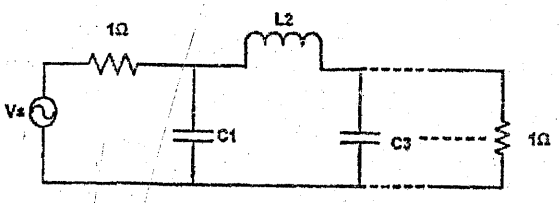
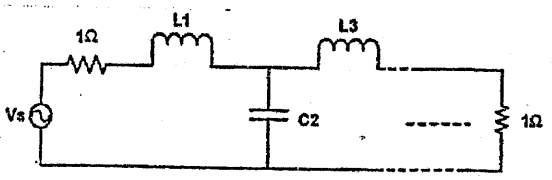


Table 1: Element values for doubly terminated Butterworth Low Pass filter normalized to half power frequency of 1 rad/sec.



n	C1	L2	C3	L4	C5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L1	C2	L3	C4	L5



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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

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

Subject: - Filter Design *(EX704)*

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

1. What is the importance of scaling in Filter design? Derive element scaling equations. [2+4]
2. Derive the expression to calculate the order n of a Butterworth Low pass filter and use it to find the order for given specification: $\alpha_{max} = 1$ dB, $\alpha_{min} = 20$ dB and $\omega_s/\omega_p = 1.5$. Also determine pole locations and transfer functions. [4+2+4]
3. What is a constant delay filter? Find the transfer function of 3rd order Bessel Thomson response having a constant delay. [2+4]
4. What is the importance of frequency transformation? Obtain a bandpass filter having $\omega_0 = 2000$ rad/s and B = 400 rad/s from fourth order Butterworth lowpass filter. [Refer table 2] [1+4]
5. Which of the following is LC lossless functions and why? Pick one of the valid LC lossless functions and realise it using Foster-I and Cauer-I form. [2+3+3]

   i) $Z_1(s) = \frac{s(s^2+4)(s^2+6)}{(s^2+3)(s^2+9)}$

   ii) $Z_2(s) = \frac{(s^2+3)(s^2+6)}{s(s^2+4)(s^2+9)}$

   iii) $Z_3(s) = \frac{(s^2+4)(s^2+6)}{s(s^2+3)(s^2+9)}$

   iv) $Z_4(s) = \frac{(s^2+3)(s^2+6)}{(s^2+4)(s^2+9)}$

6. What is transmission zeros in two port network? What is zero shifting by partial removal of pole? Explain with suitable example. [1+3]
7. Design a third order Butterworth low pass filter using resistively terminated lossless ladder with unequal termination. $R_1 = 1\ \Omega$ and $R_2 = 4\ \Omega$. [Refer table 1] [7]
8. Derive transfer function of Sallen Key low pass filter. Design second order Butterworth low pass filter using Sallen Key biquad. In your final design the values of capacitor must be 0.01μF and feedback resisters should also be equal. [Use Table 1] [4+4]
9. What is RC-CR transformation? How can you convert a Sallen Key low pass filter into the Sallen Key High pass filter using RC-CR transformation? [4]
10. What information do you get when sensitivity of x with respect to y is -3. Perform sensitivity analysis for ω_0 of Sallen Key low pass filter with respect to all the resisters and capacitors present in the circuit. [1+4]
11. What is GIC? How a GIC can be used to simulate grounded inductor? Explain with necessary figures and expression. [5]
12. Simulate the Butterworth 4th order low pass filter in resistively – terminated lossless network using FDNR. (Refer table 2) [6]
13. What is a switched capacitor filter? How resistor, summing integrator and inverting lossy integrator can be realized using switched capacitor filter? Explain with necessary derivations. [1+5]

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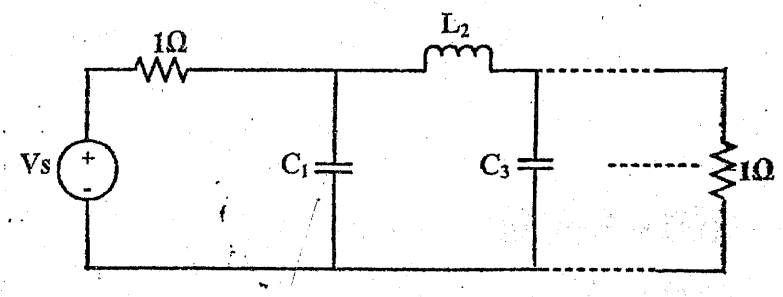
Table 1:
Pole Location for Butterworth Responses

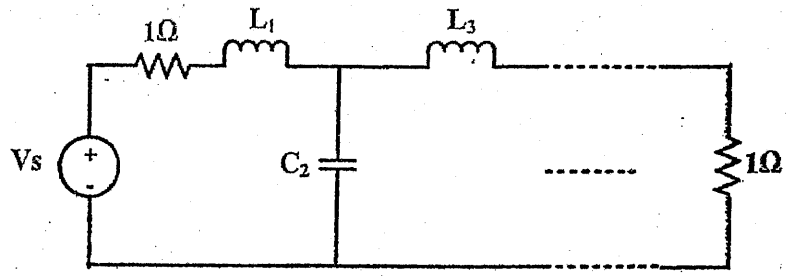
n=2	n=3	n=4	n=5
- 0.7071068 ± j 0.7071068	- 0.50 ± j 0.86603	- 0.3826834 ± j 0.9238795	- 0.809017 ± j 0.5877852
	- 1.0	- 0.9238795 ± j 0. 3826834	- 0.309017 ± j 0. 9510565
			-1.0

Table 2:

Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s



n	C_1	L_2	C_3	L_4	C_5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L_1	C_2	L_3	C_4	L_5



21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

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

Subject: - Filter Design *(EX704)*

- ✓ 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**.*
- ✓ ***Necessary tables are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What is a filter? What is its importance in communication? Explain ideal response and response of practical filter. [1+2+3]
2. Derive an expression to calculate the order of Chebyshev low pass filter. Use this formula to find the order of Chebyshev low pass filter having following specification; [3+3]
   a) For pass band extending from f = 0 Hz to f = 3.2 KHz, the attenuation should not exceed 0.4dB
   b) For stop band extending from f = 9.8 KHz to f = ∞, the attenuation should not be less than 52 dB
3. What is an all pass filter? What is its importance? Derive the transfer function of second order constant delay filter. [1+1+4]
4. What is frequency transformation? How can you convert a low pass filter into a band stop filter using frequency transformation? Explain with suitable example. [2+4]
5. What are the properties of RC impedance function? Which of the following is valid RC impedance function? State with reason. Pick a valid RC impedance function and realize it using foster I and cauer I method. [2+2+3+3]

$$z(s) = \frac{s(s^2+2)}{(s^2+1)}$$

$$z(s) = \frac{(s+1)(s+5)}{(s+3)(s+7)}$$

$$z(s) = \frac{(s+3)(s+7)}{(s+1)(s+5)}$$

$$z(s) = \frac{(s+1)(s+3)}{(s+4)(s+5)}$$

6. Define zeros of transmission. How zeros of transmission can be realized? Explain with suitable example. [4]
7. What information do you get from reflection coefficient? Design a third order Butterworth low pass filter using Resistively terminated lossless ladder with equal termination of 1Ω. (Use table 1) [1+5]

8. Draw the circuit diagram of Tow-Thomas low pass biqaud circuit and derive its transfer function. Design a second order low pass filter using Tow-Thomas biquad poles at -450± j893.03 and dc gain of 1.5. The final circuit should consist practically realizable elements. [4+4]

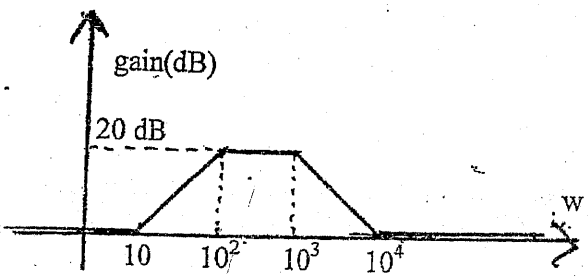
9. How excess gain can be compensated in sallen key filter? Explain. [5]

10. Define sensitivity Perform sensitivity analysis of Tow-Thomas biquad low pass filter. [1+4]

11. What is ideal gyrator? How can you simulate inductor using gyrator? Explain with necessary deriation. [1+4]

12. Design the fourth order Butterworth low pass filter using leapfrag simulation. In your final design the half power frequency should be 10000 rad/s and practically realizable elements. [Refer table 2] [7]

13. What are the applications of switched capacitor filter? Design a switched capacitor filter for following requirements. [6]



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P.T.O.

21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

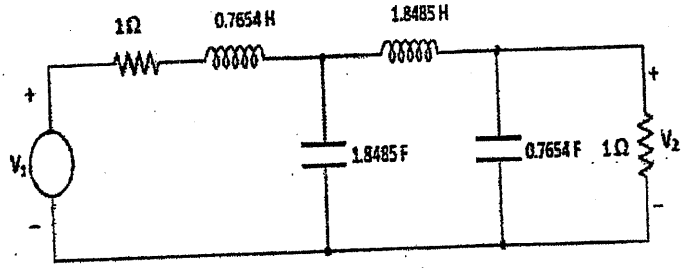
Exam.	Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Filter Design *(EX704)*

- ✓ 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 and explain the following terms with necessary diagrams: α_p, α_s, ω_p, ω_s. What is scaling? Derive element scaling equations. [4+4]
2. What are the characteristics of Inverse Chebyshev response? Derive the expression to calculate the required order of Inverse Chebyshev lowpass filter. Using your expression calculate the required order of Inverse Chebyshev filter for following lowpass filter specifications. [2+4+2]

   $\omega_p = 10000$, $\omega_s = 20000$ rad/s $\quad \alpha_{max} = 0.4$, $\alpha_{min} = 16$ dB
3. What is constant delay filter? Obtain the transfer function of second order constant delay filter. Also mention the importance of delay equalization. [8]
4. What is frequency transformation in filter design? How can you obtain a bandpass filter from given lowpass filter at normalized frequency? Obtain a bandpass filter having ω_1=100 rad/s and ω_2=10000 rad/s from following lowpass filter at normalized frequency. [1+3+4]

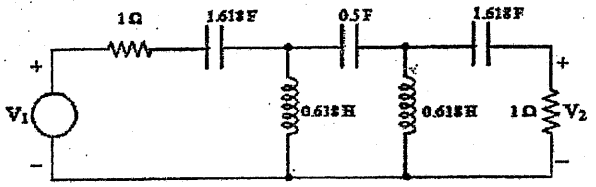


5. What are the properties of lossless one port function? Realize the following function using Cauer I and Foster II method. [2+3+3]

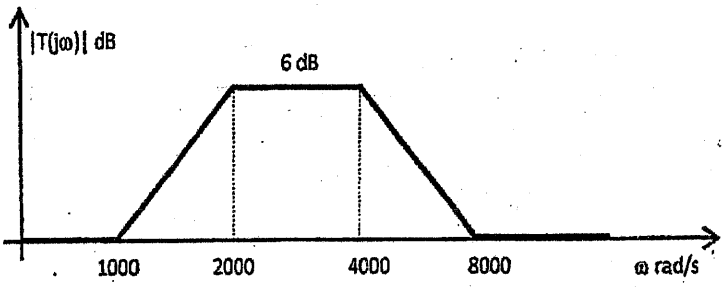
$$Z(s) = \frac{s(s^2+4)}{(s^2+2)(s^2+6)}$$

6. Define transmission and reflection coefficient. Synthesize t(s) = $1/(s^3+2s^2+2s+1)$ in LC ladder circuit terminated with $R_1=R_2=1\Omega$. [3+5]
7. Draw the circuit diagram of Sallen-Key lowpass biquad circuit and derive the transfer function. How can you obtain highpass filter from lowpass one? Design the second order lowpass Butterworth filter having half power frequency of 12 KHz using Sallen-Key biquad circuit. $T_2(s) = 1/(s^2+\sqrt{2}\,s+1)$ [4+2+4]
8. What is the importance of sensitivity analysis in filter design? Perform the sensitivity analysis of Tow Thomas lowpass filter. [2+4]

9. What is generalized impedance converter (GIC)? Explain how inductors can be simulated using GIC? Simulate the following highpass filter by active simulation of grounded inductors such that ω_0 is 4000 rad/s and practically realizable elements. [4+4]



10. What is switched capacitor filter? What are its applications? Design a switched capacitor filter for following requirement. [3+5]



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21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

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

Subject: - Filter Design *(EX704)*

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

1. Define normalization and denormalisation. Following circuit is a lowpass filter designed at normalization frequency of w_o = 1rad/s. Apply frequency and magnitude scaling so that $w_o = 10^5$ rad/s and practically realizable elements. [3+4]
2. Show that the poles of chebyshev filter lie on an ellipse. Also show the major and minor axes. [7]
3. What are the characteristics of butterworth response? Calculate the transfer function of 5^{th} order Butterworth filter. [3+4]
4. What is frequency transformation? Obtain the bandpass filter from lowpass filter given in figure 1 having center frequency 10^4 rad/s and bandwidth of 9.9×10^4 rad/s. [2+4]
5. Which of the following functions are lossless impedance function? State with reason. [2+3+3]

   a) $\frac{(S^2+1)(S^2+9)}{(S^2+4)(S^2+16)}$ b) $\frac{S(S^2+4)}{(S^2+1)(S^2+3)}$

   c) $\frac{2(S^2+1)(S^2+9)}{S(S^2+4)}$ d) $\frac{S^5+4S^3+5S}{S^4+5S^2+6}$

   Synthesize one of the valid lossless impedance function using Foster I and cauer I forms.
6. What are the zeros of transmission? How can a zero of transmission to be realized? Explain with examples. [5]
7. Realize the third order Butterworth lowpass transfer function $T(s) = \frac{1}{S^3+2S^2+2S+1}$ in the form of resistively terminated LC ladder with $R_1 = 1\Omega$ and $R_2 = 2\Omega$. [6]
8. Derive the transfer function of Sallen and Key low pass Biquad. Using Sallen and Key circuit, design a lowpass filter having w_o of 1000 rad/ses, quality factor of 0.866 and gain of 2. [4+4]
9. Explain RC –CR transformation with suitable examples. [4]
10. What is sensitivity? What is the importance of sensitivity analysis in filter design? Perform sensitivity analysis of w_o in Sallen and Key lowpass filter. [5]
11. What is frequency dependent negative resistor (FDNR)? How can it be used to avoid inductors in Lowpass LC ladder circuit? Explain from the circuit given in figure 1 design the lowpass filter having $w_o = 10^4$ rad/s and practical element values using FDNR. [5+5]

12. What are the applications of switched capacitor filters? Design the switched capacitor filter to realize the magnitude response given in figure 2. [2+5]

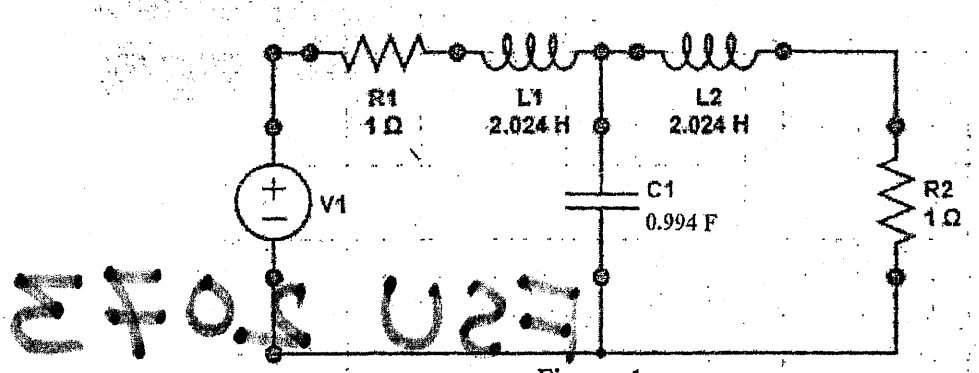

Figure: 1

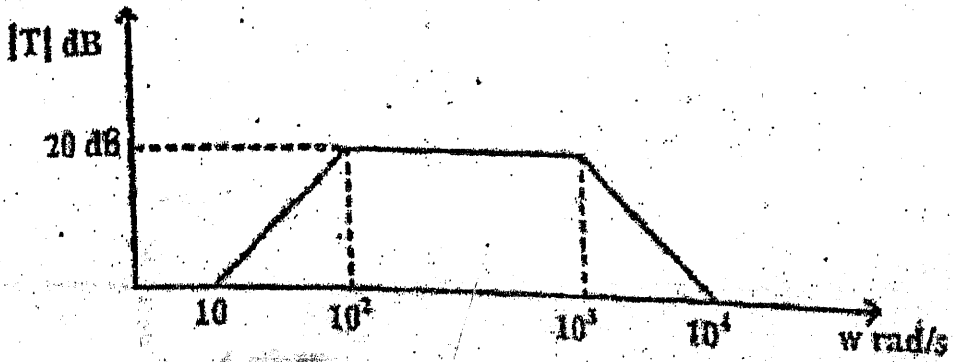

Figure: 2

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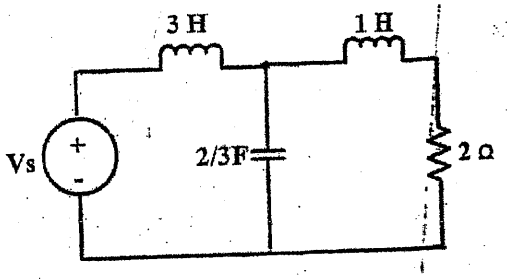
26 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

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

Subject: - Filter Design *(EX704)*

- ✓ 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 Normalization and De-normalization? A low pass filter has half power frequency of w_0 rad/s. Derive formula to calculate the new value of the resisters, capacitors and inductors present in the low pass filter if you want to change its half power frequency to w_n rad/s. [2+5]
2. What are the characteristics of Elliptical Response? Compare it with Chebyshev and Inverse Chebyshev response. [3+2+2]
3. What is a constant delay filter? Obtain the transfer function of second order constant delay filter. [4]
4. The following low pass filter has passband frequency w_p of 1 rad/s. Transform it into a highpass filter having passband frequency of 2KHz. [4]



5. Which of the following functions are LC driving point impedance function and why? [2+3+3]

$$Z(s) = \frac{s^4 + 10s^2 + 9}{s^3 + 4s}$$

$$Z(s) = \frac{s^3 + 4s}{s^4 + 5s^2 + 6}$$

Also find the Foster parallel and cauer I form of the valid LC driving point impedance function.

6. What is zero shifting by partial removal of pole? How can two-port passive circuits be synthesized using zero-shifting by partial pole removal? Explain. [1+4]
7. What is Transmission and Reflection Coefficient? How resistively terminated ladder network can be realized with finite transmission zeroes? Explain. [2+4]

8. Draw the circuit diagram of Tow Thomas low pass filter and derives its transfer function. Realize following low pass filter using Tow Thomas biquad circuit. [4+4]

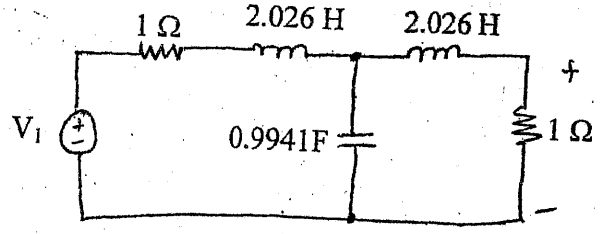
$$T(s) = \frac{-2000}{s^2 + 500s + 1000000}$$

9. How can the gain enhancement be performed in a Sallen-Key circuit? Explain with necessary diagram. [5]

10. What is sensitivity? Describe it's importance in filter design? Perform sensitivity analysis of quality factor in Tow Thomas Low Pass Filter. [6]

11. What is GIC? How a GIC can be used to simulate a grounded inductor? Explain with necessary figures and derivations. [5]

12. The following circuit is a third-order Chebyshev lowpass filter. Simulate it using the leap-frog method. The final design should have w_0 = 4000 rad/s and practically realizable element values. [8]



13. Why resistors are replaced by switched capacitor in IC technology? How can you simulate a resistor using a switched capacitor? Explain with necessary derivations. Also draw the switched capacitor equivalent circuit for inverting summer lossy integration and non inverting integrator. [7]

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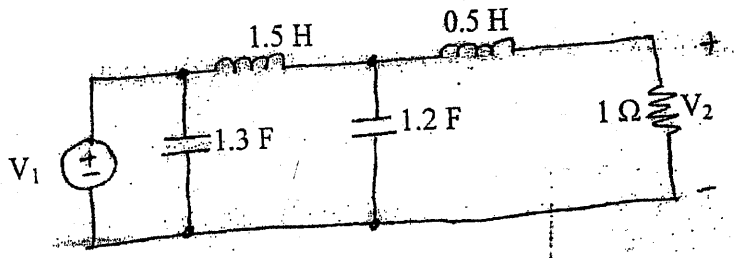
21 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

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

Subject: - Filter Design *(EX704)*

- ✓ 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**.*
- ✓ ***Necessary tables are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What is the significance of normalization and de-normalization in filter design? The following is a pass filter with $\omega_p = 1$ rad/sec. Modify the circuit so that it becomes a low pass filter with a pass band of 1000 rad/sec and a load resistance of 75 Ω. [2+3]



2. Derive an expression to calculate the order of Inverse Chebyshev low pass filter. Use this formula to estimate the order of Inverse Chevyshev low pass filter having following specification: [5+3]

$\alpha_{max} = 0.25\,dB$, $w_p = 1000\,rad/s$

$\alpha_{min} = 18\,dB$, $w_s = 1400\,rad/s$

3. What is delay equalization? How can it be done? Explain with necessary figures. [5]
4. What are the applications of Frequency Transformation in Filter Design. How can you obtain a high pass filter from a given low pass filter? Explain with a suitable example. [6]
5. Which of the following is LC lossless function and why? Pick one of the valid LC lossless functions and synthesize it using Foster and Cauer methods. [2+3+3]

i) $Z_1(s) = \dfrac{s(s^2+4)(s^2+9)}{(s^2+2)(s^2+10)}$

ii) $Z_2(s) = \dfrac{(s^2+2)(s^2+10)}{s(s^2+5)}$

iii) $Z_3(s) = \dfrac{s^2+25}{s(s^2+5)(s^2+50)}$

6. Define transmission zeros. How zeros of transmission be realized? Explain with suitable example. [5]

7. Design a third order Butterworth low pass filter using resistively terminated lossless ladder with unequal termination. $R_1 = 1\Omega$ and $R_2 = 4\Omega$ (Refer table 1) [7]

8. Realize the following transfer function by cascading two first-order sections using inverting op-amp configuration. [5]

$$T(s) = \frac{12}{s^2 + 8s + 12}$$

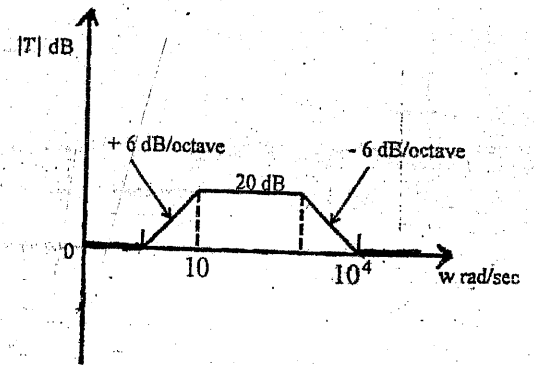
9. Design Sallen key lowpass filter for fourth order Butter worth filter. The final circuit should have $w_0 = 10{,}000$ rad/s have and practically realizable elements. (Refer table 1). [8]

10. What information do you get when the sensitivity of x with respect to y is -5? Perform sensitivity analysis for center frequency (w_0) of the Sallen Key low pass filter with respect to all the resistors and capacitors present in the circuit. [1+4]

11. Draw the circuit diagram of an generalized impedance converter. Derive the relationship between input and output current. How can it be used to simulate a grounded FDNR? Explain. [5]

12. Design a Fourth order Butterworth low pass filter having half power frequency of 4000 rad/s using Frequency dependent negative resister (FDNR). (Use table 2) [6]

13. What is switched capacitor filter? Design a switched capacitor filter to realize the magnitude response given below: [1+6]



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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

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

Subject: - Filter Design *(EX704)*

- ✓ 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 the terms: α_{max}, α_{min}, Half Power Frequency, Bandwidth, Insertion Gain and Insertion Loss with necessary figures. [6]
2. A Chebyshev low pass filter has following specifications: [8]
   $\alpha_{max} = 0.5$ dB, $\omega_p = 1$ rad/s
   $\alpha_{min} = 22$ dB, $\omega_s = 2.33$ rad/s
   Find the minimum order required to meet the specifications and also find the transfer function.
3. What is delay equalization and how can it be done? Explain with necessary figures. [4]
4. What is frequency transformation? Describe the frequency transformation from low pass to band stop filter with example. [4]
5. Realize the given function Z(S) using Cauer-I and Cauer-II method [6]
   $$Z(S) = \frac{4S^4 + 40S^2 + 36}{S^3 + 4S}$$
6. Synthesize a two port LC ladder to satisfy the following open circuit impedance parameters: $z_{21}(s) = \frac{k(s^2+9)}{s(s^2+4)}$; $z_{22}(s) = \frac{(s^2+1)}{s(s^2+4)}$ [7]
7. What do you understand when the transmission coefficient has unity value? Design a third order Butterworth low pass filter using Resistively terminated lossless ladder with equal termination of $R_1 = 1\ \Omega$ and $R_2 = 1\ \Omega$. (Refer table 1) [1+6]
8. Design an active filter using non-inverting op-amp configuration with following transfer function. $T(s) = \frac{(s+8)}{(s+2)}$ [4]
9. Draw the circuit diagram of Sallen-Key low pass filter and derive its transfer function. Design second order butterworth low pass filter having half power frequency of 10 KHz using Sallen Key biquad. In your final design the value of capacitors must be 0.01μF and feedback resistors should also be equal (Refer table 1). [5+4]
10. Define Sensitivity. What is its importance in modern filter design? Compute the sensitivity expression for the ω_0 of Sallen-Key Low pass filter. [5]
11. What is the importance of Bruton transformation in filter design? How can you simulate FDNR using generalized impedance converter (GIC)? Explain with example. [6]
12. Design third order Butterworth low pass filter using Leapfrog simulation. (Refer table 2). Your final design should have half power frequency of 4KHz and practically realizable elements. [6]
13. Design a switched capacitor filter to realize the transfer function: [3+5]
    $$T(S) = \frac{(S+200)(S+800)}{(S+400)^2}$$

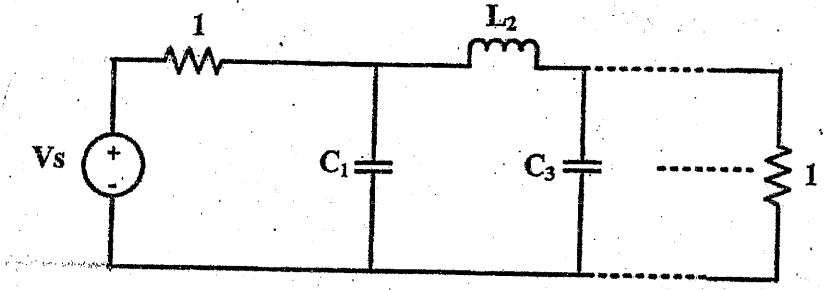
Table 1:

Pole Location for Butterworth Responses

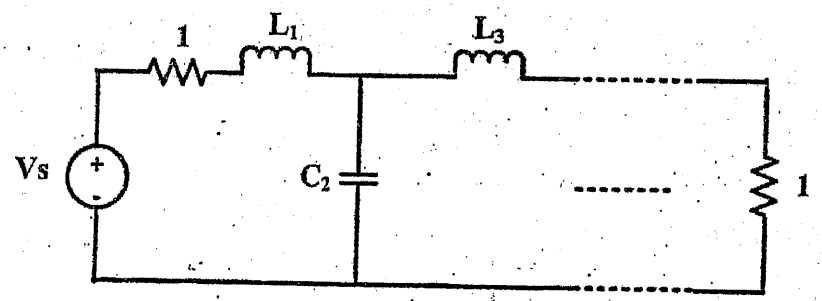
n=2	n=3	n=4	n=5
- 0.7071068 ± j 0.7071068	- 0.50 ± j 0.86603	- 0.3826834 ± j 0.9238795	- 0.809017 ± j 0.5877852
	- 1.0	- 0.9238795 ± j 0. 3826834	- 0.309017 ± j 0. 9510565
			-1.0

Table 2:

Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s



n	C_1	L_2	C_3	L_4	C_5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L_1	C_2	L_3	C_4	L_5



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27 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

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

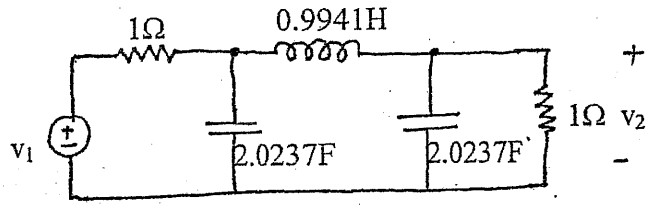
Subject: - Filter Design *(EX704)*

- ✓ 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 the significance of scaling in filter design? Derive the necessary expressions to determine the new values of circuit elements in the case of magnitude and frequency scaling. [6]
2. Derive an expression to calculate the order of Inverse Chebyshev low pass filter. Use this formula to estimate the order of Chebyshev low pass filter having following specifications: [5+3]

   $\alpha_{max} = 0.25\,dB, \qquad \omega_p = 1000 rad/s$

   $\alpha_{min} = 18\,dB, \qquad \omega_s = 1400 rad/s$
3. Explain the importance of all pass filters in delay equalization. Find the transfer function of fourth order Bessel-Thomson low pass filter. [3+3]
4. What is the importance of frequency transformation in filter design? The circuit given in figure below is a lawpass filter having passband frequency of 1 rad/s. Obtain a band pass filter having $\omega_o = 2000$ rad/s and $B = 400$ rad/s. [2+3]



5. Which of the following functions are LC driving point impedance function and why? [2+3+3]

$$Z(s) = 2\frac{s(s^2+4)(s^2+16)}{(s^2+1)(s^2+9)}$$

$$Z(s) = 4\frac{(s+2)(s+5)}{(s+1)(s+4)}$$

Also find the Faster series and Cauer II Realization of the valid LC driving point impedance function.

6. What is transmission zeros? Explain "zero shifting by partial removal of pole" with example. [1+4]

7. What is transmission coefficient? What information do we get from it? Derive expression for reflection coefficient for a resistively terminated LC ladder circuit. [2+5]

8. Realize a system using inverting op-amp configuration with zero at s = -2 and pole at s = -5 and having high frequency gain of 2. [3]

9. Perform sensitivity analysis for center frequency (W_o) and quality factor (Q) of the Tow Thomas low pass filter with respect to all the resistors and capacitors present in the circuit. [5]

10. What is Frequency Dependent Negative Resistor? How can it be used to avoid bulky inductors in the design of your circuits? Explain with suitable examples. [5]

11. Using heapfrag method simulate the LC ladder circuit given in question number 4 to obtain a low pass filter having passband of 6KHz and suitable element values. [6]

12. What is switched capacitor filter? How inverting lossy integrator, integrator and non-inverting integrator can be realized using switched capacitor? Explain with necessary diagrams and transfer functions. [7]

13. Draw a neat and clean circuit diagram of Tow-Thomas Low Pass Biquad filter and derive it's transfer function. Design a low pass filter using Tow-Thomas Biquad circuit which has poles at 1000±8994.03j and DC gain of 1.89. Use 0.01μF capacitor in your design. [9]

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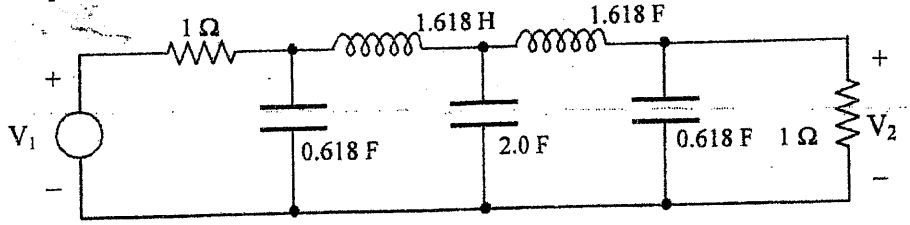
26 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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

Subject: - Filter Design *(EX704)*

- ✓ 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 normalization and denormalization? Explain the importance of normalization and denormalization in filter design with example. [6]
2. Derive the relation to calculate the order of Chebyshev filter. Using this formula calculate the required order of Chebyshev filter for following lowpass filter specification. [5+3]
   $\alpha_{max} = 0.5$ dB $\quad \alpha_{min} = 20$ dB
   $\omega_p = 1000$ rad/s $\quad \omega_s = 2000$ rad/s
3. What are the characteristics of elliptic response? Compare it with that of Inverse Chebyshev response. [6]
4. How can you obtain a bandstop filter from given lowpass filter? Explain with a suitable example. [5]
5. What are the required properties of a function to be realizable? Explain the properties of lossless two port function. [3+3]
6. Which of the following function is valid RC admittance function? State with reason. Realize one of the RC admittance function in Foster II and RC ladder form. [2+3+3]
   $Y(s) = \frac{(s+1)(s+3)}{(s+2)(s+4)}$, $Y(s) = \frac{(s^2+1)(s^2+3)}{s(s^2+2)(s^2+4)}$, $Y(s) = \frac{(s+2)(s+4)}{(s+1)(s+3)}$, $Y(s) = \frac{(s+1)(s+3)}{s(s+2)(s+4)}$
7. Define transmission and reflection coefficient. Explain how resistively terminated ladder network can be realized with finite transmission zeros. [2+4]
8. Draw the circuit diagram of Tow Thomas biquad filter and derive its lowpass transfer function. Design a second order Butterworth lowpass filter having half power frequency of 5 kHz using Tow Thomas biquad circuit. Your final circuit should have all capacitors of 0.001μF. [4+4]
9. How gain enhancement can be performed in Sallen and Key circuit? Explain with necessary diagram. [5]
10. What is sensitivity? What is its importance in filter design? Perform the sensitivity analysis of quality factor of Tow Thomas biquad lowpass filter. [1+1+2]
11. What is generalized impedance converter (GIC)? How Antonious's GIC can be used to simulate grounded inductor? Explain with necessary figures and derivations. [6]
12. What is FDNR? Explain how FDNR avoids the use of inductor. Following circuit is a lowpass filter having half power frequency of 1 rad/sec. Obtain a lowpass filter having half power frequency of 5 kHz and largest capacitor of 0.01 μF using FDNR. [2+4]



13. What is switched capacitor filter? What are its applications? Draw the switched capacitor equivalent circuit for inverting summer, lossy integrator and non-inverting integrator. [6]

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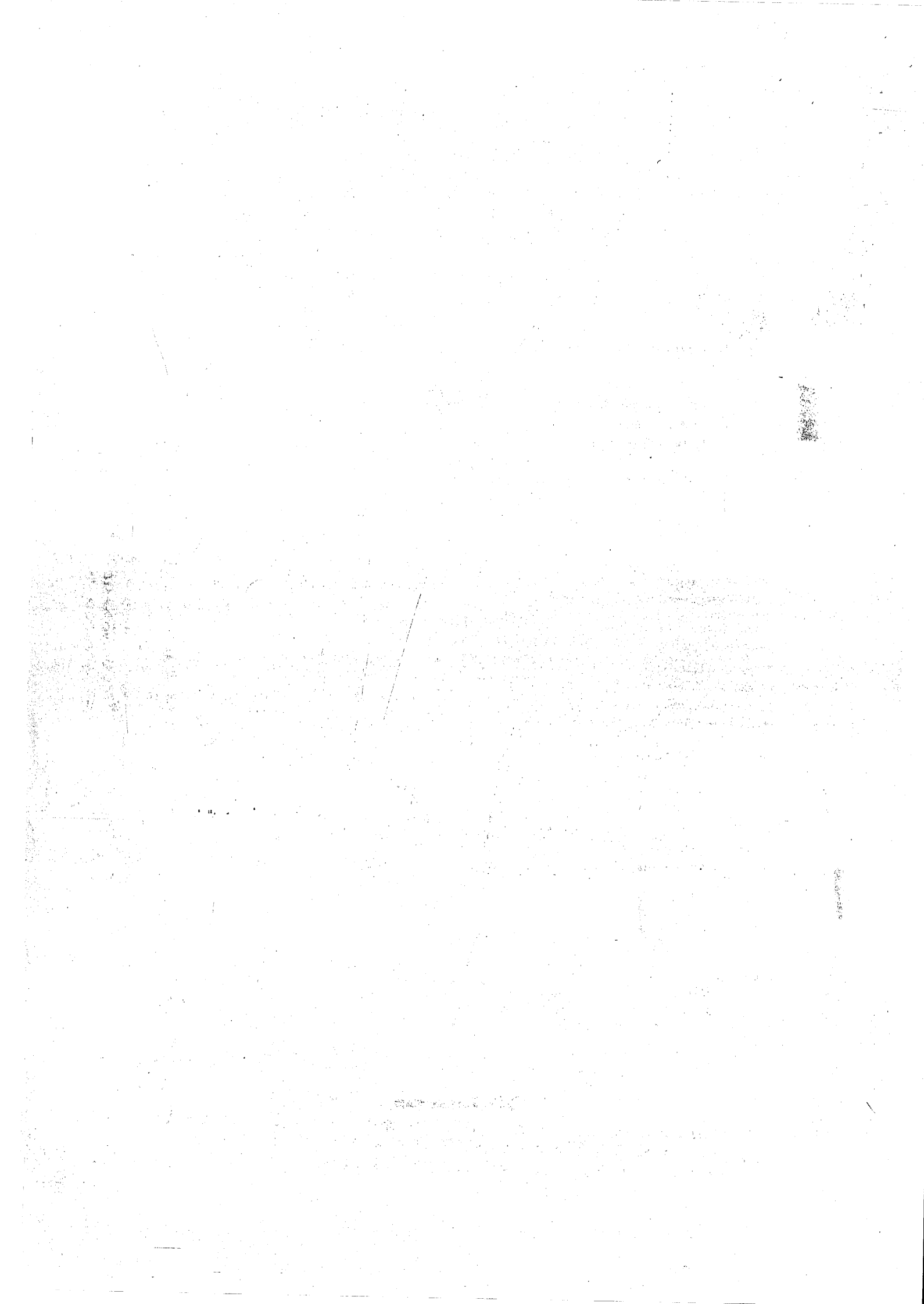


26 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Filter Design *(EX704)*

- ✓ 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**.*
- ✓ ***Necessary tables are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Define α_{max}, α_{min} and half power bandwidth with necessary diagrams. At frequency f = 20 KHz and f = 30 KHz a filter is designed to attenuate the input signal by 78 dB and 90 dB respectively. Find the amplitude of the output signal if the 30 KHz input signal has amplitude of 1V. [3+4]
2. Derive an expression to calculate the order of Chebyshev low pass filter. Use this formula to estimate the order of Chebyshev low pass filter having following specification: [5+3]
   $\alpha_{max} = 0.1$ dB, $w_p = 1000$ rad/s
   $\alpha_{min} = 20$ dB, $w_s = 2500$ rad/s
3. What is constant delay filter? What are the steps involved in designing constant delay filter? Explain with necessary example. [6]
4. What is the significance of frequency transformation in filter design? How band pass filter can be obtained from prototype low pass filter? Explain with example. [1+3]
5. Which of the following functions are LC driving point impedance function and why? Pick one of the valid LC driving point impedance and synthesize it in Foster-I and Caver-I form: [2+3+3]

$$Z_1(s) = \frac{(s^2+1)(s^2+5)}{(s^2+2)(s^2+10)} \qquad Z_2(s) = \frac{5s(s^2+4)}{(s^2+1)(s^2+3)}$$

$$Z_3(s) = \frac{2(s^2+1)(s^2+9)}{s(s^2+4)} \qquad Z_4(s) = 4\frac{(s+2)(s+5)}{(s+1)(s+4)}$$

6. What is transmission zeros? What are the steps involved in realizing transmission zeros of a lossless two port network? Explain with suitable example. [5]
7. What is reflection coefficient? Design a third order Butterworth high pass filter using resistively terminated lossless ladder with equal termination of 1Ω. (Refer following table). [1+6]

Pole Location for Butterworth Responses

n=2	n=3	n=4	n=5
- 0.7071068 ± j 0.7071068	- 0.50 ± j 0.86603	- 0.3826834 ± j 0.9238795	- 0.809017 ± j 0.5877852
	- 1.0	- 0.9238795 ± j 0. 3826834	- 0.309017 ± j 0. 9510565
			-1.0

8. Draw the circuit diagram and derive transfer function of Tow Thomas Biquad circuit. Design a low pass filter using Tow-Thomas Biquad circuit with poles at -500 ± j 2449.49 and dc gain of 2. The final circuit should consist capacitors of value 0.1μF. [3+5]

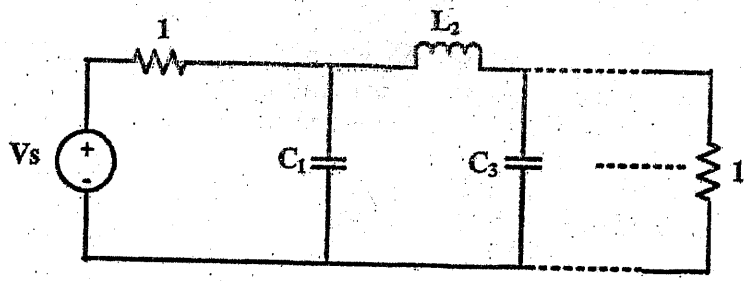
9. What is RC-CR transformation? Draw the circuit diagram of high pass sallen-key biquad obtained by RC-CR transformation of its low pass counterpart. [4]

10. What is signal parameter sensitivity? Perform sensitivity analysis for center frequency (w_o) of Sallen-Key biquad with respect to all resistors and capacitors present in the circuit. [1+4]

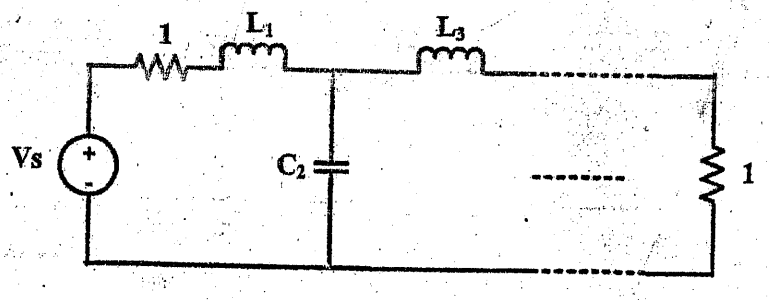
11. What is GIC? How a GIC can be used to simulate grounded inductor? Explain with necessary figures and expression. [5]

12. Simulate third order Butterworth low pass filter using Leapfrog simulation. (Refer following table) [6]

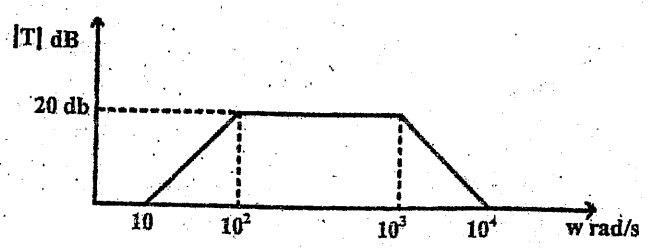
Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s



n	C_1	L_2	C_3	L_4	C_5
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L_1	C_2	L_3	C_4	L_5



13. What is switched capacitor filter? What are its applications? Design a switched capacitor filter to realize the magnitude response given below: [2+5]



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26 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

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

Subject: - Filter Design *(EX704)*

- ✓ 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 the importance of Normalization and Denormalization in filter design? Derive element scaling equations. [2+5]
2. Derive the expression to calculate the order of Butterworth appronimation for given lowpass filter specifications. Calculate the order of Butterworth low pass filter having following specification; [5+3]
   i) Passband extends from $\omega = 0$ to $\omega = 200$ rad/s and the attenuation in the passband should not exceed 0.1 dB.
   ii) Stopband extends from $\omega = 2000$ rad/s to $\omega = \infty$ and the attenuation in the stopband should not be less than 30 dB
3. What is a constant delay filter? Find the transfer function of a third order Bessel Thomson response having constant delay. [2+4]
4. What is frequency transformation? Describe the frequency transformation from low pass to band stop filter with example. [4]
5. Which of the following functions are LC driving point impedance function and why? [4+3]

$$Z(s)=\frac{s(s^2+4)}{(s^2+9)(s^2+16)},\quad Z(s)=\frac{s(s^2+1)(s^2+9)}{(s^2+4)(s^2+16)},$$

$$Z(s)=\frac{s(s^2+4)}{2(s^2+1)(s^2+9)},\quad Z(s)=\frac{2(s+1)(s+3)}{(s+2)(s+4)}$$

   Also find the Cauer II realization of the valid LC driving point impedance function.
6. What is "zero shifting by partial removal of pole"? Explain with example. Also mention its importance in two port network synthesis. [4+2]
7. What is transmission coefficient? What information do you get from the transmission coefficient? Design a second order Butterworth low pass filter using lossless ladder with equal termination of 1Ω i.e.$R_1 = 1\Omega$ and $R_2 = 1\Omega$ (Refer Table 1) [1+1+5]
8. Draw the circuit diagram of Tow thomas biqual low pass filter and derive its transfer function. Design a second order low pass filter using Tow Thomas biquad circuit having poles at $-750 \pm j\,661.44$ and dc gain of 2. Use capacitor of value 0.01μF in your design. [8]

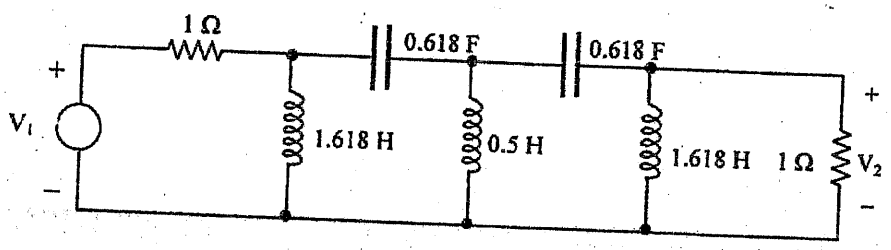
9. Design the following transfer function using inverting op-amp configuration. [4]

$$T(s) = 7\,\frac{S+400}{S+200}$$

You are not allowed to use inductors in the design.

10. What do you understand when the sensitivity of y with respect to x is equal to -3? Perform sensitivity analysis for Quality factor Q of the Tow Thomas low pass filter with respect to all the resistors and capacitors present in the circuit. [1+4]

11. What is generalized impendance converter (GIC)? How can you simulate the grounded incuctor in the passive filter using GIC? Explain The following circuit is a high pass filter having half power frequency of 1 rad/sec. Design a high pass filter having half power frequency of 4.5 kHz by active simulation of inductors. In your final circuit the largest capacitance should be 0.1 μF. [2+4+6]



12. What is a switched capacitor filter? What are its applications? How can you simulate a resistor using switched capacitor? Explain with necessary derivation. [3+3]

Table 1: Pole Location for Butterworth Responses

n = 2	n = 3	n = 4	n = 5
-0.7071068 ±j 0.7071068	-0.50 ±j 0.86603	-0.382684 ±j 0.9238795	-0.809017 ±j 0.5877852
	-1.0	-0.9238795 ±j 0.3826834	-0.309017 ±j 0.9510565
			-1.0

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

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

Subject: - Operating Systems *(CT 612)*

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

1. What is an Operating system? Explain the statement " operating system acts as a Broker between hardware and application program". [5]
2. What is priority of a process? Why do we need it? Explain. Make a schedule for the processes mentioned in the table below as per Shortest Remaining Time First (SRTF) algorithm. Also calculate average turnaround time and average waiting time, throughout and CPU utilization. [2+6]

Process	Burst Time	Arrival Time	Priority
P_1	3	0	3
P_2	6	1	5
P_3	1	2	2
P_4	4	3	1
P_5	2	4	4

3. What are the principles of I/O software? Suppose that a disk drive has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43 and previous request was at cylinder 25. The queue of pending request, in FIFO order is: 86,70,13,74,48,9,22,50,30. Produce the schedules to satisfy all the pending requests for each of the following disk scheduling algorithms? [2+6]

   a) FCFS b) C-SCAN
4. a) Explain Best fit and Worst fit memory allocation algorithm with an example. [5]

   b) What is the need process synchronization? How can the semaphore solve the reader-writer problem? Explain with respective pseudo-code of both reader and writer process. [2+6]
5. What is directory organization in files? Explain its types. [8]
6. What is Belady's anamaly in F1F0? Consider the following page reference strings; 2, 3,4,2,1,3,5,4,3,1,5,3,4,5,0,1,4,2.Find how many page fault occur according to OPTIMAL, LRU (least recently used) and LFU (least frequently used) page replacement algorithm assuming 3 page frames. [1+7]

7. Consider a system with 5 concurrent processes (P0, P1, P2, P3, P4) and 4 resource types (R0, R1, R2, R3). The number of instances of each resource type in the system are 6,4,4,2 respectively. Allocation table and Maximum claim table are as follows: [8]

Maximum claim

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

Allocation

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

a) Calculate Need matrix as per Banker's algorithm.

b) Is the state safe? If so, show the safe execution of the processes.

8. What are the roles and responsibilities of system administrator? [6]

9. Explain the types of Network Attacks? What is ACL? Why 'HASH' function is called Message Digestor? [2+2+2]

10. Write short notes on: [3×3]

a) Thrashing

b) Virtual Machine

c) User level thread vs Kernel- level thread.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

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

Subject: - Operating Systems *(CT 612)*

- ✓ 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 operating system evolve over long periods of time? Justify how OS act as resource manager. [1+3]
2. Explain fork() and spawn() system calls in the OS. Schedule the following set of process according to Round-Robin scheduling a algorithm with Quantum time = 4 ms and calculate the average waiting time and average Turn-around time, throughput and CPV utilization. [3+5]

Process	Arrival time (ms)	CPU time (ms)
A	0	12
B	2	8
C	5	7
D	10	9

3. Why do we organize disk as RAID? Suppose a disk drive with 150 cylinder numbered from 0-149. The drive is currently serving a request at 35 and the previous request is at disk 55. The queue of pending request is 98, 103, 38, 122, 10, 128, 65, 75. Starting from the current head position, Calculate the total head moment (in cylinder) that the disk arm moves to satisfy all the pending request for SSF, SCAN, and LOOK Disk Arm Scheduling Algorithm. [2+6]
4. a) Explain first fit, Next fit memory allocation algorithm with an example. [5]
   b) How semaphore is used in process synchronization? Explain how semaphore is best solution for producer consumer problem with pseudo-code of both producer and consumer process. [1+7]
5. What is file attribute? List the file system performance indicator. Explain the file allocation methods with its advantages and disadvantages. [1+2+5]
6. What are the differences between fixed partitioning and variable partitioning system of memory for multiprogramming? Given reference to the following pages by a program:

   0,9,0,1,8,1,8,7,8,7,1,2,8,2,7,8,2,3,8,3

   How many page faults will occur if the program has 4 frames for Optimal Page Replacement Algorithm? [3+5]

7. Explain necessary conditions for deadlock. Consider the following snapshot of a system (P = Process, R = Resource): [2+6]

Available

RA	RB	RC	RD
8	5	9	7

	Maximum Demand			
	RA	RB	RC	RD
P0	3	2	1	4
P1	0	2	5	2
P2	5	1	0	5
P3	1	5	3	0
P4	3	0	3	3

	Current Allocation			
	RA	RB	RC	RD
P0	1	0	1	1
P1	0	1	2	1
P2	4	0	0	3
P3	1	2	1	0
P4	1	0	3	0

By using Bankers algorithm, Calculate the need matrix. Is the system safe? If safe find safe order of process.

8. Describe the role and responsibilities of system adminstrator to keep the system updated and efficient. Explain with examples. [6]

9. Define ACL. Write the type of security breach in following attack case? Also suggest a solution in each to prevent the attack. [2+2+2+2]

"Ramesh found that Nirmal's Facebook was login in Computer Lab. He then changed the personal information and login credentials of Nirmal's account."

10. Write short notes on: [3×3]
    a) Ostrich algorithm
    b) Shell programming
    c) Process control Block

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

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

Subject: - Operating System *(CT 612)*

- ✓ 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) Explain OS as an Extended Machine. Differentiate between Monolithic Kernel and Micro-Kernel. [2+4]

   b) Explain operating system as a virtual Machine. [4]

2. a) Differentiate between Preemptive and Non-Preemptive Scheduling. Apply MLQ scheduling for following set of processes of two queues Q1 and Q2 where Priority of Q1 is greater than that of Q2 and Q1 uses Round Robin (Time Quantum = 2) and Q2 uses FCFS.

Process	AT	BT	Queue Number
P1	0	5	1
P2	2	12	2
P3	5	3	1
P4	10	6	1

   Construct Gantt –Chart and compute average TAT for above scenario. [2+4]

   b) What is multithreading? Explain five state process model with figure. [4]

3. a) Why process need to be synchronized? Explain Peterson's Solution in mutual exclusion. [2+3]

   b) What is Semaphore? How can Producer Consumer problem be solved using Semaphore? Explain. [1+4]

4. a) Why multilevel paging is required? [2]

   b) Consider the following page reference string: 5,0,2,1,0,3,0,2,4,3,0,3,2,1,3,0,1,5

   Calculate page hit percentage. How many page faults would occur for the FIFO, Optimal, LFU and LRU replacement algorithms having four frames? Remember all frames are initially empty, so your first unique page will cost one fault each. [8]

5. What are the different methods for allocating disk space for file? Explain free space management techniques. [3+7]

6. What are the functions of device independent I/Q software? Suppose that a disk has 5000 cylinders, numbered from 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests in FIFO order is:

   86,1470,913,1774,948,1509,1022,1750,130

   Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for FCFS, SSTF, C-SCAN and C-LOOK Algorithm? [2+8]

7. Explain Coffman conditions for deadlock. Consider the following snapshot

Processes	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

Is the state safe? If so, show the safe execution of processes. [3+7]

8. Write short notes on: [4×2.5]
   a) Cryptography
   b) Access Control List
   c) Roles of System Admin
   d) AWK Tool

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Operating systems *(CT 612)*

- ✓ 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 is the process table needed in a timesharing system? Is it also needed in personal computer systems running UNIX or Windows with a single user? [6]
   b) Distinguish between Shell and Kernel. [4]
2. a) What are the advantages and disadvantages of implementing threads in user space? [4]
   b) Let us consider five processes with given arrival time and length of the CPU burst given in milliseconds. [6]

Process	Arrival time	CPU time
P1	0	9
P2	1	5
P3	2	2
P4	3	6
P5	4	8

   Calculate the turnaround time and waiting time for all processes applying First Come First Serve, Shortest Job first and Round Robin (time quantum = 3) algorithms.
3. Define race condition. What are the requirements of mutual exclusion? How can you achieve mutual exclusion using Peterson's Solution? Explain with pseudo code. [2+2+6]
4. a) Differentiate between Compaction and Coalescing technique. [4]
   b) Consider a swapping system in which memory consists of the following hole sizes in memory order: 10 MB, 4 MB, 20 MB, 18 MB, 7 MB, 9 MB, 12 MB and 15 MB. Which hole is taken for successive segment requests of [6]
      (i) 12 MB
      (ii) 10 MB
      (iii) 9 MB
      for first fit? Now repeat the question for best fit and worse fit.
5. a) Explain various ways of implementing file system. [6]
   b) How do you measure the file system performance and how it can be improved? [4]
6. What do you mean by RAID? Suppose a disk with 200 cylinders numbered from 0-199. The drive is currently serving a request at 45 and previous request was at 125. The queue of pending request is 105, 178, 23, 67, 43, 78, 167, 56 and 98. Starting from current head position, calculate the total head movement (in cylinder) that the disk arm moves to satisfy all pending request for SSTF, SCAN, LOOK and C-SCAN disk scheduling algorithm. [2+8]

7. Explain in detail how can detect deadlock in operating system. Consider the following system with resources A, B, C, D and process P0 to P4. Is the state safe? If so, show the safe execution of processes. [3+7]

Process	Max				Allocation				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	6	0	1	2	4	0	0	1	3	2	1	1
P1	1	7	5	0	1	1	0	0				
P2	2	3	5	6	1	2	5	4				
P3	1	6	5	3	0	6	3	3				
P4	1	6	5	6	0	2	1	2				

8. Write short notes on Caesar Cipher and Access Control Lists. [3+3]
9. What is the significance of system Administration? Describe the roles and responsibilities of system administrator in Insurance Company. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Operating Systems (*CT 612*)

- ✓ 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. For each of the following application which Operating System is more suitable? Explain with the reason. [8]

   i) Anti-lock breaking systems in your car.
   ii) Generating quarterly bank statements.
   ii) Word processing
   iv) Missile defense system

2. What are basic operations carries out for accessing semaphore? How do you solve Bounded buffer problem using semaphore? Explain with pseudo-codes and necessary assumptions. [2+2+4]

3. What is process scheduling in an Operating System? Taking in reference with the process listed in following table below, find the average waiting time and average turnaround time using

   (i) Highest response ratio next (HRRN) scheduling algorithm and

   (ii) Compare it with shortest Job first. [2+6]

Processes	Arrival Time (AT)	Burst Time (BT)
P1	0	3
P2	2	6
P3	4	4
P4	6	5
P5	8	2

4. Compare following: [3×4]

   a) Paging systems versus hybrid system with paging and segmentation
   b) Link list versus contiguous allocation based file system
   c) Computer system threat types versus security implementation techniques

5. Define the terms deadlock in operating system. Explain the four conditions for the occurrence of deadlock. Consider the four processes A, B, C, D and three resources X, Y, Z with existing resource E = (15 9 5). After following allocation resource available becomes W = (3 2 0).

   Use Banker's Algorithm to test whether the given state is safe or not. If is safe state, then show the sequence of execution of process. [1+3+6]

	Allocation			Maximum			Need		
	X	Y	Z	X	Y	Z	X	Y	Z
A	3	0	1	3	2	2	0	2	1
B	5	4	1	6	8	2	1	4	1
C	2	2	0	3	2	4	1	0	4
D	2	1	3	4	2	3	2	1	0

6. Consider a reference string: 4, 7, 6, 1, 7, 6, 1, 2, 7, 2, the number of frames in the memory is 3. Find out the number of page faults respective to: [6]

   a) Optical Page Replacement Algorithm
   b) FIFO Page Replacement Algorithm
   c) LRU Page Replacement Algorithm

7. If you are the system administrator of a sofware company, what will be your roles and responsibilities? [6]

8. Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The head is initially at cylinder number 53 moving towards larger cylinder numbers on its servicing pass. The cylinders are numbered from 0 to 199. Calculate the total head movement (in number of cylinders) incurred are numbers these requests using following disk scheduling algorithms. [2+2+2+2+2]

   a) SSTF
   b) SCAN
   c) C-SCAN
   d) LOOK
   e) C-LOOK.

9. Write short notes on: [3×4]

   a) Sleeping barber problem
   b) Loader as an OS component
   c) Digital signature

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Operating systems *(CT 612)*

- ✓ 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 Operating System is viewed as Extended Machine. Differentiate between Multiprogramming and Time sharing system. [2+3]
   b) What is System Call? Explain the functioning of Dual Mode i.e., User Mode and Kernel Mode in an Operating system with appropriate diagram. [1+4]
2. a) What is race condition? [2]
   b) Explain the implementation of mutual exclusion with semaphore to solve
      (i) Producer Consumer Problem [4]
      (ii) Dining Philosopher Problem [4]
3. Compare long term scheduler, middle term scheduler, short term scheduler with reference to process state. Consider following process data and compute average waiting time and average turnaround time for [10]
   (i) RR (quantum 10)
   (ii) Priority scheduling algorithms in pre-emptive mode (Higher the number higher is priority).

PID	Burst time	Arrival Time	Priority
P	16	0	1
Q	37	12	2
R	25	7	3

   You are free to make necessary assumptions with explicit mentioning.
4. What is Page Fault? Consider the following page reference string:
   1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6
   How many page faults would occur for the FIFO, Optimal LFU and LRU replacement algorithms having five frames? Remember all frames are initially empty, so your first unique page will cost one fault each. [2+8]
5. Explain different file allocation schemes at least four with suitable diagrams. How do we select the block size for storage of file and what is the impact of the block size selection. [8+2]
6. What are different ways of handling deadlock? How does Banker's Algorithm deal with dead lock? Explain with your own example. [4+2+2]
7. Why disk related scheduling algorithms are required? List them out. Suppose that a disk drive has 5000 cylinders numbered 0 to 4999. The drive is currently serving a request at cylinder 143. The queue of pending requests in FIFO order is – 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from the current head position, what is the total distance that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms? [4+6]
   a) FCFS
   b) SSTF
   c) SCAN
8. Write short notes on: (Any Three) [3×4]
   a) Access Control List (ACL)
   b) Role of System Administrators
   c) Cryptography
   d) TLB

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Baishakh

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

Subject: - Operating System *(CT 656)*

- ✓ 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 Operating System. Explain Interactive and Real time OS with statement of typical characteristics examples. [1+3]
2. Explain why exo-kernel doesnot require re-mapping of resources? Is layered structure of operating system is better than monolithic structure? Explain. [2+3]
3. What do you mean by threads? Write the advantages and disadvantages of Kernel level thread and User level thread. [2+2]
4. Let us consider following processes with given arrival time and length of the CPU burst given in milliseconds. [6]

Process	Arrival Time	Burst Time
P1	0	4
P2	1	5
P3	2	2
P4	3	1
P5	4	6
P6	6	3

   a) Draw the Gantt Chart showing the execution for FCFS, SRTN and RR (Quantum = 2)
   b) Which algorithm results in Maximum Average Turnaround Time?
5. What is 'Mutual Exclusion' problem in IPC? Explain the "Dinning Philosopher problem", when such problem happens in computer system? Present the solution with pseudocode example. [2+2+6]
6. What is 'virtual memory'? Differentiate between paging and segmentation techniques. Explain TLB and exact working of TLB for paging with illustration of sample pages accessing scenario. [2+3+5]
7. Explain file system layout in detail. How file system can be implemented by linked list using index? Write its advantages and disadvantages. [3+3]
8. Suppose the disk requests comes in the order of request as 82, 170, 43, 160, 24, 16, 190 and current position of Read/Write head is 50. If a seek takes 6msec/cylinder. How much seek and seek time is needed for: FCFS, SSTF, SCAN, and C-LOOK disk arm scheduling algorithm. [10]
9. What do mean by symmetric cryptosystem? Explain Caesar cipher with suitable example. How protection domain is implemented in security? [2+3+2]
10. Compare between system policies and access control on security implementation. How does ACL work? Illustrate. [4+4]
11. Write short notes on: [2×5]
    a) Thrashing
    b) Roles & duties of SA

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

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

Subject: - Operating Systems *(CT 656)*

- ✓ 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 Operating system. Explain OS as resource manager. [1+3]
   b) Discuss the properties of batch system and real time system. [4]

2. Differentiate between process and thread. a) Consider the following set of processes, with arrival time and the length of CPU burst time given in millisecond as below: [2+6]

Processes	Arrival time	Burst time
A	0	3
B	1	6
C	4	4
D	6	2

   i) Draw Gantt chart illustrating the execution of these processes using FCFS, SRTN and RR (Quantum = 2) scheduling.
   ii) What is the waiting time and Turnaround time of each process for each of the scheduling algorithm?

3. List some differences between internal fragmentation and external fragmentation. Define virtual memory and explain how it is achieved by demand paging. [2+2+4]

4. Define page fault. Why you need page replacement algorithms? How many page fault occurs for following given reference string for three page frames: 7,0,1,2,0,3,0,4,2,3,0,3 for
   i) Least Recently Used page replacement algorithm.
   ii) First in First Out page replacement algorithm
   iii)Optimal Page Replacement algorithm [2+6]

5. Define directory and file path. Explain I node approach of file implementation with its advantages and disadvantages. [2+6]

6. What do you mean by disk arm scheduling? Explain shortest seek first and elevator algorithm with their advantages and limitations. [2+6]

7. What do you mean by critical region problem? What requirements should be met by its solution? Explain Peterson's solution to avoid race condition. [2+2+4]

8. Define deadlock. What are the conditions for resource deadlock? Explain some methods for recovering from deadlocks. [1+2+5]

9. What are the security problems associated with OS? Explain ACL with its use in security. [2+6]

10. List out some system administration tasks in OS. Describe the roles and responsibilities of system administrator with example of each administrative task you listed. [2+6]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

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

Subject: - Operating System *(CT 656)*

- ✓ 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 mean by System call in Operation System? Justify how does OS function as Manager. [4]
2. What do you mean by Shell? Discuss about Microkernel and Monolithic structuring with their advantages and disadvantages. [4]
3. Difference between process and thread. Explain how multi threading provide better solution than single threading solution. [1+3]
4. Consider the following set of process, with the length of the CPU burst time and arrival time given in millisecond. [6]

Process	Arrival Time	Burst Time
P0	0	3
P1	2	6
P2	4	4
P3	6	5
P4	8	2

   Draw Gantt chart illustrating RR (quantum = 2) and highest rank ratio next (HRN) scheduling. Also find average waiting time and average turn around time for each of the algorithm.
5. How does a 'race condition' arrive in IPC? Explain the 'Sleeping Barber' problem. When such problem happen in system? Write a solution using any type of your own technique with pseudocode example. [2+2+6]
6. What is associative memory and thrashing? Write the difference between coalescing and compaction. [1+1+2]
7. What is Demand paging? Consider the following page reference Strings; 2, 3, 4, 2, 1, 3, 7, 5, 4, 3, 1, 5. Find how many page fault occur according to OPTIMAL, LRU (least recently used) and LFU (least frequently used) page replacement algorithm assuming 3 page frames. [1+5]
8. Define file system and list out some attributes of file. Differentiate between relative and absolute pathnames. [3+3]
9. What are the disadvantages of Programmed I/O? Suppose that a disk has 200 tracks, numbered from 0 to 199. The read / write head of drive is currently serving a request at track 143, and has just finished the request at track 125. The queue of pending request in FIFO order is:

   86, 147, 91, 177, 94, 160, 102, 175, 130

   Suppose seek takes 10ms per cylinder moved. Starting from the current head position, what is the total distance that the disk arm moves to satisfy all the pending request, for FCFS, SSTF, C-SCAN and C-LOOK algorithm? Also calculate seek time needed to serve these request for each algorithm. [2+8]

10. Explain in detail how you can detect deadlock in operating system. Consider a system with 5 processes P0 through P4 and three resources type A, B and C. Resources A has 7 instances, B has 2 and C has 6 instances. Suppose at time t0 we have following state: [3+7]

Process	Allocation			Request		
	A	B	C	A	B	C
P0	0	1	0	0	0	0
P1	2	0	0	2	0	2
P2	3	0	3	0	0	0
P3	2	1	1	1	0	0
P4	0	0	2	0	0	2

a) Is the state safe? If so, show the safe execution of the processes.
b) Suppose P2 makes additional request of (1, 0, 1, 0), what will be the effect of this request to the system?

11. Explain the types of Network Attacks? What is ACL? Why 'HASH' function is called Message Digester? [2+2+2]

12. Write short notes on: [2×5]

a) Semaphores
b) UNIX File System

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

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

Subject: - Operating System *(CT656)*

- ✓ 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 I/O bound process and CPU bound process? What is process scheduling? Why do we need thread? [2+3+3]
2. Define process in OS and explain possible states. Consider the following set of processes, with the length of the CPU burst time in millisecond. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time 0. [Lowest Number being Highest Priority] [8]

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	5
P4	1	4
P5	5	2

   Draw Gantt chart illustrating priority and RR (quantum = 1) scheduling. Also find average waiting time and average turn-around time for each of the algorithms.
3. Consider a disk queue with requests for I/O to blocks on cylinders 23, 89, 132, 42, 187. Assume disk head initially at 100 and a seek takes 6m/sec/cylinder. How much seek is needed for FCFS, SSF and SCAN disk arm scheduling algorithms. [8]
4. Explain inode approach of file system implementation with its advantages and disadvantages. [8]
5. What are the differences between fixed partitioning and variable partitioning system of memory for multiprogramming? [3+5]

   Given reference to the following pages by a program:

   0,9,0,1,8,1,8,7,8,7,1,2,8,2,7,8,2,2,8,3

   How many page faults will occur if the program has 4 frames for Optimal Page Replacement algorithm?
6. Explain private and public key used in asymmetric cryptography. What is the use of ACL? [5+3]
7. What is critical section problem? Why must the executing the critical section be mutually exclusive? Describe how semaphore can be used to solve the critical section problem. [2+2+4]
8. What is the significance of system administration? Describe the role and responsibilities of system administrator to keep the system updated and efficient. Explain with an example. [3+5]

140

9. Consider a system with 5 concurrent processes (P0,P1,P2,P3,P4) and 4 resources types (R0,R1,R2,R3). The number of instances of each resources type in the system are 6,4,4,2 respectively. Allocation table and Maximum claim table are as follows: [4+4]

Allocation

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

Maximum claim

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

a) Calculate Need matrix as per Banker's algorithm.
b) Is the state safe? If so, show the safe execution of the processes

10. Write short notes: [2×4]

i) Thrashing
ii) Shell programming

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

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

Subject: - Operating System *(CT656)*

- ✓ 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 I/O bound process and CPU bound process? What is process scheduling? Why do we need thread? [2+3+3]
2. Define process in OS and explain possible states. Consider the following set of processes, with the length of the CPU burst time in millisecond. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time 0. [Lowest Number being Highest Priority] [8]

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	5
P4	1	4
P5	5	2

   Draw Gantt chart illustrating priority and RR (quantum = 1) scheduling. Also find average waiting time and average turn-around time for each of the algorithms.
3. Consider a disk queue with requests for I/O to blocks on cylinders 23, 89, 132, 42, 187. Assume disk head initially at 100 and a seek takes 6m/sec/cylinder. How much seek is needed for FCFS, SSF and SCAN disk arm scheduling algorithms. [8]
4. Explain inode approach of file system implementation with its advantages and disadvantages. [8]
5. What are the differences between fixed partitioning and variable partitioning system of memory for multiprogramming? [3+5]

   Given reference to the following pages by a program:

   0,9,0,1,8,1,8,7,8,7,1,2,8,2,7,8,2,2,8,3

   How many page faults will occur if the program has 4 frames for Optimal Page Replacement algorithm?
6. Explain private and public key used in asymmetric cryptography. What is the use of ACL? [5+3]
7. What is critical section problem? Why must the executing the critical section be mutually exclusive? Describe how semaphore can be used to solve the critical section problem. [2+2+4]
8. What is the significance of system administration? Describe the role and responsibilities of system administrator to keep the system updated and efficient. Explain with an example. [3+5]

140

9. Consider a system with 5 concurrent processes (P0,P1,P2,P3,P4) and 4 resources types (R0,R1,R2,R3). The number of instances of each resources type in the system are 6,4,4,2 respectively. Allocation table and Maximum claim table are as follows: [4+4]

Allocation

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

Maximum claim

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

a) Calculate Need matrix as per Banker's algorithm.
b) Is the state safe? If so, show the safe execution of the processes

10. Write short notes: [2×4]

i) Thrashing
ii) Shell programming

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

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

Subject: - Operating System

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

1. a) Explain multiprogramming, multiprocessing and distributed operating system. [6]
   b) Explain the virtual machine structure. What are the benefits over other operating system structure? [2+2]
2. a) Difference between process and thread. Explain how thread based execution minimizes context switching problem of process based execution. [2+2]
   b) Suppose 5 processes are submitted at time 0.

Process	A	B	C	D	E
Burst Time	35	10	15	5	20
Priority	3	2	4	5	1

   Show the execution timeline of the processes using Gantt Chart for FCFS, SJF and Round Robin (q=5). Also calculate mean turnaround time in each case. [6]
3. a) What is race condition? Explain how Sleep() and Wakeup() solution is better than busy waiting solution for critical section problem. [2+3]
   b) What is TSL? Why it is used? Explain the major operations of semaphore with a simple implementation as a class. [5]
4. What is thrashing? Consider the following page-reference storing-
   7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. How many page faults woud occur for the following page replacement algorithms, assuming 3 frames:-
   a) FIFO b) Optimal c) LRU d) LFU [2+8]
5. Discuss various file allocation and access methods. Compare their advantages and disadvantages. [4+6]
6. A disk drive has 50 cylinders, numbered 0 to 49. The drive is currently serving a request at cylinder 15, and the queue of pending requests, in FIFO order is 4,40, 11, 35, 7, 14. What is the total distance that the disk arm moves for the following algorithms:-
   a) FCFS b) SSTF c) SCAN d) LOOK e) C-SCAN [10]
7. What is Deadlock and indefinite Postponement? Explain the necessary conditions for deadlock and Explain how deadlock can be prevented? A system has 2 process and 3 resources. Each process need maximum of two resources, IS deadlock possible? Explain. [1+1+3+3+2]
8. How authentication is an essential mechanism for maintaining security? Explain. [4]
9. Write short notes on: [2×3]
   a) Caesar Cipher
   b) Administration tasks

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

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

Subject: - Operating System *(CT565)*

- ✓ 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 Operating system is termed as virtual machine? Briefly mention the function of Operating system. [5]

   b) What is System Call? Explain in brief about the given architecture of operating system. [2+3]

   i) Monolithic Architecture

   ii) Virtual Machine

2. a) Define process. Describe the various states of process. How significant is the process hierarchy? [1+2+2]

   b) Make a schedule as per Rate Monotonic (RM) algorithm for the following set of real time tasks: [5]

Task, T	Period, P	Execution time, E	Phase, ∅
T_1	4	1	0
T_2	5	2	0
T_3	20	5	0

3. Define race condition. What are the requirements of mutual exclusion? Solve producer consumer problem using semaphore and message passing. [2+2+6]
4. Under what circumstances do page fault occur? Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6 how many page faults would occur for the LRU replacement, FIFO replacement and optimal replacement algorithms by assuming three frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each. [4+6]
5. Suppose a disk drive with 200 cylinders numbered from 0 to 199. The drive is currently serving a request at 53. The queue of pending request is 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, Calculate total head movement (in cylinder) that the disk arm moves to satisfy all the pending request for FCFS, SSF and SCAN disk scheduling algorithm. [6]
6. What is File Attribute? Write the difference between Single level directory system and Hierarchial directory system. Explain how operating system manages free blocks of Secondary storage. [1+3+6]
7. List four essential conditions for deadlock. Explain each of them briefly. What would be necessary (in operating system) to prevent the deadlock? How deadlock is recovered? Explain. [10]
8. Write short notes on: [3.5×4]

   i) Protection Domain
   ii) Cryptography
   iii) System administration
   iv) Dining philosopher problem

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

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

Subject: - Operating System *(CT656)*

- ✓ 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 primary purposes of an operating system? Explain. Why should the operating system prevent users from accessing the boot sector? [3+2]
   b) Explain in brief any four types of OS. [5]
2. Assume the system having two processors of same configuration, schedule the following set of processes according to preemptive priority and round robin algorithm (Time quantum = 3) and calculate average waiting time and average turnaround time. [5+5]

Process	Arrive Time	CPU Time (ms)	priority
A	0	12	1
B	2	8	2
C	5	7	4
D	3	9	3
E	4	6	2
F	8	5	1
G	7	7	3
H	3	4	4
I	4	2	3

3. a) Explain Critical Section problem. Why is it important for a thread to execute a critical section as quickly as possible? [5]
   b) Define Semaphore and explain the major operations in semaphore including pseudocode. [5]
4. a) Differentiate compaction and Coalescing technique. How logical address is mapped to physical address by Paging Technique? Explain with suitable example. [2+3]
   b) With an example, show that FIFO page replacement algorithm suffers from Belady's anomaly. What is thrashing? [3+2]
5. Briefly mention the structured I/O software with suitable diagram. Compare the throughput (overall performance) of SCAN with SSTF [6]
6. a) In what ways is file system management similar to virtual memory management? What are the advantages and disadvantages of a contiguous file allocation scheme? Which file organization technique is most appropriate for tape storage? Why? [3+3]
   b) List the file system performance indicators with brief explanation. [4]

7. What is the difference between deadlock and indefinite postponement? Consider a system with 5 concurrent processes (P0,P1,P2,P3,P4) and 4 resource types (R0,R1,R2,R3). The number of instances of each resource type in the system are 6,4,4,2 respectively. Allocation table and Maximum claim table are as follows: [3+7]

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

Allocation

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

Maximum claim

Is the state safe? If so, show the safe execution of the processes.

8. Write short notes on: [3.5×4]

i) Duties and responsibilities of system administration
ii) Types of security Attack
iii) Principle of I/O Software
iv) UNIX file system

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

Subject: Operating System *(CT656)*

- ✓ 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.*

100

1. a) Explain the Virtual Machine Structure. What are the benefits over other operating system structure? [2+2]
   b) What is operating system? Briefly explain the function of operating system. [1+4]
2. a) Differentiate between process and thread. Explain the advantages of multithreading. [2+2]
   b) Schedule the following set of processes according to HRRN and Round Robin algorithm (Time quantum=4) and calculate average waiting time and average turnaround time. [5]

Process	Arrival Time	CPU Time (ms)
A	0	12
B	2	8
C	5	7
D	10	9

3. What is TSL instruction? Why it is used? Solve producer-consumer problem using monitors. [1+2+7]
4. Define page fault and demand paging. Consider a paged memory system with eight pages of 8KB page size each and 16 page frames in memory. Using the given page table, compute the physical address for the logical address 18325. [3+6]

7	10
6	4
5	0
4	7
3	13
2	11
1	14
0	5

5. What is file system layout? Explain how operating system manages free blocks of secondary storage. [3+7]
6. What is disc scheduling? Explain details about the device independent I/O software with example. [3+6]
7. What is deadlock? Explain the essential condition for deadlock. How you detect deadlock? Explain with example. [2+4+4]
8. Explain the types of attacks. Explain, how can you implement security and protection on all components of a system. [3+6]
9. What is system administration? How is a special user different from a general user? Explain. [2+3]

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Magh

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

Subject: - Operating System *(CT656)*

- ✓ 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. Is layered structure of operating system better than monolithic structure? If yes, explain with an example. If no, why? [10]
2. a) What is process? Differentiate between process and thread. [1+3]
   b) Assume you have the following processes to execute with one processor. [5]

Process	Arrival time	CPU burst	Priority
P1	0	10	3
P2	2	7	2
P3	3	8	4
P4	5	6	1

Priority is defined as 1>2>3>4.

   i) Make the GANTT chart of the execution of these processes using preemptive priority and Shortest remaining time first algorithm.
   ii) Find out turnaround time, waiting time, and their average time of each process.

3. Why processes need to be synchronized? Explain Peterson's Solution and TSL instruction approaches used in mutual exclusion with busy waiting. [2+4+4]
4. What is page fault? Consider following page reference string [2+8]

   1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,21,2,3,6

   How many page faults would occur in LRU, FIFO and Optimum replacement algorithm?
5. Explain the role of each layer in a file system. Compare and contrast the linked list allocation and linked list allocation using index method. [4+5]
6. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order is: [10]

   56, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

   Starting from the current head position, what is the total distance (in cylinder) that the disk arm moves to satisfy all the pending requests, for each of the following algorithms:

   FCFS, SCAN, LOOK, CSCAN, SSTF
7. What is deadlock avoidance and detection? Explain all possible deadlock prevention techniques. [2+6]
8. The use if internet is possible cause of a security breach. Describe the major threats by which a system connected to the internet is always prone to attack. Explain. [6]
9. Write short notes on: [4+4]
   a) Role of system Administrator
   b) Shortest Seek Time First Algorithm with example

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85/-

43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

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

Subject: - Operating System *(CT656)*

- ✓ 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 the role of supervise call in an operating system? Write down the major differences between following types of operating system. [2+8]
   a) Batch System
   b) Interactive System
   c) Real Time System
   d) Time Sharing System
2. Define Context Switching. Discuss 5-state model of process. Schedule the following set of process according to multilevel feedback queue scheduling algorithm and compute AWT and ATAT. [2+3+5]

Process	P1	P2	P3	P4
Arrival Time	0	12	25	32
CPU Burst (ms)	25	18	4	10

   Assume that there are three ready queues Q1, Q2 and Q3. The CPU time slice for Q1 and Q2 is 5 ms and 10 ms respectively and processes are scheduled on FCFS basis in Q3.
3. Define race condition with example. Explain Peterson's Algorithm. [3+7]
4. Differentiate compaction and coalescing techniques. How logical address is mapped to real physical address by paging technique? Explain with suitable example. What is the role of TLB? [4+4+2]
5. Describe different file allocation methods. Explain free disk space management with example? [6+4]
6. Consider a system with 5 processes P_0 through P_4 and three resources types A, B, C. Resources types A has 7 instances, B has 2 and C has 6 instances. Suppose at t0 time we have following state: [10]

Process	Allocation			Request			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	0	0	0	0	0	0
P1	2	0	0	2	0	2			
P2	3	0	3	0	0	0			
P3	2	1	1	1	0	0			
P4	0	0	2	0	0	2			

   a) Is the given system in deadlock state?
   b) Suppose P2 makes an additional request (0, 0, 1) what will be the effect of this request to the system?

7. A disk with 1000 cylinders, numbered 0 to 999, compute the number of tracks the disk arm must move to satisfy all the requests in the disk queue. Assume the last request serviced was at track 345 and the head is moving towards track 0 (zero). The queue in FIFO order contains request for the following tracks: [10]

   123, 874, 693, 475, 105, 376

   Perform the computation for the following scheduling algorithms:

   a) FIFO
   b) SSTF
   c) SCAN

8. Write short notes on: [5+5]

   a) Types of network security attack
   b) Duties and responsibilities of system administrator

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46 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

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

Subject: - Operating System *(CT656)*

- ✓ 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 is operating system? Briefly mention the type of operating system. [1+4]
   b) Differentiate between monolithic and micro-kernel structure of operating system. [5]
2. What is process? From the given following information: [2+8]

Process	Arrival time	Burst time	Priority
P_1	0	3	3
P_2	1	6	5
P_3	2	1	2
P_4	3	4	1
P_5	4	2	4

   a) Draw the Gantt chart.
   b) Calculate average waiting time and average turn around time for the following scheduling algorithm.
      i) Round Robin (q = 1) ii) Priority Preemptive
      iii) Preemptive SJF
3. Why do we need pipe() function? Define Semaphore and explain the major operations in semaphore. Can semaphores be used in distributed system? Explain why or why not. [3+4+3]
4. What is residence monitor? Consider logical address spaces of eight pages of 1024 words, each mapped onto a physical memory of 32 frames then. [5+5]
   a) How many bits are in logical address?
   b) How many bits are in physical address?
5. What is file and their attributes? Briefly explain the file allocation methods. [3+7]
6. Consider a disk drive having 200 cylinders, numbered from 0 to 199. The head is currently positioned at cylinder 53 and moving toward the cylinder 60. The queue of pending requests are 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, what is the total head movement (in cylinders) to service the pending requests for each of the following disk arm scheduling algorithms? (a) FCFS (b) SSTF (c) SCAN (d) LOOK (e) C-SCAN. [11]
7. Explain the necessary conditions of deadlock? How can a system detect deadlock and what does it do after detection? [4+6]
8. Write short notes on: [3×3]
   a) Shell Scripts b) Cryptography
   c) Security Policy

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

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

Subject: - Operating System *(CT656)*

- ✓ 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. List the essential properties for the Batch-oriented and Interactive operating system. For each of the following application which system (Batch or Interactive) is more suitable? State the reason. [4+6]
   a) Word Processing
   b) Generating monthly bank statements
   c) Computing pi to million decimal places
   d) A flight simulator
   e) Generating mark statement by University
   f) Data acquisition from temperature sensor
2. Consider the following set of process with the length of the CPU burst time given in millisecond. [4+4]

Process	P1	P2	P3	P4	P5
Burst time	10	1	2	1	2
Priority	3	1	3	4	2

   Assume the processes arrived in the order P1, P2, P3, P4 and P5 all at time 0, priority 1 as highest and 4 as lowest.
   a) Draw the Gantt chart for FCFS, SJF, Priority and Round Robin (Quantum = 2)
   b) Which algorithm results in the maximum average waiting time?
3. What is race condition and critical section problem? Explain all possible approaches to handle the situation "while one process is busy updating shared memory, no other process will enter its critical section and cause trouble". [2+8]
4. Calculate Hit and Faults using various page replacement algorithm policies. (FIFO, LRU, Optimal) for the following page sequence (The page frame size is 3) [2+6]

   2 3 5 4 2 5 7 3 8 7
5. Explain file system layout in detail. What are the major differences between file system interfaces and file system implementation? [6+4]
6. What are the disadvantages of programmed I/O? Explained about DMA. What are the functions of device independent I/O software? [2+2+4]
7. What is deadlock? State the necessary conditions for deadlock to occur. Give reason, why all conditions are necessary. [10]
8. Explain the domain-object and ACL. How these mechanisms are implemented for security? [4+4]
9. Write short notes:
   a) Roles of System Administration [4]
   b) Shell Scripts [4]

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43 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

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

Subject: - Operating System *(CT656)*

- ✓ 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 operating system as an extended machine? Distinguish between Kernel and Micro-Kernel. Explain the purpose of system call. [2+3+3]
2. For the process listed in following table, what is the average turnaround time using: [10]

   (a) FCFS (b) RR (quantum=4) (c) SJF (d) SRT (e) HRRN

Process	Arrival Time (ms)	Processing Time (ms)
A	0	3
B	2	6
C	4	4
D	6	5
E	8	2

3. Define critical section and mutual exclusion with respect to multiple-process system. Solve producer and consumer problem using semaphore. [3+5]
4. What is page fault? Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the FIFO, Optimal, LFU and LRU replacement algorithms having five frames? Remember all frames are initially empty, so your first unique page will cost one fault each. [2+8]
5. What are the different methods for allocating disk space for file? Explain free space management techniques. [2+6]
6. Suppose that a disk drive has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43, and previous request was at cylinder 25. The queue of pending request, in FIFO order is: [10]

   86, 70, 13, 74, 48, 9, 22, 50, 30

   Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending requests for each of the following disk scheduling algorithms?

   a) First-come, First served
   b) Shortest Seek Time First
   c) Look
   d) C-Scan
   e) Scan
7. What is deadlock? How it occurs? Explain various deadlock avoidance methods with examples. [2+2+6]
8. What are the roles of system administrators for an organization? How can you increase operating system performance if you are selected as a system administrator? [4+4]
9. Write short notes on: (any two) [4+4]

   a) Information security model
   b) Security attack

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

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

Subject: - Data Base Management Systems *(CT 610)*

- ✓ 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 Database and DBMS. How DBMS is differed from file system? Explain z-tier architecture in DBMS. [1+2+2]
2. Define Attributes and explain its type with example. [4]
3. List the entities, attributes and their relationships and draw an ER diagram for the university database. " A lecturer, identified by his or her number, name and room number, is responsible for organizing a number of course modules. Each module has a unique code and also a name and each module can involve a number of lectures who deliver part of it. A module is composed of a series of lectures and because of economic constraints and common sense, sometimes lectures on a given topic can be part of more than one module. A lecture has a time, room and date and is delivered by a lecturer and a lecturer may deliver more than one lecture. Students, identified by number and name, can attend lectures and a student must be registered for a number of modules. We also store the date on which the students first registered for that module. Finally, a lecturer acts as a tutor for a number of students and each student has only one tutor." [8]
4. Consider the employee database Schema. [2×6]

   employee (employee name, street, city)

   works (employee name, company name, salary)

   company (company name, city)

   manages (employee name, manager name), where the primary keys are underlined. Give an expression in SQL and RA for each of the following queries.

   a) Find the names and cities of residence of all employees who work for First Bank Corporation.

   b) Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than $10,000 and employee name must not start with the letter "z".

   c) Find all employees in the database who do not work for First Bank Corporation.

   d) Find all employees in the database who earn more than each employee of Small Bank Corporation.

   e) Assume that the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.

   f) Find the company that has the most employees.

5. Why normalization is an important in DBMS? Explain anomalies in DBMS with example. In relation R = (A, B, C, D, E). The set of functional dependencies is : ($A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$.) decomposed it into R1 = (A, B, C), R 2 = (A, D, E). Show that this decomposition is a lossless-join decomposition. [1+3+4]

6. Explain basic steps of query processing. Transform the following relational algebra expression using equivalence rule. Show each step involved. [2+6]

   instructor (ID, name, dept_ name, salary)

   teaches (ID, course_id, sec_id, semester, year)

   course (course _id, title, dept _name, credits)

   $\Pi_{name,\ title}\ (\sigma_{dept\_name} = \text{“ Music”} \wedge year = 2017$

   $(instructor \bowtie (teaches \bowtie \Pi_{course\_id,title}\ (course))))$

7. What is the role of index in DBMS? Explain primary index and secondary index with example. What are the characteristics of B^+ tree? [1+4+3]

8. Explain about the state diagram of transaction. How do test Conflict Serializability of a Schedule S, explain in details with example. [3+5]

9. What are the different types of failure in DBMS? Explain shadow page recovery technique with example. [3+5]

10. Define transaction. What are the ACID properties in DBMS. [5]

11. Explain Distributed Database System with its type. What are different data fragmentation techniques? [4+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

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

Subject: - Data Base Management Systems *(CT 610)*

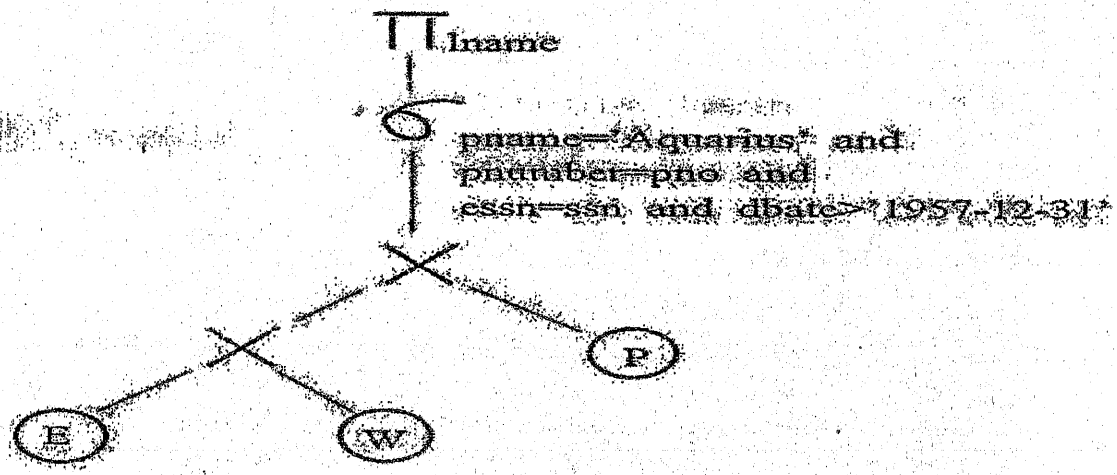
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define Database system. Explain the four components of Database System. [1+4]
2. What are an instance and scheme? Explain three schema architecture in DBMS. [2+2]
3. Define the following terms briefly: Attribute and its types, entity, participation constraint, weak entity set. Also construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars, and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received. [3+5]
4. Consider the relational database as follows: [2×6]

   department (*dept_name*, building, budget)
   Course (*course_id*, title, dept_name, credits)
   instructor (*ID*, name, dept_name, salary)
   section (*course_id*, *sec_id*, *semester*, *year*, building, room_number, time_slot_id)
   teaches(*ID*, *course_id*,*sec_id*, *semester*, *year*)
   student (*ID*, name, dept_name, total_credit)

   a) Write an SQL to add a check constraint in semester attribute.[winter, fall, spring, summer] of table "section".
   b) Write an SQL to find the names of all instructors that have a salary value greater than that of each instructor in the Computer department.
   c) Write an SQL to find the list of the entire department relation in descending order of budget. If several departments have the same budget, order them in ascending order by department name.
   d) Write an SQL to Delete the records of all instructors with salary below the average at the university.
   e) Write an SQL to update all instructors with salary over 10,00,000 receive a 5 percent raise, whereas all others receive a 10 percent raise.
   f) Write a Relation Algebra expression to find the name of student whose department name and total credit are same as Shyam's department name and total credit.
5. Explain view with example. How is it different from table? [3+2]
6. What is Decomposition? Briefly explain about 3NF and BCNF with example. Computing a canonical covering of the given FD. R = (A, B,C) and F = { A→BC, B →C, A→B, AB→C}. [1+3+4]

7. Briefly outline the Query Processing and optimization. Optimize the given query tree. [3+5]



8. What is secondary index? Explain with example. Explain about Dynamic hashing techniques in details. [2+6]
9. Check whether the given schedule S is conflict serializable or not. If yes, then determine all the possible serialized schedules. [2+6]
10. Explain about Checkpoints with example. Explain about immediate-database modification techniques with example. [3+5]
11. What is spatial data? How do you store spatial data in a database? What are differences between object oriented and relational database management system? [1+2+3]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

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

Subject: - Data Base Management Systems *(CT 610)*

- ✓ 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. Distinguish between logical and physical data independence. Define DDL, DML and DCL with examples. [2+3]

2. What is keys and explain different types of keys. "A football club has a name and a ground and is made up of players. A player can play for only one club and a manager, represented by his name manages a club. A footballer has a registration number, name and age. A club manager also buys players. Each club plays against each other club in the league and matches have a date, venue and score." Create an ER diagram for above scenario. [2+8]

3. Consider the following insurance database.

   PERSON (lisenceNO, name, address)

   CAR (modelNo, brand, year)

   ACCIDENT (reportNo, date, location)

   OWNS (lisenceNo, modelNo)

   PARTICIPATED (lisenceNo, reportNo, damage Amount)

   a) Write relational aigebra expression for the given queries:

      (i) Find the Person name and car he/she owns and the car was manufactured on 2010.

      (ii) Find the total number of accidents occured on jan 20, 2022 location wise.

      (iii) Find the details of accident where the damage amount exceeds 50000.

      (iv) Find name of all person who met an accident. [4×2]

   b) Write SQL expression for the given queries:

      (i) Find the Person detail whose name starts with 'A' and is involved in some accident.
      (ii) Find the car details that are involved in accident and calculated more than 40000 as a damage amount.
      (iii) Delete the information of car which is owned by person living in Humla.
      (iv) Creat a view named PERSON_REPORT which contains lisenceNO, name and reportNo as its member and the person's address is Ktm. [4×2]

4. a) Define integrity constraints and domain constraints. [4]

   b) What is normalization? Explain the role of function dependency in normalization of data. [2+2]

5. Define query processing with necessary figure. Explain the differences between cost-based and heuristics based methods of query optimization. [3+5]

6. a) What is the difference between ordered indices and hash indices in a database? What is the advantages of using sparse index? [4]

   b) What do you mean by RAID? Explain the types of RAID and mention how to select an appropriate level of RAID. [4]

7. a) Database-system implementers have paid much more attention to the ACID properties than have file-system implementers. Why might this be the cases? [4]

   b) Briefly explain two phase locking protocol with an example. [4]

8. a) Explain the purpose of the checkpoint mechanism. How often should checkpoints be performed? [4]

   b) What is deferred-database modification technique in context to log based recovery approach? Explain. [4]

9. Differentiate between data warehousing and data mining with an example. What are the types of data fragmentation in distributed databases? Write any four advantages of distributed database. [3+3+3]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Data Base Management Systems *(CT 610)*

- ✓ 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 advantages of Database Management System? List roles and responsibilities of Database Administrator. [3+2]

2. a) Design an E-R diagram for a company human resource database, "The Company has a set of branch offices. Each branch office has a set of departments. Each department has a set of employees, a set of projects. Each employee has a job history, academic qualification. For each job type, the employee also has a salary history." [7]

   b) What is key attribute? List out the types of keys and explain them briefly. [3]

3. a) Consider the following relational database model: [4×2]

   Product (product_id, pname, price, pdescription)
   Customer (customer_id, cname, address, phone)
   Purchase (product_id, customer_id, quantity, sales_mid)
   Salesman (sales_mid, sname, salary)

   Write SQL statement for the following:

   (i) Create table Purchase (use foreign key)
   (ii) List name and address of all customers who purchased the product SSD
   (iii) Find the name of the product which purchase quantity is maximum
   (iv) Increase the salary of all salesman by 5% who have sold at least 10 SSD

   b) For the relational database model given in the Question No. 3(a). Write relational algebraic expression for the following: [4×2]

   (i) Display name of the customers who are from Kathmandu and name start with 'R'.
   (ii) List the name of the product purchased by customer 'Sita' from the salesman 'Ram'
   (iii) Find the product wise total purchased quantity
   (iv) Update the price of all products by 8%

4. What is Normalization? Why is it important? How can you convert a Unnormalized table to Third Normal Form? Explain with example. [1+2+5]

5. Explain the steps of query processing with examples. Compare cost based evaluation and heuristic optimization method. [4+4]

6. What is record organization? Explain the way of file organization. Compare secondary index and multilevel indexing techniques. [2+2+4]

7. Define transaction and explain its ACID properties. Define schedule and give proper examples. What is a serializable schedule? [1+3+2+2]

8. Define checkpointing with example. How REDO and UNDO operations performed in log based recovery mechanism? [3+5]

9. Write short notes on: [3×3]

   a) Advantages of object oriented database model
   b) Parallel database architecture
   c) Data warehousing

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Database Management Systems (*CT 610*)

- ✓ 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. Briefly explain the levels of Data abstraction with suitable diagram. [4]
2. Draw an ER diagram for the mini-case "Centralized Entrance Examination System (CEES)". The CEES stores student's basic demographic information as well as previous academic information. It should have capabilities to manage multiple shift/day of examinations based on the number of applicants. All the questions are of objective types and there is provision of negative marking for wrong answers. Student's rank is calculated based on the entrance score and previous academic scores. [8]
3. a) Consider the relational database as follows: [4×2]
   Employee (Empnamem, street, city)
   Works (empname, post, cmpname, salary)
   Company (cmpname, iocation)
   Write relational algebraic expression for
   i) Display all the record of employee whose name is John and works for CG cooperation.
   ii) Update the relation company so that all companies in Kathmandu is shifted to Banepa.
   iii) Remove all the records of employee who lives in Banepa.
   iv) Write QBE to display all the record of employee whose salary is > = 40000 and < = 90000 and from Kavre.

   b) Consider the following relations [4×2]
   Course (CID, title, dept_name,credits)
   Student(SID, name, dept_name,tot_credits)
   Teacher (TID, name, dept_name,salary)
   Write SQL ststements to:
   i) Create relation student.
   ii) Find the titles of courses in the 'Computer Science' department that have 3 credits.
   iii) Find the highest salary of any teacher.
   iv) Find all the teachers earning the salary more than 60000 from BCT department.
4. a) Show the Differentiate between 3NF and BCNF with example. [4]
   b) Suppose that we decompose the schema R = (A,B,C,D,E) into (A,B,C) and (C,D,E). Is it lossless decomposition? Does it preserve dependencies? Consider that the following set F of functional dependencies hold A→BC; CD→E; B→D; E→A [2+2]
5. Explain basic steps of query processing. Explain about heuristic query optimization with one example. [4+4]
6. Why does RAID level 6 give better data protection than RAID 5? Write pros and cons of dense index files and sparse index files. [4+4]

7. What is recoverable and nonrecoverable schedule? Explain with example. Define deadlock and explain two approaches to deadlock prevention. Consider the three transactions T_1, T_2, and T_3 and the schedules S_1 and S_2 given below. Draw the serializability (Precedence) graphs for S_1 and S_2 and state whether each schedule is serializable or not. If a schedule is serilizable, write down the equivalent serial schedule(s). [3+3+3+3]

T_1: $r_1(X)$; $r_1(Z)$; $w_1(X)$;
T_2: $r_2(Z)$; $r_2(Y)$; $w_2(Z)$; $w_2(Y)$;
T_3: $r_3(X)$; $r_3(Y)$; $w_3(Y)$;
S_1: $r_1(X)$; $r_2(Z)$; $r_1(Z)$; $r_3(X)$; $r_3(Y)$; $w_1(X)$; $w_3(Y)$; $r_2(Y)$; $w_2(Z)$; $w_2(Y)$;
S_2: $r_1(X)$ $r_2(Z)$; $r_3(X)$; $r_1(Z)$; $r_2(Y)$; $r_3(Y)$; $w_1(X)$; $w_2(Z)$; $w_3(Y)$; $w_2(Y)$;

8. Briefly explain recovery algorithm for redo and undo phase with checkpoints. [4+4]

9. What are the characteristics of Data Warehouse? Explain the parallel database architecture with figures. [3+5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Data Base Management Systems *(CT 610)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
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1. Define Schema and explain three schema architectures. [4]
2. List the entities and their relationships and Draw an ER diagram for the movie database. Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are summarized as follows: "Each movie is identified by title and year of release. Each movie has a length in minutes. Each has a production company and each is classified under one or more genres (such as horror, action, drama and so forth). Each movie has one or more directors and one or more actors appear in it. Each movie also has a plot outline. Finally, each movie has zero or more quotable quotes, each of which is spoken by a particular actor appearing in the movie. Actors are identified by name and date of birth and appear in one or more movies. Each actor has a role in the movie. Directors are also identified by name and date of birth and direct one or more movies. It is possible for a director to act in a movie (including one that he or she may also direct).Production companies are identified by name and each has an address. A production company produces one or more movies." [8]
3. a) Consider the following relational database model: [2×4]
   Employee (eid, ename, email, phone, address)
   Department (dept_id, dname, block)
   Designation (did, title, salary)
   Works (eid, dept_id, did, effective_date)
   Write relational algebra expression for the following:
   (i) List all the designation title with starting letter 'M'.
   (ii) List the name and id of employees who worked for 10 years in the same department.
   (iii) Find the total salary that should be paid by the organization every month.
   (iv) List all the employees who are from KTM and works in ADMIN department.

   b) For the relational database model given in the Question no.3. Write SQL statements for the following:
   (i) List the name, email of all employees from electronics department who have joined the department in this month. [2×4]
   (ii) List the name, designation of the employee with their monthly salary.
   (iii) List the name of the departments having more than 10 employees.
   (iv) Find the highest paying employee's name for each department.
4. a) What do you mean by trigger and assertion? [3]
   b) What do you mean by multivalued dependency? How it is handled in 4-NF? Demonstrate with a suitable example. [1+4]
5. Define query processing and query optimization. Explain the ways of query evaluation with an example. [3+5]
6. What factors to be taken into account in choosing a RAID level? What is index evaluation metrics, explain? What is primary index, explain its type in details. [2+2+4]
7. a) Explain the different possible states of database transaction. What is conflict serializibility? Explain with example. [3+3]
   b) Explain various methods of concurrency control mechanism in database transaction. [6]
8. What is log-based recovery? Explain about immediate-database modification techniques with example. [2+6]
9. Why does an organization need data warehouses? Briefly explain on the requirement of data fragmentation and replication in the context of distributed databases. [3+5]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Baishakh

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

Subject: - Database Management System *(CT 652)*

- ✓ 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 is database system more preferred over file system? Explain briefly. [4]
2. a) Define total participation with an example. Explain weak entity set with an example. [2+2]

   b) A publishing company produces books on various subject. The books are written by authors who specializes in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book requires some items for publication. These items supplied by suppliers. One supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books but one book can be bought by one shop owner only. Books are uniquely identified by Bookid. Draw ER-diagram for above scenario. Use necessary attributes for each entity. [8]
3. a) Consider the following relational data model.
   Salesman(salesman_id, name, commission, city)
   Customer(customer_id, cust_name, city, grade, salesman_id)
   Order(order_id, Purchase_amt, order_date, customer_id, salesman_id)
   Write down the SQL query for the following:
   (i) Find the customer names and the salesman names and city who lives in the same city.
   (ii) Find the names of all customers along with the salesman who works for them.
   (iii) Find all the orders by the customers not located in the same cities where their salesman lives.
   (iv) Find the total number of orders handled by each salesman along with his/her name. [4×2]

   b) Consider the following relational database. [2×4]
   Flights (flight_no, from, to, distance, depart_time, range)
   Aircraft(aircraft_id, aircraft_name, range)
   Certified(emp_id, aircraft_d)
   Employees(emp_id, ename, salary)
   Write the relational algebra expressions for the following:
   (i) Find the empids and names of pilots certified for Boeing aircraft.
   (ii) Find the names of aircraft such that all pilots certified to operate them earn more than 80,000.
   (iii) Increase the salary of all employees by 5% who earn less than 100,000.
   (iv) Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft.

120

4. a) Explain why normalization is necessary? Explain 1NF, 2NF, and 3NF with example. [3+3]
   b) What is the role of functional dependencies in normalization? Explain lossy and lossless decomposition. [2+4]
5. Explain with diagram about steps involved in query processing. Briefly explain about the approaches used for query optimization. [5+3]
6. a) What is record organization? Explain primary and secondary indexing with example. [1+3]
   b) Explain the distinction between static and dynamic hashing with approximate example. [4]
7. Define transaction and explain various states of a transaction. What do you mean by concurrent execution and describe about two phase locking protocol along with its limitations? [4+4]
8. Explain the deferred database modification of log based recovery scheme. Explain the steps along with an example. [6]
9. Write short notes on: [2×3]
   a) Data Warehouse
   b) Remote Backup System

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

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

Subject: - Database Management System *(CT 652)*

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

1. Explain the layers of abstract in database design. Why physical data independence is important in data modeling? [2+2]

2. a) Draw an ER diagram for an online book store that contains written by authors and published by the publisher. Also the book is stocked in the warehouse. The store also maintains record about the selling of books online via shopping basket (shopping cart), ie. customers purchase the books online via the shopping basket. Books have ISBN, price, title and year whereas authors may have url, name, address and email. Also the publishers name, address, phoneno and url are stored. The customer's name, address, email and phone are stored. The warehouse may have code, phoneno and address. Assume other parameters accrodingly. [8]

   b) Distinguish between degree and cardinality of a relationship in an ER diagram. Explain generalization in ER diagram with an example. [2+2]

3. Consider the relational model. [7×2]
   Employee (empid, empname, address, title)
   Project (pid, pname, budget, location)
   Assignment(empid, pid, responsibility, duration)
   Payment (title, salary)

   a) Write SQL to count the number of project with duration more than 2 years.
   b) Write SQL query to find the name of engineers working in ICTC project and earning salary more than 20K.
   c) Write SQL to update the salary of employees by 5% if salary less than 10k, by 7% if salary between 10K and 20K and, by 9% if salary greater than 20K.
   d) Write Relational Algebra to find the projects having budget more than 500K.
   e) Write Relational Algebra to list the employees working for more than 10 years in CAD/CAM project.
   f) Write Relational Algebra to find the name and salary of employees working in Kathmandu.
   g) Give an expression in QBE to find the employee name and address who have salary greater than 50K.

4. a) What do you mean by closure of functional dependency? Explain about referential integrity constants and illustrate with suitable examples. [3+3]

   b) Wha is the purpose of Normalization? Explain 3NF and BCNF. [2+4]

5. Describe the basic steps in query processing. Explain how pipelining can be used to imporve query evalution efficiency. [5+3]

6. a) What do you mean by hashing and indexing? Differentiate between dense index and sparse index? [2+2]

   b) What do you mean by RAID? Explain the types of RAID and mention how to select an appropriate level of RAID? [4]

7. a) During execution, a transaction passes through several states until it finally commits or aborts. Explain all possible sequences of states through which a transaction may pass. [5]

   b) Explain the following briefly: [2×2]

   (i) Two phase locking protocol
   (ii) Wait & die scheme for deadlock prevention

8. a) Explain the architecture of remote backup system? [3]

   b) What is Immediate database modification technique in context to log based recovery approach? Explain. [4]

9. Write short notes on: [2×3]

   a) Fragmentation in distributed databases.
   b) Object Relational Mapping (ORM)

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

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

Subject: - Database Management System *(CT 652)*

- ✓ 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 schema and instances. What are the disadvantages of conventional file system? [4]

2. a) Define data independence and explain its significance. What is importance of aggregation in ER design? Discuss with an example. [2+2]

   b) Draw an E-R diagram for the given case. [8]

   A company having a chain of pharmacies wishes you to design a database for the company. Patients are identified by an SSN, and their names, addresses, and ages must be recorded. Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded. Each pharmaceutical company is identified by name and has a phone number. For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer. Each pharmacy has a name, address, and phone number. Every patient has a primary physician. Every doctor has at least one patient. Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another. Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and a quantity associated with it. You can assume that if a doctor prescribes the same drug for the same patient more than once, only the last such Prescription needs to be stored. Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract. Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

3. Write SQL query. [Consider following relations] [8]
   Product(Pid, Pname, Price, description)
   Customer(Cid, Cname, Address)
   Sells(Pid, Cid, quantity)
   a) Retrieve the record of product who were sold to customer id 12.
   b) Create above table product as indicated.
   c) Find the product whose sells quantity is maximum.
   d) Find the total number of customer whose name start with S.

4. Write relational algebra. [Consider following relations.] [8]
   Emp (Eid, Ename, Address, Salary, Dptid)
   Depart(Dptid, Dname)
   a) Insert a single record in Emp table.(100,'Ram','Balaju',10000,5)
   b) Retrieve the record of employee who earns more than 10000 in computer department.
   c) Increase the salary of all employee by 10 percent.
   d) Delete all the record of employee who are from ELX department. (Dptid='ELX')

5. a) What do you mean by closure of functional dependency? What is a trigger in DBMS? Is it safe or risky to use triggers? Explain. [3+3]
   b) Define normalization and levels of normalization 1NF, 2NF and 3NF. Compare the advantage of BCNF over 3NF. [4+2]

6. Explain the basic steps in query processing with diagram? What is pipelining in query evaluation. Explain with an example. [5+3]

7. a) What do you mean by hashing and indexing? Differentiate between dense index and sparse index? [2+2]
   b) Write about fixed length record and variable length record organization in DBMS? [4]

8. a) What is transaction? What are the ideal properties of a transaction? [1+4]
   b) Describe strict two-phase locking protocol (2PL). [3]

9. Define term Recovery and Atomicity in database. Consider the following log contents when a crash occurs. Explain how recovery would be done for each state. [2+4]

(a)	(b)	(c)
<T_0 start>	<T_0 start>	<T_0 start>
<T_0, A, 1000, 950>	<T_0, A, 1000, 950>	<T_0, A, 1000, 950>
<T_0, B, 2000, 2050>	<T_0, B, 2000, 2050>	<T_0, B, 2000, 2050>
	<T_0 commit>	<T_0 commit>
	<T_1 start>	<T_1 start>
	<T_1, C, 700, 600>	<T_1, C, 700, 600>
		<T_1 commit>

10. Write short notes on: [3+3]
    a) Distributed database
    b) Remote Backup System

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33 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

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

Subject: - Database Management System *(CT652)*

- ✓ 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 mean by scheme and instances? Mention the different levels of data abstraction and explain. [2+2]

2. a) Identify relevant attributes and construct an ER diagram with proper mapping constraints for a university which has many departments and each department has multiple instructors; one among them is the head of the department. An instructor belongs to only one department, each department offers multiple courses, each of which is taught by a single instructor. A student may enroll for many courses offered by different departments. [6]

   b) Define unary relationship along with example. How you convert an ER relationship into relation schema? Explain with examples of different cardinalities. [2+4]

3. a) Consider the following relational data model. [2×4]

   Student (crn, name, address, phone, dob)

   Course (courseid, crn, duration, fee)

   Enroll (enrolled, cname, courseid, enrolldata, completedata)

   i) Write the SQL statements required to create the above relations, including appropriate versions of all primary and foreign key integrity constraints,
   ii) Write an expression in SQL to find crn, names and enroll data of all students who have taken the course 'java' (cname)
   iii) Write SQL to find the names and address of all the students who have taken both course java and linux.
   iv) Write an expression in SQL to Create a view 'student_course' having the attributes crn, name, phone, coursename, enrolldata

   b) Consider the following relational database [2×4]

   sailor (sailorid, sname, rating, age)

   boat (boatid, boatname, color)

   reserves (sailorid, boatid, date)

   Write relational algebra expressions for the following:

   i) Find the names of sailor who has reserved boat number 105.
   ii) Find the names of sailors who have reserved a red boat.
   iii) Find the names of all sailor who have reserved either a red boat or a green boat.
   iv) Give an expression in QBE to find the sailors name and age who have reserved a red boat.

4. a) Why do we need normalization? Differentiate primary key and foreign key. Differentiate between 3NF and BCNF. [2+2+3]

   b) Consider the relation Treatment with the schema: Treatment (doctorID, doctorName, PatientID, diagnosis) and functional dependencies; [5]

   doctorID→doctorName and (doctorID, patientID)→diagnosis.

   Describe different types of problem that can arise for this relation with records

5. Explain with diagram about process of query processing in RDBMS. How are equivalence rules for relational algebra helpful for query optimization? Explain with example. [5+3]

6. a) Describe about fixed-length record and variable length record along with examples. [4]

   b) Describe B+ tree structure used for indexing. [4]

7. Define transaction and explain various states of a transaction with a transition diagram. Describe about two phase locking protocol for concurrent transaction along with its limitations. [4+4]

8. Write the different types of failures that may occur in system. Differentiate between shadow paging and log-based recovery. [3+3]

9. a) Write about data warehouse with its components. [4]

   b) Write about spatial database. [2]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

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

Subject: - Database Management System *(CT652)*

- ✓ 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 Data Abstraction. Explain its different levels with suitable example. [1+3]
2. Construct an ER-Diagram for the following NFL database.

   You are given the requirement for a simple database for the National Football League (NFL). The NFL has many teams, and each team has a name, a city, a coach, a captain and a set of players. Each player belongs to only one team and each player has a name, a position (such as left wing, mid fielder or a goalkeeper) a skill level, and a set of injury records. A team captain is also a player and a game is played between two teams (referred as host team and guest team) and has a match date (such as June 11, 2018) and score (such as 2 to 5).

   Explain strong and weak entity sets along with example. [8+4]
3. Consider the following relational schema:

   tblsalesman(s_id, name, city, commission)
   tblOrders(ord_no, prch_amt, ord_date, c_id, s_id)
   tblCustomer(c_id, name, city, grade, s_id)

   [2×4]

   Write SQL query expression to

   a) find those salesmen with all information whose name containing the 1st character is 'N' and the 4th character is 'R' and rests may be any character.
   b) Find the highest purchase amount on a date '2017-07-17' for each salesman with their ID.
   c) count the customers with grades above Kathmandu's average.
   d) Increase commission of salesmen by 2% if they are from humla.
4. Consider the following relational database model

   Author(a_name, citizenship, birthYear)
   Book(isbn, title, a_name)
   Branch(libname, city)
   Topic(isbn, subject)
   Instock(isbn, libname, quantity)

   [2×4]

   Write relational algebra expressions for the following:

   a) Give the cities where each book is held.
   b) Give the title and author of each book of whichat least two copies are held in a branch located in Kathmandu.
   c) Delete those books that are from author 'xyz'
   d) List total no. of available books of each subject.

5. a) What is a functional dependency? List the various integrity constraints and explain about the referential integrity along with an example. [3+3]

   b) Define 1NF, 2NF and 3NF. Illustrate your answer with suitable example. [6]

6. What is the task of evaluation engine in query processing? Explain cost based query optimization and Heuristic optimization. [4+4]

7. a) What is the difference between ordered indices and hash indices in a database? What is the advantage of using sparse index? [2+2]

   b) Write about fixed length record and variable length record organization in DBMS? [4]

8. Explain the possible transaction states in DBMS. Explain the concept of conflict searilizability with an example. [4+4]

9. Explain the idea of log-based recovery. [6]

10. a) Explain homogenous and heterogeneous distributed database. [4]

    b) What is Spatial Database System? [2]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

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

Subject: - Database Management System *(CT652)*

- ✓ 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. Mention the advantages of the DBMS over the file processing system and explain briefly. [4]
2. a) Define discriminator in ER diagram. Explain different keys used in database design. [4]

   b) Draw the Entity-Relationship Diagram (ERD) with appropriate mapping cardinalities for the following scenario.

   A Production company consists of a machining, fabrication and assembly department. Employees are assigned to different departments. Each department is managed by a manager. Each employee has at most one recognized skill, but a given skill may be possessed by several employees. An employee is able to operate a given machine-type (e.g. lathe, grinder, welding) of each department. Some of the employees are paid overtime and some of them are paid with daily basis. According to their designation (eg. mechanic, welder) are supposed to maintain at least one machine-type of their department. Raw materials are bought from different vendors and fetched to the machining department. Parts from machining department are fetched to fabrication department and so on. Many parts are assembled together to form a product. The final products from assembly department are stored in the ware house. Products are labeled with different specifications (eg, Product_Id, Product_type, MRP, etc). [8]

   [2×4]

3. Consider the following relational data model

   Employee (empid, ename, age, salary)
   Department (deptid, dname, budget, managerid)
   Works (empid, deptid, hours)

   (i) Write the SQL statements required to create the above relations, including appropriate versions of all primary and foreign key integrity constraints.
   (ii) Write an expression in SQL to find the name of department whose employee earns the maximum salary.
   (iii) Write SQL to find the name of the employee, department name and the number of hours they work
   (iv) Write an expression in SQL to give every employee a 20% raise in salary whose age is in between 45 to 50 years.

   [2×4]

4. Consider the following relational database

   Account (account-number, branch-name, balance)
   Branch (branch-name, branch-city, assets)
   Customer (cust-name, cust-street, cust-city)
   Loan (loan-number, branch-name, amount)
   Depositor (cust-name, account-number)
   Borrower (cust-name, loan-number)

   Write the relational algebra expressions for the following:

(i) Find the names of customers who has loan at "Koteshwor" branch.
(ii) Find the largest account balance.
(iii) Find the names of all depositors along with their account number, street and city address.
(iv) Give an expression in QBE to find the customer name, loan number and amount for all customers who have a loan from the "Koteshwor" branch.

5. a) What are Triggers? Define Domain constraint and Referential Integrity constraint with an example. [1+4]

   b) What is the role Functional dependencies in Normalization? Explain trivial and non-trivial dependencies. Explain BCNF. [2+2+3]

6. Explain about the steps involved in query optimization. How is pipelining approach different from the materialization approach? [3+5]

7. Discuss about sequential file organization and multi-table clustering file organization. Explain dense index file and sparse index file. [4+4]

8. Explain ACID properties of a database transaction. Describe how conflict serializability differs from the view serializability for concurrent execution of transactions. [4+4]

9. What is the purpose of implementing check points in data recovery mechanism? What are the recovery actions performed if failure arises at the end of the given transaction states? [2+4]

<T_0 start>
<T_0, A, 1000, 950>
<T_0, B, 2000, 2050>

(a)

<T_0 start>
<T_0, A, 1000, 950>
<T_0, B, 2000, 2050>
<T_0 commit>
<T_1 start>
<T_1, C, 700, 600>

(b)

10. Write short notes on: [3+3]

a) Spatial database b) Remote Backup System

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

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

Subject: - Database Management System *(CT652)*

- ✓ 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 is data independence important in data modeling? Differentiate between schema and instances. [4]
2. Differentiate total and partial participation with suitable example and draw an ER diagram for the airport database. Be sure to indicate the various attributes of each entity. Every airplane has a registration number and each airplane is of a specific model. The airport accommodates a number of airplane models and each model is identified by a model number (eg DC-10) and has a capacity and a weight. A number of technician works at the airport. You need to store the name, SSN, address, phone number and salary of each technician. Each technician is an expert on one or more plane model(s) and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded. Traffic controllers must have an annual medical examination. For each traffic controller you must store the data of the most recent exam. [4+8]
3. Consider the following relational schema

   Employee (Ename, street, city)

   Works (Ename, company_name, salary)

   Company (company_name, city)

   Manages (Ename, manager_name)

   a) Write the queries in Relational Algebra. [2×3]

      i. Find all the employees name who work in 'NMB bank'.

      ii. Find all the employee names who live in the same city as their company is located.

      iii. Find the name and city of those employees whose salary is greater than 30000 and lives in 'ktm' city.

   b) Write SQL queries for the following. [2×3]

      i. Create Employee and Works relation with primary key and foreign key constraints.

      ii. Find the employee name their company name and city name which ends with 'pur' ~~as substring~~.

      iii. Increase the salary of each employees by 25% whose salary is less than 30000.

4. a) What do you mean by functional dependencies? Define formally. What is BCNF? [3+3]
   b) What is normalization? Explain INF, 2NF, 3NF and 4NF. [2+4]

5. Explain the basic steps in query processing. Make distinctions between cost based optimization and heuristic optimization. [4+4]

6. a) What is the use of RAID storage device? How is a record searched from a sparse sequential index? [2+3]

   b) Explain about the remote backup system with diagram. [3]

7. a) What are schedules? Describe the concept of view serializability for concurrent execution of transaction. [2+4]

   b) How deadlocks arise while processing transactions? Explain the deadlock prevention strategies. [2+4]

8. Write the different types of failures that may occurs in system. Differentiate between shadow paging and log-based recovery. [3+3]

9. Write short notes on the following: [3×2]

   i) Distributed database system
   ii) Spatial database system

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

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

Subject: - Database Management System

- ✓ 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 mean by data abstraction? List the various level of data abstraction and briefly explain. [1+3]
2. a) What are data models? Explain various types of data models. [1+3]
   b) Design an E-R diagram for a database for an airlines system. The database must keep track of customers and their reservations, flights and their status, seat assignments on individual flights and the schedule and routing of future flights. Apply all the database design constraints as much as possible. [8]
3. a) Consider the following relational data model. [2×3]

   Employee(empid, name, address, manager_id)

   Department(deptid, dname)

   Project(pid, title, budget, deptid)

   Works_on(empid, pid, hours)

   Write down the relational algebraic expression for the following:

   i. Find the names of all employee from computer department along with their manager name.

   ii. Find the names of all the employees who works on project with budget more than 50000.

   ii. Find the total number of projects from each department along with the department name.

   b) Write down the SQL queries for following: [2×3]

   i) Find the name of employees who works on project with the highest budget.

   ii) Create a view with empid, name, project title and budget.

   iii) Update the budget of all project by 20% where any employee works for more than 12 hours.

4. a) Define functional dependency. Explain partial and transitive functional dependency with example. [1+4]
   b) Define decomposition and its desirable properties. Explain 3NF and BCNF. [3+4]

5. Define query processing. Explain the various approaches used to evaluate any expression with suitable example. [2+6]

6. a) What is RAID? Which RAID level would you prefer the best for safety of application and why? [1+3]

   b) What is indexing? Why dynamic hashing is advantageous over static hashing? [1+3]

7. a) Define ACID properties of a transaction. Describe the concept of conflict serializability for concurrent execution of transactions. [4+4]

   b) How two phase looking protocol helps in concurrency control? Explain. [4]

8. What is stable storage? Explain the log based recovery mechanism. [2+4]

9. a) Describe briefly about object oriented database. [3]

   b) Explain the differences between homogenous and heterogeneous distributed database. [3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

Subject: - Database Management System *(CT652)*

- ✓ 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 data independence is importance in data modeling? Differentiate between physical and logical data independence. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between strong and weak entity sets?

   Patients are treated in a single ward by the doctors assigned to them. Healthcare assistants also attend to the patients; a number of these are associated with each ward. Each patient is required to take a variety of drugs a certain number of times per day and for varying lengths of time. The system must record details concerning patient treatment and staff payment. Some staffs are paid part time and doctors and healthcare assistants work varying amounts of overtime at varying rates, the system will also need to track what treatments are required for which patients. [8+4]
3. Write relational algebra queries for (a, b, c). Write SQL queries for (i, ii, iii)
   a) Retrieve the detail of employee with eno, add, dob, phone with highest salary. [2]
      i) Create above table Emp as indicated. [2]
      ii) Find employee who earns more than 50000, works in CS department and name contains alphabet **a**. [2]
      iii) Increase salary of those employee who earns less than average by 25% [2]
   b) Find total amount spent by ECON department for its employee salary. [2]
   c) Find total number of post in CS department. [2]
4. a) What is lossless decomposition and dependency preservation? Suppose that we decompose the schema R = (A, B, C, D, E) into (A, B, C) and (C, D, E). Is it lossless decomposition? Is it dependency preserving? [3+4]
      Consider that the following set F of functional dependencies hold.
      $A \rightarrow BC$
      $CD \rightarrow E$
      $B \rightarrow D$
      $E \rightarrow A$
   b) What is the importance of normalization? Define BCNF. [2+3]
5. Explain the steps involved in query processing. What is the significance of materialized views? [6+2]
6. Write about fixed-length record and variable length record organization DBMS. Define B+ free structure used for indexing. [4+4]
7. Explain different states of a transaction along with state transition diagram. Explain conflict Serializability with example. [4+4]
8. Explain briefly two phase locking protocol for Concurrency Control. [4]
9. Explain in detail the working of log-based recovery method. [6]
10. Explain the importance of data warehouse in decision making. Write the application areas of spatial database. [3+3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Magh

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

Subject: - Database Management System *(CT652)*

- ✓ 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 drawbacks of file system to store data? [4]

2. a) An information system is to be designed for keeping the records of Universe Cup Cricket Tournament. There are 10 teams participating in the tournament. Each country sends 15 players and 4 other members. For players, the runs he scores and the number of wickets taken (so far) are to be rerecorded. For non-players, the role (manager, coach etc) and the number of years of experience are recorded. There are matches scheduled among the teams on several grounds on fixed dates. Each ground has fixed seating capacity and a size. For 38 matches, 11 referees have been assigned. Each match will have 3 refries. The performance of every player in every match is to be recorded in terms of runs he scored and wicket he took. Draw E-R model of the system. [8]

   b) Explain how network data model is different from relation data model. [4]

3. Consider the following relational scheme: [2×6]

   Account (account number, branch_name, balance)

   Branch (branch name, branch_city, assets)

   Customer (Customer name, customer_street, customers_city)

   Loan (loan number, branch_name, amount)

   Depositor (customer name, account number)

   Borrower (customer name, loan number)

   a) Write SQL Query expressions to list all the customers details, branch details and account details according to account number.
   b) Write SQL Query expressions to list the branch name where the average account balance is more than 50,000.
   c) Write SQL Query expressions to increase all accounts with balances over $10,000 by 5% and other accounts receive 6%
   d) Write a query in SQL to list the branch _cities and total assets where the total assets are more than $10,00,000 in the city.
   e) Write relational algebra expression to count the number of accounts in each branch.
   f) Write relational algebra expression to delete all loans less than $1,000 in amount

4. a) What is the advantages of 3NF over BCNF? Suppose that we decompose the scheme R = (A, B,C) into R1 = (A,B), R2 = (A,C). Show that this decomposition is a lossless join decomposition and not dependency preserving if the F = {A->B, B->C} [3+4]

   b) What do you mean by integrity constraints? Explain any four constraints that can be enforced to database tables. [1+4]

5. Explain the basic steps in query processing with diagram. What is pipelining in query evaluation? [6+2]

6. What is RAID? Distinguish between dense and sparse indices along with example. [3+5]

7. What is transaction? Explain ACID properties with examples. [2+6]

8. Describe the different types of locks used for concurrency control. Draw the lock compatibility matrix.

9. Explain redo phase and undo phase of log based failure recovery mechanism. [6]

10. What is the significance of object-oriented databases? Briefly explain parallel database architectures. [3+3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

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

Subject: - Database Management System *(CT652)*

- ✓ 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 difficulties would you face if you used file system directly to implement a database application? What is physical data independence? [3+1]

2. Draw a complete ER-diagram for the following case.

"A Bus Company owns a number of busses. Each bus is allocated to a particular route, although some routes may have several busses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a garage where busses are kept and each of the busses are identified by the registration number and can carry different numbers of passengers, since the vehicles vary in size and can be single or double-decked. Each route is identified by a route number and information is available on the average number of passengers carried per day for each route. Drivers have an employee number, name, address, and sometimes a telephone number."

What is the difference between the degree and cardinality of a relationship? [8 + 4]

3. Consider the following relational database model

Employee(eid, name, address, supervisor_eid)
Department(dept_id, name)
Project(pid, title, dept_id)
Works_on(eid, pid, hours)

Write relational algebra expressions for the following: [2 X 4 = 8]

a) List the name of all employees from Computer department along with the name of their supervisor.
b) Find the name of all employees who work on the "Network monitoring" project for more than 15 hours.
c) Delete all projects which belong to the "Electrical" department.
d) Find the total number of projects from each department, along with the department name.

4. Consider the relational schema given below. [2 X 4 = 8]

Product (pid, name, price, category, maker-cid)
Purchase (buyer-ssn, seller-ssn, quantity, pid)
Company (cid, name, stock price, country)
Person(ssn, name, phone number, city)

a) Write an SQL query to find the name and price of all products of "camera" category made in "Japan".

b) Write an SQL query to create a view to expose only the Buyer name, Seller name and product name from all transactions.

c) Write a query in SQL to increase the price of all products from DELL company by 5 %.

d) Write skeleton tables in QBE to find the name and phone number of all persons who purchased products of Laptop category with price greater than 80,000.

5. a) Explain what is referential integrity constraint along with an example? Briefly explain cascading actions in referential integrity constraints. [3+3]

b) Briefly explain how to normalize a database from un-normalized form to 1NF, 2NF, 3NF and 4NF? [6]

6. Explain the difference between cost-based and heuristics-based methods for query optimization. How can you optimize the following query? [3+5]

$$\Pi_{name,\ title}(\sigma_{dept\_name=\text{"Music"}}(instructor \bowtie \Pi_{course\_id,\ title}(teaches \bowtie course)))$$

7. a) What is the difference between ordered indices and hash indices in a database? What is the advantage of using a sparse index? [2+2]

b) What is a RAID? How would you choose the best RAID level for your database server? [1+3]

8. Explain Atomicity and Isolation properties of a database transaction. Describe the concept of conflict serializability for concurrent execution of transactions. [4+4]

9. Briefly explain the idea of a stable storage. Explain the architecture of a remote backup system. [3+3]

10. Write short notes on the following

a) Types of distributed databases [3]

b) Data warehousing [3]

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44 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

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

Subject: - Database Management System (CT [illegible])

- ✓ Candidates are required to give their answers in their own wor[illegible]ble.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ *Assume suitable data if necessary.*

1. Distinguish between a database and a DBMS. What is the advantage of separating the logical level and physical level in database design? [2+2]

2. Draw a complete ER-diagram for the following case.

"A lecturer (having an ID, name and room number) is responsible for organising a number of course modules. Each module has a unique code and also a name and each module can involve a number of lecturers who deliver part of it. A module is composed of a series of lectures and sometimes lectures on a given topic can be part of more than one module. A lecture has a time, room and date and is delivered by a lecturer and a lecturer may deliver more than one lecture. Students, identified by number and name, can attend lectures and a student must be registered for a number of modules. We also store the date on which the student first registered for that module. Finally, a lecturer acts as a tutor for a number of students and each student has only one tutor."

Explain generalization and specialization in ER diagram along with an example? [8 + 4]

3. Consider the following relational database model

Employee(<u>eid</u>, name, address, supervisor_eid)
Department(<u>dept_id</u>, name)
Project(<u>pid</u>, title, dept_id)
Works_on(<u>eid</u>, <u>pid</u>, hours)

Write relational algebra expressions for the following: [2 X 4 = 8]

a) List the titles of all projects along with the department names.
b) Find the names of all employees who live in "Kathmandu" and are supervised by employee who also lives in "Kathmandu".
c) Increase the working hours of all employees who work in the "Voter registration" project by 5 hrs.
d) Find the total number of employees involved in each project along with the project title.

4. Consider the relational schema given below. [2 X 4 = 8]

Product (<u>pid</u>, name, price, category, maker-cid)
Purchase (buyer-ssn, seller-ssn, quantity, pid)
Company (<u>cid</u>, name, stock price, country)
Person(<u>ssn</u>, name, phone number, city)

a) Write an SQL query to find the names of all Japanese companies which sell products of "Computer" category.

b) Write an SQL query to create a view to expose only the product id, name, category and maker country.

c) Write a query in SQL to decrease the stock price of all makers of "LCD" category products by 1%.

d) Write skeleton tables in QBE to find the name and phone number of all persons who sold products of "Automobile" category.

5. a) What are integrity constraints in a database? Explain with example. What is a trigger in DBMS? When is it risky to use triggers? [3+3]

b) Define what a functional dependency is. Explain BCNF in terms of functional dependencies. [3+3]

6. Explain how a DBMS chooses an appropriate query execution plan for optimized query execution. Explain the difference between materialization and pipelining methods for query evaluation? [5+3]

7. a) Explain, along with an example, how a database record is searched using a sparse primary index? Write the SQL syntax to create an index. [3+1]

b) Explain the node structure of a B+ tree. Why is B+ tree good for indexing? [2+2]

8. a) What is a transaction? What are the properties a transaction should satisfy in a database system? [1+3]

b) What do you mean by serializability of a schedule? What do you understand by granularity of locking for concurrency control? [2+2]

9. Distinguish between immediate-modification and deferred-modification in the context of log-based database recovery. What is the significance of checkpoints in a log? [4+2]

10. Write short notes on the following

a) Object-relational mapping [3]

b) Parallel database architectures [3]

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45 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

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

Subject: - Database Management System *(CT652)*

- ✓ 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 the difference between DDL, DML and DCL along with examples. [4]

2. Assume that at Pine Valley Furniture each product (described by Product No., Description, and Cost) is comprised of at least three components (described by Component No., Description, and Unit of Measure) and components are used to make one or many products (i.e., must be used in at least one product). In addition, assume that components are used to make other components and that raw materials are also considered to be components. In both cases of components being used to make other components, we need to keep track of how many components go into making something else.

   Draw an ER-diagram for this case. Describe what is total participation using an ER-diagram example. [8 + 4]

3. Consider the following relational database model

   Product (pid, name, price, category, maker-cid)
   Purchase (buyer-ssn, seller-ssn, quantity, pid)
   Company (cid, name, stock price, country)
   Person(ssn, name, phone number, city)

   [2 X 4]

   Write relational algebra expressions for the following:

   a) Find the *ssn* and *name* of all people who have purchased products of category "telephone"
   b) List the *pid* and *name* of all products which is more expensive than $500 and made in China.
   c) Increase the price of all products of "television" category by 10%.
   d) List the *ssn* and *name* of each seller along with the total quantity of products sold.

4. Consider the relational schema given below. [2 X 4]

   Hotel (Hotel_No, Name, Address)
   Room (Room_No, Hotel_No, Type, Price)
   Booking (Hotel_No, Guest_No, Date_From, Date_To, Room_No)
   Guest (Guest_No, Name, Address)

   a) Write an SQL query to list all guests who have booked rooms at the Himalayan Hotel.
   b) Write an SQL query to create a view to expose only the *Hotel_No, Guest_No, Room_No* and *Price* of the room of all booked rooms.
   c) Write a query to offer 5% discount on all rooms of type "Delux" for the Everest Hotel.
   d) Write skeleton tables in QBE to find the Check-in date and Name of all guests currently booked for the Everest Hotel.

5. a) Explain the necessary condition for decomposing a relational database table into two tables. Why is normalization needed? [4+4]

   b) Compare 3NF and BCNF normal forms? [4]

6. Explain the process how a query is evaluated in RDBMS systems. How are equivalence rules for relation algebra helpful for query optimization? Explain with example. [3+5]

7. a) Distinguish between dense index and sparse index? What is a secondary index? [3+2]

   b) Briefly explain how variable length records are stored in databases? [3]

8. What do you understand by the ACID properties of transactions? Explain with examples. [8]

9. Explain the functions of Undo and Redo operations in a log-based recovery of database. [6]

10. a) Briefly explain horizontal and vertical fragmentation in distributed databases. [3]

    b) Write a short note on Data warehouse and associated applications. [3]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

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

Subject: - Engineering Economics *(CE 615)*

- ✓ 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 the principle of engineering economics. [4]

2. a) Explain the concept of ' time value of money' and " interest payment schemes" with suitable examples. [2+2]

   b) while you are planning to deposit Rs 5000 in 3-months interval for 4 years in increasing trend at a 2.5 % growth rate per deposite, a bank enticing you with an interest rate of 10% pa compounded semi-annually. What will be equivalent equal annual deposite of that money? [4]

3. a) Machinery costs Rs. 250,000 and has an annual expense of 40,000. It will generate a revenue of Rs.120,000 per year and will have a salvage value of Rs.50,000 after 5 years. Calculate its conventional B/C ratio and ERR if MARR = reinvestment rate = 20%. Use AW formulation. [3+3]

   b) What are sunk costs? Calculate IRR and show the unrecovered balance diagram in both tabular and graphical form of the following cash flows. MARR = 20%. [1+7]

EOY	0	1	2	3	4	5
Outflows	60,000	10,000	0	50,000	20,000	0
Inflows	0	30,000	40,000	10,000	70,000	70,000

4. a) Recommend the best project from the following two projects if the study period is 5 years. [6]

Project	A	B
Investment	350,000	500,000
Annual Revenue	130,000	175,000
Annual Cost	15,000	25,000
Salvage Value	35,000	50,000
Useful life	6 years	8 years

   b) Define Independent, Contingent and Mutually exclusive project. Three projects are being considered with the estimated cash flow over 10 years. Recommend which investment alternative should be selected using IRR method? Assume MARR = 10%. [2+8]

Project	A	B	C
Initial Investment	320000	250000	720000
Annual Revenues	70000	50000	120000
Annual Expenses	7000	5000	12000
Salvage Value	40000	30000	50000

5. a) Define the terms: defender, challenger, ESL, AEC and replacement strategy. [5]

   b) You are going to purchase a new bike costing Rs 400000 with 12% interest loan from a bank, the market value of the bike is if assumed to be Rs 350000 after its 1 year use than decreases by Rs 35000 every year then after, it requires operation and maintenance cost of Rs 65000 for the first year then increases by 20% each year, what will be the ESL of this bike? [7]

6. a) What are the different techniques used to assess the riskiness of the project parameter. Explain with suitable example. [4]

   b) Perform sensitivity analysis for given parameters to find the most sensitive parameter of a project proposal having first cost Rs 50,000 Salvage value of Rs 15,000, Gross Revenue of Rs 30,000, O & M of Rs 5,000 and life of 8 years . Take 10% MARR and use Modified B/C ratio.(i) Investment (ii) MARR (iii) life span [8]

7. a) What is depreciation? What are the basic requirements for a property to be depreciated? What is a corporate tax? [1+2+1]

   b) Cost basis of a machine is Rs.20,000 and the useful life is 5 years. The estimated salvage value is Rs.4000. Compute the depreciation schedule and resulting book values (i) Double declining balance method and (ii) Sum of years' digit method. [3+3]

8. Calculate the average inflation rate for a two-year period: the first year's inflation rate is 4.5%, the second year's rate is 7.8% and the third year's rate is 6.5% on a base price of Rs 100. How deflation method can be differentiated from adjusted discount method? Explain with suitable example. [2+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

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

Subject: - Engineering Economics *(CE 615)*

- ✓ 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. How an engineer plays an important role in making the economic decisions? Explain. [4]

2. a) Suppose that you are planning to deposit the sum of Rs 10, 000 at the end of each month for the next 5 years in a bank which gives the interest rate of 12% compounded quarterly. What will be the maturity of the deposit after 10 years? [4]

   b) A process engineer starts investing his money when he graduates from college. He is able to afford investing $25,000 a year from the time he graduates in four years until the end of eight years. He also plans to invest an additional $ 5,000 per year (increasing by $ 5,000 per year) at the end of the year after he graduates until year eight. How much will the process engineer have saved by the end of year eight and what is its present worth if the interest rate 10% compounding monthly? [6]

3. a) The owner of the business company is considering investing Rs 50,00,000 in a new equipment. He estimates that the cash flows during the first year will be 50,000 but these will increase by Rs.25,000 per year the next year and each year thereafter. The equipment is estimated to have 10 years' service life and a net salvage at this time will be 60,000. The Firm MARR is 12% [3+3+2]
   (i) Determine the annual capital cost for the equipment
   (ii) Determine the equivalent annual saving (revenues)
   (iii) Determine if this a wise investment

   b) Calculate ERR of the project and comment on its acceptability if MARR = 20% and reinvestment rate is 15%. [6]

EOY	NCF
0	-150,000
1	+30,000
2	+50,000
3	+60,000
4	+80,000
5	-35,000
6	+45,000

4. a) KFC is in the process of forming a separate business unit that provides crunchy fried chicken in Birtnagar. Since the meals are prepared in one central location and distributed by the food delivery throughout the city for its online order. Mr. Harka is the General manager of this unit, and he wises to choose between two location for the cost economic delivery service as below perform analysis for infinite study period with MARR 8%. [6]

	Mahindra Chowk, Location	Khanar Location
Initial Cost, I	15 lakhs	22 Lakhs
Annual O and M Cost	6 lakhs	9 Lakhs
Refurbishment Cost	0	2 Lakhs every 4 years
Trade in value, % of I	20	30
Contract period, years	4	12

b) Recommend the best project from the following two projects. Use IRR method. MARR = 10% per year. [6]

Project	A	B
Investment	350,000	500,000
Annual Revenue	130,000	175,000
Annual Cost	35,000	25,000
Salvage Value	35,000	50,000
Useful life	8 years	8 years

5. a) Write down the steps for making the replacement decision when planning horizon is infinite. [4]

b) An existing asset that cost $ 16,000 two years ago has a market value of $ 12,000 today, an expected salvage value of $2,000 at the end of its remaining useful life of six more years, and annual operating costs of $ 4,000. A new asset under consideration as a replacement has an initial cost of $10,000, an expected salvage value of $4,000 at the end of its economic life of three years , and annual operating costs of $ 2,000. It is assumed that this new asset could be replaced by another one identical in every respect after three years at a salvage value of $4,000, if desired. Use a MARR of 11%, a six-year study period, and PW calculations to decide whether the existing asset should be replaced by the new one. [8]

6. a) As an economy analyst, how do you explain the risk and source in any investment? [4]

b) Perform the sensitivity analysis of a project with following cash flow over a range of ± 30% (with increment of 10%) in (i) Initial investment (ii) net annual revenue using the FW formulation. Present your result in sensitivity graph.
Initial Investment, useful life = 50,00, Annual revenues = 15,500, Annual expenses = 3,000, salvage value = 20% of initial investment, useful life = 5 years, MARR = 15%. [6]

7. a) Nova Auto Ltd. has purchased a car-painting plant for Rs.20,00,000. Its expected life is 10 years and the salvage value at the end of its useful life is Rs.1,00,000. Using the sum-of-the-year-digits (SYD) method, compute (i) depreciation cost during the third year, (ii) cumulative depreciation cost through the fifth year and (iii) book value at the end of sixth year. [6]

b) If the purchase price of an equipment is Rs 60,000 and its salvage value after 8 years is Rs.6,000. Calculate the annual depreciation and the resulting book value of the equipment each year. Use the sinking fund method and assume the interest rate is 10% per year. [6]

8. Consider the following project's after-tax cash flow and the expected annual general inflation rate during the project period. [1+2+3]

	Expected	
End of Year	Cash flow (in Actual or Current Doller)	General Inflation Rate
0	-45000	
1	32000	3.5%
2	32000	4.2%
3	32000	5.5%

a) Determine the average annual general inflation rate over the project period.
b) Convert the cash flows in actual dollars into equivalent constant dollars with the base year 0.
c) If the annual inflation-free interest rate is 5%, what is the present worth pf the cash flow? Is this project acceptable?

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

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

Subject: -Engineering Economics *(CE 615)*

- ✓ 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 the roles of engineer in economic decision of any enterprise. [4]
2. Distinguish between nominal and effective interest rates. You have just purchased 100 shares of ABC company at RS.100 per share, hoping to sell the stock at double the market price. If the stock price is expected to increase by 20% per year. How long do you wait before selling the stock? [2+4]
3. a) Differentiate between Financial and Economic analysis of a Project. [2]

   b) Evaluate IRR of the following project and decide whether the project is acceptable or not? Also draw investment Balance diagram. Use AW formulation for calculation. [8]

   Initial investment = Rs. 50,000
   Annual Revenue = Rs. 20,000
   Salvage value = Rs.10,000
   Useful life = 6 years
   MARR = 10%

   c) Calculate both types of BCR of a project with following details. [8]

   MARR = 15%

   Initial Investment = Rs. 20,000

   Annual income = Rs.2000 at the end of first year and increases by 15 % every year.

   Annual expense = Rs. 100 at the beginning of first year and increases by Rs. 50 per year.

   Salvage Value = Rs. 2500

   Useful life = 12 years.

4. a) Compare repeatability assumption and co-terminated assumption as per their suitability. [4]

   b) Select the best project using IRR method if MARR = 10% and market value at the end of useful life of each project is zero. [8]

Project	A	B
Initial investment	3500	5000
Annual Benefit	1900	2500
Annual O and M	645	1383
Useful life	4 years	8 years

5. A company is contemplating replacing a machine having a current market value of Rs. 9,000 which decreases each year by Rs.1500 per year. Its operating cost is Rs.3000 for the first year and increases each year by 800 Rs. Per year for 5 years. The company will have to pay Rs. 18,000 for the new machine and its market value decreases by 20% per year over the previous year for five years. The new machine needs Rs.1500 for operation in the first year and this cost increases by 25 % each year. Find the annual equivalent cost of both the machines and compute the best replacement strategy if the machine is needed for 5 years. [5+5]

6. a) Perform sensitivity analysis for (i) MARR (ii) Annual Revenue and (iii) Investment from given information and identify the most sensitive parameters using sensitivity plot. [10]

   I = Rs 1000000 R = Rs 400000 O and M = Rs 100000 Sv = Rs 20000

   MARR = 15% N = 7 yrs Overhauling at the end of 4^{th} yr = Rs 25000

   b) What is break even analysis? How it can per performed for single and mutually exclusive alternatives? [4]

7. An asset has installed value of Rs. 60,000 and Salvage value zero. It is classed as 5 years property. Determine MACRS depreciation schedule. This asset is used for 8 years and revenue generated is Rs.15,000 first year Rs 25,000 each year thereafter. While annual operating cost is Rs. 5,000. Calculate After Tax Cash Flow if tax rate is 25 %. Is the investment of this asset profitable? Check your decision using PW method. Take MARR = 14%. [4+6+2]

8. Explain the impact of inflation on economic evaluation. Define constant dollar and actual dollar analysis. [2+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Engineering Economics *(CE 615)*

- ✓ 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. "Engineers make good decision-makers." Justify this statement. [4]
2. Compute the equivalent linear growth rupees to make economic equivalence for present deposit of Rs. 38,281.23 against one-year withdrawals at the end of two months each (6 number of linearly increased withdrawals in total) with base amount Rs. 5000 at first (at the end of 2nd months) with 12% interest rate compounding quarterly. [6]
3. a) Explain drawbacks of IRR with examples. Differentiate between financial analysis and economic analysis. [3+3]

   b) If a machine will be operated according to varying hours. 1200 hrs in the first year, 2100 hrs in the second year, 1800 hrs in the third year and 1500 hrs in the fourth year. Compute the annual equivalent saving or cost per machine hour, If the firm's MARR is 13% with annual worth of Rs. 7500. [5]

   c) Calculate ERR of the following cash flow MARR = 11%, reinvestment rate 13%. [5]

EOY	0	1	2	3	4	5
C/F	-80,000	22,000	38,000	45,000	-17,000	48,000

4. a) Compute the Imputed Market Value (IMV) for study period 4 years if initial investment is Rs. 1000 and market value after 8 years is Rs. 200. Take MARR = 10%. [4]

   b) Prepare all possible mutual exclusive combinations for the following properties of projects A, B, C, D and E. [4]
   - Project A and B are mutually exclusive projects.
   - Project C and D are mutually exclusive and contingent on acceptance of Project A.
   - Project E is contingent an acceptance of Project D

   c) Select the best project using ERR method. Take MARR = 10% and Reinvestment rate = 20%. [4]

	Project ABC	Project XYZ
Initial investment	Rs. 12,000	Rs. 16,000
Annual revenue	Rs. 5,000	Rs. 6,000
Annual expenses	Rs. 500	Rs. 600
Useful life	5 years	5 years
Salvage value	Rs. 2,000	Rs. 2,500

5. A company is considering the replacement of old machine. If the machine is repaired, it can be used for 5 more years. It can be sold to the other firm in Rs. 5000. If the machine is kept it will require an immediate overhaul (renovation) of Rs. 1200 to make it operable condition. Overhaul charge is not extended for service life. The operation cost is estimated at Rs. 2000 during first year and these are expected to increase by Rs. 1500 per year thereafter. Further market values are expected to decline by Rs. 1000 per year. The new machine cost Rs. 10000 and will have operating costs of Rs. 2000 in the first year, increasing Rs. 800 per year thereafter. Salvage Value is Rs. 6000 after one year and will decline by 15% each year. The company requires a rate of return of 15%. Determine economic life of each option and when the defender should be replaced? [12]

6. a) Perform Sensitivity Analysis of the following project over a range of ± 15% with an increment of 5% in (i) Initial Investment (ii) Net annual revenue (iii) Useful life (iv) MARR. Use AW formulation. Also draw sensitivity graph and find the order of sensitivity from high to low. [8]

   Initial investment = Rs. 5,00,000
   Net annual revenue = Rs. 1,20,000
   Salvage value = Rs. 80,000
   Useful life = 6 years
   MARR = 8%

   b) Explain with examples, how the project risk is determined using Scenario Analysis? [4]

7. a) Differentiate between tax depreciation and book depreciation. Why recovery period called as depreciable life. For I = 10,000, N = 5 yrs, SV = 2,000. Calculate depreciation amount and resultant book value using SOYD method. [2+2+2]

   b) If an organization has annual revenue generation of Rs. 18,000 and operation and maintenance cost is about Rs. 9000 annually. If cost basis of 5 years project is Rs. 80,000 then determine after tax cash flow. (Use sinking fund method of depreciation) use tax rate = 38%. [6]

8. Which project is most feasible? MARR = 12%, general inflation rate is 8%. [6]

EOY	CF of Project A ('000') in Constant Dollar	CF of Project B ('000') in Actual Dollar
0	-800	-1200
1	+300	+600
2	+400	+400
3	+800	+700

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Engineering Economics (*CE 615*)

- ✓ 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 Engineering Economics. Why do engineers need knowledge of economics during engineering decision making process? [1+3]

2. a) How much amount should be deposited at this time if you wish to withdraw an accumulated fund Rs. 1,87,819.83 after 8 years with 11% annual interest rate. [2]

   b) How the compounding frequency affects the real rate of return? Explain with suitable example. [2]

   c) While you are planning to deposit Rs 5000 in 3-months interval for 4 years in increasing trend at a 2.5% growth rate per deposit, a bank enticing you with an interest rate of 9.5% pa compounded monthly. What will be your accumulated fund at the end of your four? [4]

3. a) What is life cycle costing? What are the advantages and disadvantages of IRR method of calculation? Calculate the value of annual equivalent A, continuing forever, if there is an annual cash disbursement of Rs. 200, Rs. 400, Rs. 600 and Rs. 400 in year 1,2,3 and 4 respectively and this fixed pattern also repeats forever, interest = 15%. [4+2]

   b) Make an investment decision for the following projects if cost of capital is 10% and salvage value is Rs. 2000 for both using (i) Conventional BCR method (Use FW) (ii) Discounted payback period method. [5+5]

Year	Project A	Project B
0	-10000	-10000
1	3000	1000
2	3000	3000
3	3000	4000
4	3000	6000

4. a) Select which project is feasible to invest among other alternatives projects whose cash flows are as follows: if MARR is 10%. Use IRR method and incremental analysis if necessary. [6]

	Investment of A (Rs)	Investment of B (Rs)
Investment	50,000	1,50,000
Net annual revenue	25,000	70,000
Net annual cost	3,000	2,000
Salvage value	15,000	40,000
Useful life	7 years	7 years
Repair and maintenance cost at 3rd and 5th year	10,000	15,000

b) A mobile company is taking quotations for purchase, installation and operation of microwave towers for long period. If MARR is 15% determine the best alternative project using repeatability assumption. [6]

	Project A	Project B
Equipment Cost	6,50,000	5,80,000
Installation	15,00,000	20,00,000
Annual Maintenance	1,00,000	1,25,000
Annual extra charge	0	50,000
Salvage Value	0	0
Useful life	40	35

5. a) Define economic life, useful life, marginal cost and sunk cost. [1+1+1+1]

b) A machine brought 5 years ago at Rs. 15,000 has a market value of Rs. 2500 today and will lose Rs. 1000 in value by next year and Rs. 500 per year thereafter. The operating cost for the first year is Rs. 8,000 and is estimated to increase by Rs. 1000 annually. Its use will be discontinued in 4 years. A new and improved machinery can be purchased for Rs. 16,000 and is expected to have annual operating cost of Rs. 6,000 and economic life of 7 years and it can be sold off at Rs. 1,500 at the end of its use. Compute replacement evaluation if minimum attractive rate of return is 12%. [8]

6. a) What are the different techniques used to assess the riskiness of the project parameter. Explain with suitable example. [4]

b) Perform sensitivity analysis for given parameters to find the most sensitive parameter of a project proposal having first cost of Rs. 50,000, salvage value of Rs. 15,000, Gross revenue of Rs. 30,000, O and M of Rs. 5,000 and life of 8 years. Take 10% MARR and use modified B/C ratio. (i) Investment (ii) MARR (iii) Life span. [8]

7. a) What are the methods that are used in calculating the deprecation in economics? Explain slinking fund deprecation with example. [2+2]

b) A construction equipment has initial cost and annual saving per year are of Rs. 40,000 and 20,000 respectively with depreciate by MARCS method and will have no salvage value. The useful life of equipment is 5 years. Estimate before and after tax cash flow. The company pays income tax @ 40%. [8]

8. A company is investing in new solar plant with expected cash flow in actual dollars as follows. If the inflation rate is 5% per year and discount rate is 10%, what is the present worth of the company in constant dollars? [4]

Period	0	1	2	3	4
Cash flow	-75,000	29,000	32,800	35,700	58,000

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Engineering Economics *(CE 615)*

- ✓ 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. "Engineering Economics prepares engineering professionals to take right decision in right time on behalf of any organization". Justify the statement with the concept of principles of economics and role of engineer as a decision maker. [5]

2. a) What is a sinking fund? How much money will you have in your bank account at the end of 3 years if you deposit Rs. 500 now and the bank's interest rate is 6% compounded quarterly? [1+3]

   b) Mr. Jha deposits his annual bonuses into an account that pays 6% interest per year for five years. The bonus of first year is Rs. 20000 and increases each year by Rs. 5000. How much amount will he have in his account after 10 years? [4]

3. a) Find out the both types of B/C ratio using annual worth method. [4]

Initial Investment	5,00,000
Annual Revenues	100,000
Salvage Value	14000
Useful Life	10
MARR	10%
Annual Costs	30,000

   b) Find the IRR and ERR of the following cash flow. Explain why the values are different. MARR = 12%. [4+4]

EOY	0	1	2	3	4
Net Cash flow in Rs.	-5,50,000	-50,000	+1,25,000	+3,50,000	+6,25,000

4. a) For different alternatives having different life spans as given below, analyze the alternative projects for 5 years of study period to select best one using FW method. [8]

Alternative Projects	ABC	XYZ	JKL
Investment (Thousand)	2500	3000	2800
Net Annual Revenues (Thousand)	250	300	280
Life (years)	3	5	7

   b) Use a suitable method for evaluating the public projects having following information. Use AW formulation. Take MARR = 14%. Choose a best project. [6]

Alternative Projects	Project A	Project B
Initial Investment	40000	45000
Revenues	12000	12500
O & M	1500	1450
Life (yrs)	8	8
Salvage	5000	5000

5. a) Define defender and challenger and Explain economic service life. [1+1+2]

   b) A firm has a contract to provide printing service to IOE for the next 8 years. It can provide the service using its old printing machine (the current defender) or the newly brought machine (the challenger). After the contract work neither the old machine nor the new machine will be retained. Considering the annual equivalent costs of the old machine as follows, what are their economic service life? And what is the best strategy? [8]

Number of years (n)	Annual equivalent cost Rs	
	Old Machine	New Machine
1	5,15,000	7,50,000
2	5,10,000	6,15,000
3	5,50,000	5,86,000
4	5,96,000	5,83,000
5	6,44,000	5,90,000

6. a) Find out how sensitive is the project's Net present worth to changes in (i) investment (ii) useful life (iii) MARR and (iv) net annual revenue, over a range of ±40%. MARR = 10%. [8]

Investment	3,00,000
Net annual revenue	1,25,000
Salvage value	30,000
Useful life	10 yrs

   b) What do you understand by break-even point? Explain the components and procedure of decision tree analysis. [1+3]

7. A company had an equipment having 5 years life span. The cost basis for the machine is Rs 2,00,000 and salvage value of the equipment is Rs 15,000. Prepare an accounting book for the machine showing book values and depreciations of each year using following methods of charging the depreciation. (a) SOYD (b) DB
   Calculate the NPV using after tax cashflow analysis technique. Take annual revenue from operation of machine is Rs 95,000 with Rs 7000 annual operation cost throughout 6 years. Take MARR = 8% and used MACRS method for depreciation charging. [5+6]

8. How do we measure inflation? Suppose you borrowed Rs 100000 from a bank to buy a bike and you have promised to pay Rs. 5500 per month for two years. What is the inflation free interest rate you supposed to pay if average inflation rate is 0.75% per month? [2+4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Baishakh

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

Subject: - Engineering Economics *(CE 655)*

- ✓ 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 mean by engineering economics? List out the principles of Engineering Economics. [1+3]
2. Define time value of money. Calculate effective interest when r = 5% and compounding is; semi-annually, quarterly, monthly & continuously. [1+3]
3. How much should you deposit at present for monthly draw of Rs. 15,000 throughout 4 years when interest rate is 6% per years? [4]
4. If cash flow at the end of 1st year is Rs. 5,000; find FW using gradient formula taking MARR = 7% when; Cash flow increases by 10% over 5 years. [2]
5. Evaluate IRR and ERR if MARR = 10%. Prepare the uncovered investment balance (UIB) diagram. [4+4]

EOY	0	1	2	3	4	5
Cash inflow	0	$5000	$5000	$5000	$5000	$5000
Cash outflow	$10000	$1000	$1400	$1800	$2200	$2600

6. Evaluate the Discounted Payback period if MARR is 10%. [4]

EOY	0	1	2	3	4	5	6
Cash inflow	0	$3000	$4000	$5000	$6000	$7000	$8000
Cash outflow	$10000	$1000	$900	$800	$700	$600	$500

(Standard Payback period is 4 years)

7. Which option would you recommend?

Option	First Cost	Annual Benefit	Annual Cost	Salvage Value	Useful life
A	$3500	$1900	$600	$500	4 years
B	$5000	$2500	$1300	$1000	8 years

   a) Using the repeatability assumption and the FW formulation if MARR is 10%. [4]
   b) Using the co-termination assumption if study period is 4 years. MARR is 12%. Select suitable method and Evaluate. Which method do you prefer and why? [6]
8. Explain with suitable examples the comparing mutually exclusive, contingent and independent project in combination. [4]
9. Why replacement analysis is necessary in engineering economics study? Discuss with an example. [4]

10. Consider the following cashflow for defender and challenger.

Defender	Challenger
Market Price = Rs. 50,000	Initial Cost = Rs. 75,000
Remaining useful life = 3 years	Useful life = 3 years
Salvage value = Rs. 12,500	Salvage value = Rs. 30,000
Operation and Maintenance Cost = 40,000	Operation and Maintenance Cost = 30,000

Perform the replacement analysis using the cashflow approach and opportunity cost approach. [8]

11. Explain the Decision Tree Analysis with appropriate illustration. [4]

12. Investigate the Modified BCR (using FW formulation) over a range of ± 30% in initial investment, useful life and MARR, of the following project. [8]

Initial investment = $200,000; Salvage value = $25,000; MARR = 12%; Annual Revenue = $50,000; Annual expenses = $5,000; Useful life = 10 years.

Draw also sensitivity diagram and interpret.

13. A taxpayer wants to use costing of Rs. 10,000 asset in business that assigned to 5 years life. Find:- [3×4]

a) Depreciation amount for each year using straight line and declining balance method taking salvage value Rs.1,500.
b) Rate of depreciation and depreciation amount by MACRS guideline.
c) After tax cash flow when annual income is Rs. 3,000 and business has to pay 25% corporate tax followed by declining balance deprecation.

14. How do you measure the average inflation rate? Explain with an example. Calculate IRR (Inflation free) the following cash flow if inflation rate is 10% per year. [4]

EOY	Cash flow in Actual $
0	-7,50,000
1	3,20,000
2	3,57,000
3	3,28,000
4	2,90,000
5	5,80,000

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

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

Subject: - Engineering Economics *(CE 655)*

- ✓ 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 the role of engineers in Engineering Economic Decisions. [4]
2. What is the time value of money? Suppose that you make the monthly deposits of Rs. 5,000 each into a bank account that pays an interest rate of 8% compounded weekly for 5 years. After 5 years, interest rate changes to 6% per year. How much money will you have accumulated in this bank account at the end of 8 years? [1+4]
3. A couple is planning for their child's education. They wish to deposit Rs. 10,000 now in a bank account that gives 12% per year compounded monthly and increase the amount by Rs. 2,000 each year from the previous year for next 9 years. How much amount they will expect at the end of 10 years? [5]
4. Use IRR to evaluate following project when MARR is 15% per years. [5+1]

EOY	Cash flow (Rs.)
0	-60,000
1	20,000
2	40,000
3	-40,000
4	50,000
5	70,000

   Make also unrecovered balance diagram.
5. Your college is considering to purchase a machine of Rs. 3,00,000 expecting salvage value Rs. 50,000 at the end of 10th year. The use of machine saves Rs. 80,000 per year when it needs Rs. 20,000 operating cost for each year. Find
   (i) Both types of B/C ratio using AW formulation
   (ii) Both types of payback periods. [3+3]
6. Distinguish between financial and economic analysis. [3]
7. Recommend the best period from the following projects using repeatability assumption. Assume MARR = 10% per year. [6]

Project	A	B	C
Investment	500,000	700,000	900,000
Annual Revenue	175,000	250,000	325,000
Annual cost	25,000	40,000	60,000
Salvage Value	50,000	70,000	90,000
Useful life	6 years	8 years	10 years

8. Using the IRR method, recommend the best project from the following set of mutually exclusive projects taking 10-year useful life for all alternatives. Assume MARR=10%. [8]

Project	A	B	C
Initial Investment	1,80,000	1,00,000	2,80,000
Annual revenues	53,000	35,000	77,000
Salvage Value	18,000	10,000	28,000
Annual operating cost	16,000	12,000	28,000

9. Suppose a company is considering purchasing a new machine that would cost $1800 and operating cost of $300 in the first year. For the remaining years, Operating Cost increases by 15% over the previous year's Operating Cost. Similarly, the salvage value declines each year by 20% from the previous year's salvage value. The new machine truck has a maximum life of eight years. MARR = 12% before tax. Find the economic service life to the asset. [8]

10. Explain the procedure for the replacement analysis when the planning horizon is infinite. [4]

11. Perform sensitivity analysis of the following project over a range of ±30% in; initial investment, net annual revenue, MARR & useful life. Indicate sensitive parameter also. [5+1]
Initial cost = Rs. 4,00,000
Annual revenue = Rs. 1,50,000
Operating cost = Rs. 30,000
Salvage value = Rs. 50,000
Useful life = 7 years
MARR = 11% per year

12. A small hydro project has following estimated data. [5]
Initial investment = Rs. 10,00,000
Energy generated per year = 200MW
Annual operating cost = Rs. 6,00,000
Market price of energy = Rs. 4/KWhr
MARR = 10%
Salvage value = Rs. 1,00,000
Find its break-even point of time.

13. Define the term book value and salvage value. [2]

14. You purchased a machine at a cost of Rs. 3,20,000 having useful life of Rs. 8 years. The estimated salvage value is Rs. 50000. Determine the annual depreciation schedule using DDB, SOYD and sinking fund method. Assume i% = 12%. [8]

15. Define inflation. What are its causes? Find rate of inflation per year when price of a product has increased from Rs. 5,00,000 to Rs. 6,30,000 over the period of 3 years. [1+1+2]

Or,

Define Actual dollar and Constant dollar. Calculate NPV if i is 6% and inflation rate is 8% of the following cashflow. [1+3]

Year	0	1	2	3
Actual dollar cashflow	-1000	+500	+500	+500

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

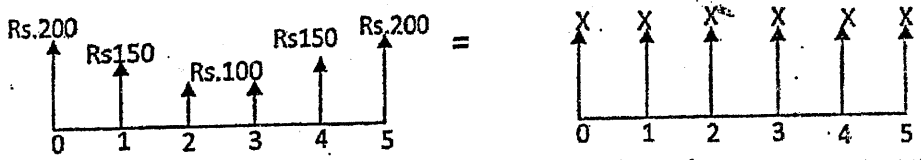
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Engineering Economics *(CE 655)*

- ✓ 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 does an engineer must have the knowledge of economics during decision making process? List out principles of engineering economics. [1+3]

2. a) The two cash flow transactions shown below are said to be equivalent at 10% interest, compounded annually. Find the unknown X value which satisfies the equivalence. [5]



b) A man in planning to retire in 25 years. He wishes to deposit regular money every months until he retires so that he will receive annual payments of Rs. 4,50,000 after the first year of his retirement for the next 10 years. How much he deposit if the interest rate is 8%, compounded monthly? [5]

3. a) Explain the limitations of IRR with suitable examples. Compute ERR for a project with following projected cash flows: [2+4]

EOY	0	1	2	3	4	5	6
Cash Flows	-3,00,000	1,50,000	2,00,000	-1,00,000	2,00,000	1,50,000	-50,000

Take MARR=12% ε=15% (if needed)

b) Explain in brief, the absolute and relative measures used under different methodologies of engineering economic analysis. Assess the feasibility by computing both types of payback periods from the following information regarding an engineering project. [2+4]

EOY	0	1	2	3	4	5
Cash Flows	-25,00,000	5,20,000	12,00,000	12,00,000	8,00,000	10,00,000
Bank provides a loan for investment @ 16% pa.						

4.a) Why incremental analysis is essence during comparative analysis of alternatives using BCR, IRR and ERR? Illustrate with the help of example. Compare the following mentioned projects using IRR method MARR=14%. [2+6]

Alternatives	Investment	Gross Revenues	O & M	Salvage Value	Life Span (years)
Project A	20,00,000	8,50,000	3,50,000	15% of First Cost	8
Project B	25,00,000	9,00,000	3,50,000		
Project C	40,00,000	9,50,000	2,50,000		
Project D	35,00,000	10,00,000	3,00,000		

b) Explain Capitalized Worth Four projects are being considered with the estimated cash flow over 10 years. Recommend which investment alternative should be selected? Assume MARR=10%. [2+6]

Project	A	B	C	D
Initial Investment	320000	250000	720000	800000
life	5	6	7	8
Annual revenues	70000	50000	120000	160000
Salvage Value	40000	30000	50000	60000
B & C	Mutually Exclusive			
D	Contingent on C			
A	Contingent on B			

5. a) Write down the reasons of replacement of an existing asset. [4]

b) A chemical plant owns a filter press that was bought 3 years ago for Rs. 30,000. Now it has a market value of Rs. 9000, a life of 5 years, and a salvage value of Rs. 2000 at that time. The challenger has a cost of Rs. 36,000, a life of 5 years, and estimated market value of Rs. 12,000 after 5 years. 5 years planning period to be used and the MARR is 15%. The operating and maintenance cost of the alternatives are given in the following table:

End of Year	Defender	Challenger
0	0	0
1	7,000	0
2	8,000	1,000
3	9,000	2,000
4	10,000	3,000
5	11,000	4,000

Should the old filter press be replaced now? Use cashflow approach. [6]

6. a) A newly establish hat company estimated following data;
Output of hat per annum= 3,00,000 NOS
Expected sales revenue per annum= Rs. 1,50,00,000
Fixed cost= Rs. 35,00,000
Variable cost= Rs. 66,00,000
i) Find out breakeven level of output
ii) If fixed cost increases to Rs. 40,00,000, find out its effect on breakeven point.
iii) What should be output if profit desired is Rs. 10,00,000 per year? [5]

b) Perform sensitivity analysis over ±25% for the following project on parameters
i) Initial Investment
ii) Annual revenue
iii) Useful life
When I =10,000
AR = 4,000 for the 1st year that increases by 500 thereafter for next 4 years.
MARR= 10% per year [7]

7. a) List out advantages of depreciation. Calculate depreciation amount for each year using declining balance and MACRS methods.
I=10,00,000
N=5 years
S=2,00,000
(If applicable) [1+2+3]

b) Define direct tax & indirect tax. Prepare after tax cash flow of a project having following cash flow details.
Initial cost = 1,00,000
Useful life = 5 years
Salvage value = 20,000
Annual income = Rs. 20,000 at the end of first year and increases by Rs. 2000/ year
Tax rate = 20%
Depreciation method sum of year digit [2+4]

8. Draw the concept of inflation using suitable example. If the real interest rate is given as 5% and general inflation rate as 8%, calculate MARR. Explain meaning of constant dollar and actual dollar. [1+1.5+1.5]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	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 <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ *Assume suitable data if necessary.*

1. Define opportunity cost. Why engineering economics is considered as important aspect for making decision for engineers? Explain. [1+3]

2. a) A bank is starting its nominal interest rate of 9% p.a and compounding quarterly. Calculate the effective interest rate (i) a year (ii) a quarter (iii) a month (iv) half year [4]

   b) If you wish to withdraw Rs 2000 at the end of 1st year and expecting to be increased by 15% pa then after till end of 8 years, what amount need to be deposited in a bank right now which has an interest of 15% pa. [4]

3. a) Find both types of B/C ratio using FW formulation from the following cash flow of a project. Initial investment = Rs 5,00,000, Revenue = Rs 5,0000 in the first year and increases by 15000 each year after that, Expenses = 30000 in the first year and increase by 5% each year after that. Salvage value at the end of 8 years = 25000. MARR = 8%. [8]

   b) Calculate both IRR and ERR. MARR = ϵ = 12%. [6]

EOY	NCR
0	-45,000
1	-4,000
2	+9,000
3	+40,000
4	+60,000
5	+10,000

4. a) Nepal government is planning to invest three irrigation projects. The detail cash flow estimation are given below (in billion) with MARR = 10% and life of each project is 20 years. [6]

	Koshi	Gandaki	Karnali
Initial cost	20,000	22,000	24,000
Annual benefit	4,000	4,500	5,000
Annual cost	1,000	1,200	1,400

Compare mutually exclusive project to invest.

   b) Use repeatability assumption to select the best project. [6]

	Project A	Project B	Project C
Initial cost	1,00,000	2,00,000	3,00,000
Annual income	25,000	30,000	45,000
Salvage value	20,000	50,000	70,000
Useful life year	6	10	15
MARR	12%		

   c) Define mutually exclusive, independent and contingent projects. How much should you deposit at present that earns 12% interest per year when you can draw Rs 10,000 per month for (i) 50 years (ii) Forever [2+2]

5. Define replacement. Explain the main reasons for replacement. Find economic service life from the following data. [1+3+8]

Initial cost = Rs 50,000

Operating cost = Rs 10,000 for the 1st year that increases by 15% thereafter

Salvage value = Decreases each year by 20% from previous value

Useful life = 7 years

MARR = 15% per year

6. Enunciate different methods of analyzing the riskiness of the project. Perform sensitivity analysis to identify the most sensitive parameter, among considered parameters by plotting the graph, using IRR computations for a project having following information over the range of ±15% (interval of 5%) for the parameters: (i) Net Annual Revenues (ii) Salvage Value (iii) Life Span [2+8]

Investment (Rs)	Net Annual Revenues (Rs)	Salvage Value (Rs)	Life of Project (Year)
80,000	25,000	10,000	12

7. a) Explain the terms depreciation, corporate tax, personal income tax and book value. Show the depreciations and book values in each year for an equipment having following details using MACRS method. [2+4]

Investment (I) = 25,00,000

Useful life (n) = 7 years

b) Perform after tax cash flow analysis to examine the feasibility of a project having investment of Rs 1,00,000 in a machine, with zero salvage value, 5 years useful life, net annual revenues of Rs 20,000 at the end of first year then after increases by Rs 10,000 pa. Use SL depreciation. Tax rate is 25%. [6]

8. Calculate the equivalent present worth of the project from the following cash flow. Assume inflation free interest rate as 5% and inflation as 10% respectively. [4]

EOY	Cash flow in Actual $
0	-7,50,000
1	3,20,000
2	3,75,000
3	3,28,000
4	2,90,000
5	5,80,000

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define term Engineering economy. Explain principles of engineering economy. [1+3]
2. a) If you make equal monthly deposits of Rs. 5000 into the bank for 10 years, saving accounts that pays interest rate of 6% compounded monthly, what would be the amount at the end of 15 years? [4]

   b) How much rupees should you deposit now so that you will be able to draw Rs.5000 at the end of this month which increases by 2 percent per month for 15 years. Bank interest rate is 5% per year. [4]
3. a) Explain any two drawbacks of IRR with example. Differentiate between Economic analysis and financial analysis. [3+3]

   b) Evaluate the project by using AW formulation of the project at i = 12%. [4]

EOY	0	1	2	3	4	5
Cash flow	-3000	800	1000	1100	1210	1464

   c) Calculate the ERR of the following cash flow. MARR = 12%, reinvestment rate = 14%. [6]

EOY	0	1	2	3	4	5
Cash flow	-100,000	25,000	40,000	-10,000	50,000	50,000

4. a) Choose the best project among these alternatives using IRR, if MARR = 15% and study period is 10 years. Salvage value is 20%. [6]

Project	A	B	C	D
First Cost Rs.	900	1500	2500	4000
Annual Revenue Rs.	150	276	400	925

   b) Consider the following two mutually exclusive alternatives; recommend the best alternatives using repeatability assumptions. MARR = 15% [16]

	Project X (Rs.)	Project B (Rs.)
Initial Cost	100,000	150,000
Annual Cost	25,000	12,000
Salvage Value	40000	50000
Useful Life	6 years	10 years

5. Define defender and challenger and Explain economic service life. Company X is going to purchase a router having initial cost Rs.18,000 having salvage value of Rs.12000 at the end of first year and decreases by 20% each year then after for remaining useful life. Annual operation and maintenance cost is Rs. 5000 in first year and increases by Rs.2000 each year. Its useful life is 6 years. Calculate economic service life of the router. [2+2+8]

6. a) A project costs Rs. 125,000 with annual revenue of Rs.65,000 and annual cost of Rs.35,000. Salvage value will be 8% of the initial investment. Perform Sensitivity analysis using PW formulation over a range of ±40% in i) Initial Investment ii) Annual Revenue iii) Useful Life and iv) MARR. Draw the sensitivity diagram and indicate the most sensitive and least sensitive parameters. [6+2]

   b) Define breakeven point and breakeven volume. How does interest rate change affect the project? [2+2]

7. a) Compute the annual depreciation allowances and the resulting book value using the double declining balance method with Switch over to straight line method.
   Cost of asset = Rs. 100,000, Useful life = 5 years, Salvage Value = 20000 [6]

   b) A company bought a machine at Rs 25000 which is expected to produce benefit of Rs 8000 per year for five years. Its salvage value at the end of five years is Rs 10000. Calculate after tax cashflow if Tax rate is 40% and depreciation is on Sinking fund method. I = 20% [6]

8. Define inflation. Calculate IRR if MARR = 12% and inflation rate is 8%. [1+3]

Year	0	1	2	3	4
Constant Dollar	-6000	1500	2000	2500	3000

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. State and explain principles of engineering economics. [4]
2. Define time value of money, nominal and effective interest rate. Calculate future sum at the end of 5th year when monthly deposit is Rs 6,000 for 3 years that earns 7% interest per year. [3+3]
3. a) Make investment decision for the following project by using (i) IRR (ii) B/C (iii) Discounted Payback methods. [4+4+4]

   Initial cost = Rs. 4,00,000
   Annual Revenue = Rs. 1,60,000 for the 1st year and decreases by Rs. 10,000 thereafter
   Annual Expenses = Rs. 40,000 for the 1st year and increases by Rs. 5,000 thereafter
   Salvage value = Rs. 1,00,000
   Life year = 8
   MARR = 9% per year

   b) What do you mean by financial and economic analysis? Briefly explain the concept of lifecycle costing. [2+2]
4. a) Compare following two projects by IRR method when i = 10% per year. [4]

	Initial Cost	Annual revenue	Annual cost	Salvage value	life year
Project A	5,00,000	2,00,000	50,000	80,000	7
Project B	7,00,000	3,00,000	1,00,000	1,50,000	7

   b) Select the best project by using repeatability assumption when MARR = 13% [4]

	Initial cost	Annual revenue	O and M	Life year	Salvage value
Project X	4,00,000	1,75,000	50,000	4	1,00,000
Project Y	7,00,000	2,50,000	70,000	6	1,50,000

   c) Define independent and contingent projects. Find Present worth from annual cash flow series of Rs. 5,000 forever when i = 8% per year. [1+1+2]
5. What do you mean by replacement analysis and economic service life? What are the procedures for replacement when planning horizon is infinite and finite? Calculate AECs from the following information and determine economic service life. [2+2+2+6]

   I = 18,000
   N = 8 years
   O and M = 3,000 for the 1st year and increases by 15% thereafter
   S = Decline by 20% each successive year over than previous price
   MARR = 12% per year

6. a) Explain the concept of scenario and decision tree analysis. If 20 watt CFL bulb price is Rs. 280 and 100 watt filament bulb price is Rs. 30 at market but their lighting power is equal. Which bulb do you prefer to use in your house when electricity cost is Rs. 12 per unit? [6]

b) Perform sensitivity analysis for the following project over range of ±30% in parameters; (i) Initial investment (ii) Annual revenue (iii) life year [6]

Initial Cost	Rs. 5,00,000
Annual revenue	Rs. 1,20,000
Salvage value	Rs. 80,000
Life year	6 year
MARR	10% per year

7. a) Define depreciation. What are the advantages of depreciation concept? Your college is considering purchase vehicle of Rs. 4,00,000 that assigned to 5 years useful life and expected salvage value is Rs. 1,00,000. Calculate depreciation for each year by using declining balance and MACRS. [1+2+3+3]

b) What do you mean by tax, personal tax and corporate tax? Develop a model to calculate after tax cash flow. [1+1+1+2]

8. What is inflation? List out the impact of inflation. Calculate the rate of inflation when CPI moves from 100 to 250 over three years. [1+2+1]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define Engineering Economics. Write down the principles of Engineering Economic Analysis. [4]
2. What is nominal and effective interest rate? Evaluate FW at the end of 10 years with 12% interest rate compounded monthly of a cash flow of Rs. 40,000 at the beginning of each year for 5 years. [2+4]
3. a) Use IRR method to evaluate following project when MARR is 15%. Make also unrecovered balance graph. [5]

EOY	0	1	2	3	4	5
Cash flow	-60,000	20,000	40,000	-40,000	50,000	70,000

b) Your college is considering to purchase a vehicle of Rs. 3,00,000 expecting salvage value Rs 50,000 at the end of 10th year. The use of vehicle saves Rs. 80,000 per year. When it needs Rs. 20,000 operating cost for each year. Find: (i) Both type of B/C ratio by FW formulation (ii) both types of payback period. [4+4]

c) Distinguish between financial and economic analysis. [2]

4. a) Compare the following two mutually exclusive projects by using (i) Co-terminated (ii) Repeatability assumption taking MARR = 8% [4+4]

	Project A	Project B
Initial cost	1,50,000	2,00,000
Annual revenue	90,000	1,00,000
Operating cost	20,000	20,000
Life year	4	6
Salvage value	80,000	1,20,000

b) Define mutually exclusive, contingent and independent projects with suitable example. [3]

5. What are the procedure for replacement analysis when planning horizon is infinite? [4+8]

Find economic service life from the following information.

Initial cost = Rs 50,000

Operation cost = Rs 10,000 for the 1st year and increases by 15% thereafter

Salvage value = Decline each successive year by 20% over previous year.

Useful life = 8 years

MARR = 15%

6. Explain about the decision tree analysis. Perform sensitivity analysis of the following project over range of ±30% at an interval of ±10% in (i) Initial Investment (ii) Net Annual Revenue and (iii) Useful life. Use PW formulation. [2+10]

Initial Investment (Rs)	1,00,000
Net Annual Revenue (Rs)	40,000
Salvage Value (Rs)	15,000
Useful life (years)	6
MARR (%)	10

7. Write down the causes for depreciation of assets. If a machine costing of Rs. 1,00,000 is purchased by expecting salvage value of Rs 20,000 at the end of 6^{th} years. Calculate the depreciation amount for each years by SOYD and straight line method. [2+5+5]

8. Define constant dollar and actual dollar amount. Suppose you borrowed Rs.1,20,000 from a bank to buy a bike and you have promised to pay Rs.6000 per month for two years. What is the inflation free interest rate you are supposed to pay if average inflation rate is 0.75% per month. [4+4]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. "Knowledge of engineering economics helps in decision making process". Justify it by the principles of engineering economics. [4]
2. A person invest a sum of 50,000 in bank at a nominal interest rate of 18% for 15 years. The compounding is monthly. Find maturity amount of the deposit after 15 years. Also briefly explain the importance of time value of money. [3+3]
3. Initial investment of a project is Rs. 1,00,000 having useful life is equal to 5 years with no salvage value. Annual operation and maintenance cost is Rs. 25,000. Annual revenue at the end of first year is Rs. 70,000 and decreases by Rs. 5,000 each year for the remaining years. [6+5+5]
   i) Draw U/B diagram
   ii) Evaluate modified BCR using PW formulation. Take salvage value Rs. 10,000
   iii) Evaluate discounted payback period. Take standard (cut off) payback period 3 years.
4. a) Select the best proposed using ERR (Take ε=25% and MARR = 20%) [4+4]

EOY	0	1	2	3	4	5	6
Proposal A	-6000	2400	2800	2900	3000	3000	2450
Proposal B	-7000	1900	3800	3700	3600	3600	3300

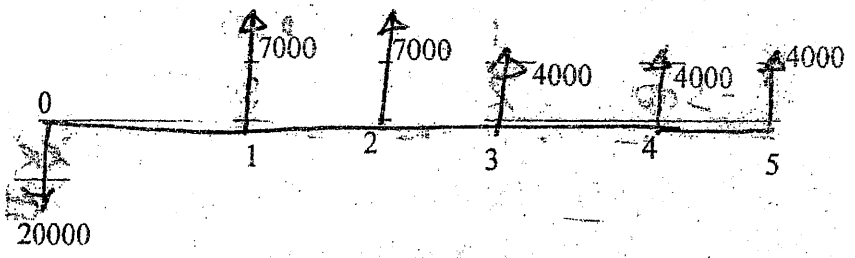
   b) What do you mean by mutually exclusive, contingent and independent project? Compute the following projects by using repeatability assumption when MARR is 10%. [2+6]

Project	A	B
Initial Investment (Rs)	1,00,000	1,50,000
Annual Revenue (Rs)	15,000	20,000
Annual Cost (Rs)	3,000	4,000
Useful life (Years)	6	8
Salvage value (Rs)	5,000	10,000

5. Define sunk cost and economic life of an assets. What are the reasons for replacement of asset. The Annual Equivalent cost of defender and challenger are given in table below. What is the best replacement strategies? Use MARR = 12% and planning horizon of the project is 8 years. [1+1+2+8]

End of Years (n)	1	2	3	4	5	6
(AEC) (Rs)	5300	5100	5400	5600	6000	6500
(AEC) (Rs)	7500	6000	5600	5500	5650	5800

6. a) Consider the following cash flow diagram. Plot changes in present worth to ± 20% and ± 30% for the project life. Let MARR = 10%. Assume salvage value = 0 [8]



b) A small hydro project has given following information [4]

Initial investment = Rs. 10,00,000

Energy Generated per year = 200 MW

Annual operating cost = Rs. 6,00,000

Market price of energy = Rs. 4/KWhr

Salvage value = Rs. 1,00,000

MARR = 10%

Find its break even point of time

7. a) If a machine has following information, compute the depreciation and book value of each year by [4+4]

i) SOYD method

ii) Sinking fund method

Cost basis	Salvage value	life	MARR
$ 8000	$2000	10 years	10%

b) Explain about the method of "MACRS" depreciation. [3]

8. Define inflation. What are its causes? Find rate of inflation per year when price of a product has increased from Rs. 5,00,000 to Rs. 6,30,000 over the period of 3 years. [1+1+1]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Explain why the subject of engineering economics is important to Civil Engineer. [4]
2. What is difference between nominal and effective interest rate?

   You deposit Rs. 1000 in your bank account. If the bank pays 4% simple interest, how much will you accumulate in your account after 10 years? What if the bank pays compound interest? How much of your earnings will be interest on interest? [2+4]
3. a) Calculate IRR from the following cash flow and draw investment balance diagram. [6]

Year	0	1	2	3	4	5
Cash Flow	-800	250	300	400	-150	600

   b) Calculate both types of BCR of a project with following details. MARR = 12% [6]

Initial Investment	Annual Income	Annual Cost	Useful Life	Salvage Value
Rs. 100000	Rs. 20000 at the end of first year and increase by 5% per year	Rs. 3000 at the end of first year and increase by Rs. 500 per year	12 years	25000

4. a) Select the best project by ERR method. Take MARR = 10% and ε = 20% [6]

EOY→	0	1	2	3	4	5	6
PROJECT A	-64,000	26,200	29,000	30,200	31,000	31,000	26,000
PROJECT B	-68,000	-4,000	39,200	38,000	38,000	38,000	38,000
PROJECT C	-75,500	20,500	40,600	40,000	39,000	39,000	32,400

   b) Co-terminating both project at 5 years and select the best project by modified BCR (using AW formulation). Take Salvage Value of each project = 10% of First Cost, MARR = 15% [6]

PROJECT	First Cost	Annual Benefits	Annual O & M Costs	Useful Life
A	Rs. 4,00,000	Rs. 175,000	Rs. 25,000	6 years
B	Rs. 7,00,000	Rs. 250,000	Rs. 35,000	8 years

5. a) An existing machine has market value of Rs. 10000 and decreases by Rs. 2000 per year. Its operating cost is Rs. 2500 in year 1 and increases by 20% each year for 4 years. New machine costs Rs. 20000 now and its market value will decreases by Rs.20% per year for 4 years. Operating cost is Rs.1500 in first year and increase by 30% each year. Calculate equivalent uniform annual cost of both existing and new machines. MARR = 15%. Formulate the best replacement strategy if we need the machine for four years only. [4+4+4]

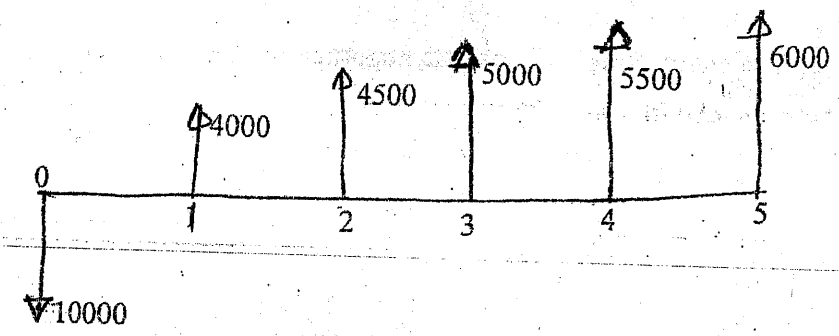
   b) Define mutually exclusive project, independent project and contigent project with proper combinations. [4]

6. a) A company produces an electronics timing switch that is used in consumer and commercial products made by several other manufacturing firms. The fixed cost and total cost are Rs. 40,000 and Rs. 85,000 respectively. The total sales are Rs. 1,05,000 and sales volume is 15,000 for this situation. [4]

i) Find the breakeven points in terms of number of units
ii) What should be the output if the profit desired is Rs. 50,000?

b) Draw sensitivity chart using PW formulation of the following cash informations. It is desired to evaluate the sensitivity of PW to ±30% changes on: [8]

i) Interest
ii) Investment



7. a) Explain the general procedure for after tax economic analysis with suitable example. [4]

b) Considering the following information, compute the annual depreciation and book value of each year by (i) SL method (ii) DB method (iii) SOYD method and (iv) Sinking fund method. [1+2+3+2]

Cost basis	Salvage Value	Useful Life	MARR
$ 7,000	$ 2,000	5 years	10%

8. Choose the best project from the following alternatives. [6]

Project	Machine X	Machine Y
First Cost	15,00000	20,00000
Life	7 years	7 years
Salvage Value	200000	300000
Annual operating and maintenance cost	300000	250000

Assume an average inflation of 5% for the next five years and interest rate is 15% / year.

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Magh

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

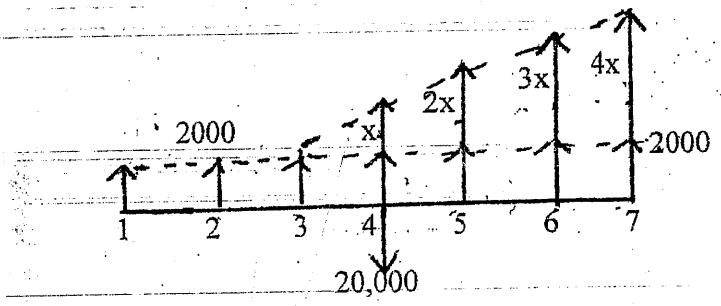
Subject: - Engineering Economics *(CE655)*

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

1. Define Engineering economics. Explain any three principles of engineering economic analysis. [1+4]

2. a) Define nominal and effective interest rates. If you deposit Rs 2000 per month for two years, what will be the amount at the end of five years if bank interest rate 3% in every six month? [1+3]

   b) Find the value of X if i = 10% [4]



3. a) What is MARR? Explain the factors affecting its determination. [3]

   b) Cash flows of a project are as follows: Take MARR = 10%

EOY→	0	1	2	3	4	5
Cash inflow	0	500,000	560,000	620,000	680,000	740,000
Cash outflow	-1000,000	100,000	200,000	300,000	400,000	500,000

   i) Evaluate both type of payback period (Standard payback period = 3years). [1+2]

   ii) Evaluate IRR (PW formulation) using linear interpolation and prepare UIB both in table & diagram. [3+2+2]

   c. Explain the financial and economic analysis. [3]

4. a) Choose the best project among these alternatives using IRR, if MARR = 12% and study period 10 years. [6]

Project	A	B	D	E
First Cost Rs.	2000	1500	4000	3000
Annual Revenue Rs.	390	276	925	500

   b) Determine both types of B/C ratio for the given project if interest rate is 11%. [7]
   Investment = 10000
   Annual benefit = 4600
   Annual cost = 3000
   Salvage value = 2500
   Life of project = 8 years

5. a) Explain the required assumption and decision framework for replacement analysis when required service life is long. [4]

b) An old machine can sell it now for $5,000. If repaired now, can be used for another 6 years. It will require an immediate $1,200 for overhaul to restore it to operable condition. Future market values are expected to decline by 25% each year over the previous year's value. Operating costs are estimated at $2,000 during the first year and these are expected to increase by $1,500 per year thereafter. Determine economic service life of this machine. [8]

6. Perform sensitivity analysis by IRR using FW formulation (with increment of 10%) over a range of ±30% in (a) useful life and (b) MARR. Take MARR= 10%. [8]

PROJECT	First Cost	Annual Benefits	Annual Expenses	Salvage Value	Useful Life
A	Rs. 3,00,000	Rs.1,50,000	Rs.25,000	10% of First Cost	10 years

7. a) What are the purpose of depreciation calculation? Compute the annual depreciation allowances and the resulting book value using the double declining balance method with Switch over to straight line method. Cost of asset = Rs 1,00,000, Useful life = 5 years, Salvage Value = 20,000. [1+5]

b) A machine is expected to cost Rs. 5,00,000 and will generate revenue of Rs 1,50,000 per year for five years. Its salvage value is Rs 2,00,000. Calculate after tax cash flow and corresponding NPV if tax rate is 30% and depreciation is on sum of year digit method. MARR = 15% [6]

8. Explain any two reasons for inflation and compute the equivalent present worth using deflation method. [2+4]

EOY→	0	1	2	3	4	5
Cash inflow	-	5,00,000	5,60,000	6,20,000	6,80,000	7,40,000
Cash outflow	-10,00,000	1,00,000	2,00,000	3,00,000	4,00,000	5,00,000

Given cash flow are in Actual Dollars. Take f = 5% and i = 10%

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

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 *(CE655)*

- ✓ 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 Engineering Economics. Write down the principles of Engineering Economic Analysis. [4]
2. What is nominal and effective interest rate? Evaluate FW at the end of 15 years with 10% interest rate compounded monthly of a cash flow of Rs. 50,000 at the beginning of each year for first 10 years. [3+5]
3. Define IRR. Find IRR and ERR of the following project. MARR = ε = 15%. [2+6]

Year	0	1	3	4	5
Cash flow	-50	-10	30	40	50

4.

	Machine A
Initial Investment	Rs. 6000
Annual Benefits	Rs. 3000
O & M Cost	Rs. 1000
Salvage Value	Rs. 1500
MARR	10%

a) Evaluate both type of BCR (FW Formulation). Take Useful life = 10 years. [4]
b) Evaluate both type of Payback Period. If Useful life = 5 years. (Take Standard payback period = 3 years) [4]
c) Explain the factors affecting determination of MARR. [4]

5. a) Use Repeatability assumption to select the best project from the following three projects. [6]

Project	A	B	C
Initial Investment	100000	200000	250000
Annual Expenditure	25000	20000	15000
Useful Life, Years	3	5	7
Salvage Value	40000	50000	60000
MARR	14%		

b) Explain about the Sunk Cost, Economic life and reasons for replacement of an asset. The Annual Equivalent Cost of defender and challenger are given in the table below. What is the best replacement strategy? Use MARR = 10%. The planning horizon of the project is 8 years. [8+4]

End of year (n)	1	2	3	4	5	6
$(AEC)_D$	5400	5200	5500	5700	6200	6600
$(AEC)_C$	7700	6200	5700	5600	5680	5900

6. a) For the improvement of a manufacturing plant, following three alternatives are being considered. The estimated investments and the corresponding increment in income are also given as below. Draw decision tree diagram of the situation and decide on the best alternative using FW formulation. MARR = 15%. Life of the Project is 6 years. [6]

Alternatives	Investment Cost	Sales		Annual Income
A	1000000	High Success	Probability = 0.4	500000
		Medium Success	Probability = 0.5	300000
		Low Success	Probability = 0.1	125500
B	600000	High Success	Probability = 0.2	400000
		Medium Success	Probability = 0.5	250000
		Low Success	Probability = 0.3	100000
C	400000	High Success	Probability = 0.5	200000
		Medium Success	Probability = 0.1	125000
		Low Success	Probability = 0.4	50000

b) Perform sensitivity analysis of the following project over a range of 10 to 50 percent in (i) initial investment and (ii) MARR using PW formulation. Assume Sv = 0. Draw sensitivity diagram also. [6]

7. What do you mean by depreciation? Explain about the causes of it. Explain about any three methods of depreciation calculation that are used commonly. A machine purchased for Rs. 60,000 by expecting useful life of 10 years. Calculate the depreciation amount for each year by using deciding balance method when rate of depreciation is 20% per year. [6+6]

8. Define Constant dollar amount and Actual dollar amount. Suppose you borrowed Rs. 100000 from a bank to buy a bike and you have promised to pay Rs. 5500 per month for two years. What is the inflation free interest rate you are supposed to pay if average inflation rate is 0.75% per month? [2+4]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

Exam.	New Back (2060 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	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.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. a) List out the principles of engineering economy. [1]

   b) Explain the cash flow diagram. [3]

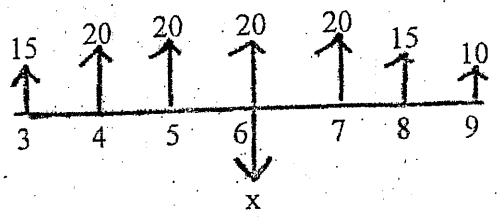
   c) First Cost = $ 80000. SV = 10% of First Cost. The general inflation rate = 5%. [5]

EOY	1	2	3	4	5
Net Cash Flow in Actual Dollars	32000	35000	33000	29000	50000

   Evaluate the PW by deflection method, if inflation free interest rate = 10%.

2. a) What will be the amount at the end of 10 years if you deposit Rs. 5000 per month for five years continuously if nominal interest rate is 10% compounded quarterly? [3]

   b) Find the value of X from the following figure. i = 10% [3]



3. Calculate both types of BCR using FW formulation when [8]
   - Initial investment is Rs. 50000;
   - Income is Rs. 10000 at the end of first year and increasing by 10% per year;
   - Annual expenditure is Rs. 2000 at the end of first year and increasing by Rs. 200 per year;
   - Useful life is 6 years
   - Salvage value is Rs. 20000
   - MARR - 15%

4. Use IRR method to select the best project. Use MARR = 12%. (Select the best combination if A, B and C are mutually exclusive.) [8+4]

	A	B	C	D
Initial Investment (Rs.)	10,000	15,000	27,000	20,000
Annual Income (Rs.)	5,000	7,000	12,000	9,000
Useful Life (yrs.)	4	4	4	4
Salvage Value (Rs.)	2,500	5,000	8,000	10,000
MARR (%)	15	15	15	15

5. Annual Equivalent Cost of defender and challenger are given below: [8]

n	Defender	Challenger
1	5380	7700
2	5203	6184
3	5469	5756
4	5844	5625
5	6258	5631
6	6682	5721

Either the defender or challenger is required for next 8 years.

After the work, neither the defender nor the challenger will be retained.

What is the best replacement strategy?

6. What are the sources of risk in engineering projects in Nepal? Perform sensitivity analysis of the following project over a range of ±30% in (a) Initial investment, (b) Net Annual Revenue and (c) Useful Life. Draw also the sensitivity diagram. Use PW formulation. [8]

Initial Investment (Rs.)	5,50,000
Net Annual Revenue (Rs.)	1,50,000
Salvage Value (Rs.)	80,000
Useful Life (years)	6
MARR	10%

7. a) Compute the Book Value at the end of 3 Years (BV3) by all the methods of depreciation except MACRS method. Cost basis of a machine is Rs. 10,000. SV = 0. Useful Life = 5 years. MARR = 10%. [4]

b) Evaluate after tax PW. The cost basis for a machine is Rs. 10,000. The machine is 5-year MACRS property. Over 6 years, it is estimated to save Rs. 4,500 per year in maintenance costs with annual operating cost being Rs. 1000. It will be depreciated by MACRS method. SV = 0. Tax rate = 30%. MARR = 15%. [8]

8.

	Machine A	Machine B
Initial Investment	Rs. 50000	Rs. 35000
Annual Benefits	Rs. 20000	Rs. 15000
O.& M Cost	Rs. 10000	Rs. 2000
Salvage Value	Rs. 15000	Rs. 10000
Useful Live	4 years	3 years
MARR	12%	

a) Select the best machine by ERR method. Required study period is 5 years. Take ε = 10%. [8]

b) Evaluate also by capitalized worth method. [4]

9. A machine has a Fixed Cost of Rs. 40,00,000. It has variable cost Rs. 45,000 per unit. Find BEP both in volume and value if selling price per unit is Rs. 60,000. What would be the effect on profit/loss when fixed cost increase by 10% and selling price decreases by 5%. [5]

OR

Explain the Decision Tree Analysis.

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, B.Agri.	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Scarcity is an emerging issue in engineering field. How does the study of economics help to engineers in decision making process? Discuss. [5]

2. 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]

3. Initial Investment = Rs. 100,000
   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. [6+5+5]

   a) Draw U/B diagram.
   b) Evaluate conventional BCR using PW formulation. Take salvage value = 10,000.
   c) Evaluate Discounted Payback Period. Take standard (cut off) Payback Period = 3 years.

4. 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.

5. 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
$(AEC)_D$	5300	5250	5400	5750	6200	6550
$(AEC)_C$	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. $S_s = 0$. 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. [6+6]

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. [5]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2070 Magh

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

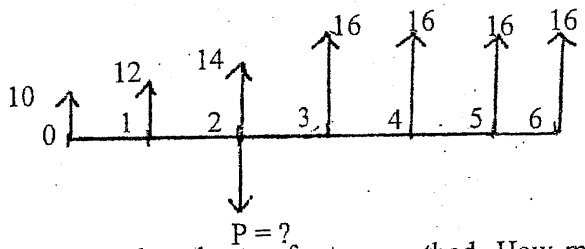
Subject: - Engineering Economics *(CE655)*

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

1. Explain the roles of engineers in making economic decision with appropriate examples. [4]

2. a) If you deposit Rs.10000 in a saving account now which gives 10% nominal interest rate, what will be the amount after 5 years if interest is compounded (i) semi-annually (ii) Monthly [2]

   b) Find the value of P if i=10%. Use gradient formula also. [4]



3. a) Define equivalent worth and rate of return method. How much rupees should you deposit now in a bank account that gives 8% interest per year if you wish to draw Rs.10,000 per month for 10 years? [2+4]

   b) What is the different between financial and economic analysis? Determine both type of B/C ratio from the following cashflow. [2+4]

   Initial investment = 3,00,000
   Annual revenue = 85,000
   Annual costs = 15,000
   Salvage value = 20% of initial investment
   Useful life = 6 years
   MARR = 10%

   c) Compute IRR by using trial and error process of the following project. Determine also investment decision. [4]

   Initial investment = 25,000
   Annual revenue = 8,000
   Salvage value = 5,000
   Useful life = 5 years
   MARR = 20%

4. a) Select the best proposal using ERR (ε=25%, MARR=20%) [4]

EOY	0	1	2	3	4	5	6
Proposal A	-6400	2620	2900	3020	3100	3100	2600
Proposal B	-7550	2050	4060	4000	3900	3900	3400

   b) State and explain about the cases of mutually exclusive, contingent and independent projects with example. Compare the following projects by using repeatability assumption when MARR is 12% [4+4]

Project	A	B
Initial investment	2,00,000	3,00,000
Annual revenue	25,000	30,000
Annual costs	7,000	9,000
Useful life year	6	8
Salvage value	10,000	20,000

5. The new machine costs 10,000 operating cost 2200 in first year, then increases by 20% per year. Market value is 6000 after one year and will decline by 15% each year N = 5 years. If required, old machine can work another 3 years. Market value now is 5000 and will decline by 25% each year. Immediate overhauling to restore to operable condition costs 1200. Operating costs 2000 in the first year increases by 1500 per year thereafter. MARR = 15% [8+4]

i) Find the economic service life of this machine (new)
ii) AEC of defender is as followings:

(AEC)

N	1	2	3	4
AEC	5380	5203	5468	5845

When should the old machine be replaced with the new machine.

6. a) Explain decision free Analysis: [4]

b) Calculate break-even hours of operation per year to become cost equal and recommended economic pump if it is to be operated 5 hours daily at full load. [8]

	KHASA Pump	SARVO Pump
Capacity	100 hp	100 hp
Purchase cost (Rs.)	5,00,000	10,00,000
Tax per year (Rs.)	10,000	15,000
Maintenance cost per year (Rs.)	36,500	29,200
Efficiency	80%	90%
Life year	5	5
Salvage value	20 % of purchase cost for both	
MARR	20% per year	
Electricity cost	Rs. 10/kwhr	

7. a) Define depreciation. What are the causes for it? If a machine costing of Rs. 1,50,000 is purchased by expecting salvage value Rs.40,000 at the end of 6th year. Calculate depreciation amount for each years by [2+5]

i) SOYD
ii) Declining balance

b) Suppose an equipment purchased for Rs.10,00,000. It is expected to generate income of Rs. 3,50,000 per year during 5 years and corporate income tax rate is 25% per year. Under the recovery periods depreciation are as follows. [6]

Year	1	2	3	4	5
Depreciation amount	1,00,000	2,00,000	2,00,000	2,00,000	1,00,000

Calculate ATCFs and determine profitability (IRR) when MARR is 15% by using PW method.

8. Evaluate the PW of the following project: [5]

Initial investment = Rs. 1,00,000 → in constant dollers
Annual sales income = Rs. 40,000 → in constant dollers
Annual labour cost = Rs. 3,000 → in constant dollers
Annual material X = Rs. 2,000 → in constant dollers
Annual material Y = Rs. 1,000 → in constant dollers
Salvage Value = 20% of initial investment - in constant dollers

Inflation rate for sales income, labour cost, materials X, material Y and salvage value are 5%, 8%, 0%, 6% and 3% respectively for the project period. Take market interest rate = 20% project life is 4 years.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

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

Subject: - Computer Network *(CT 613)*

- ✓ 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 do you need layering? How does P2P works? Explain. [2+6]
2. Discuss briefly Delay, Bandwidth and MAC address. Discuss how data or packets goes through switch to switch in Frame Relay Virtual-circuit network. [3+5]
3. What are the services provided by data link layer? How CRC can be used to detect error? Explain with an example. [2+6]
4. Explain the Flooding algorithm with ways to minimize the duplication of packets. Write down steps for Link State Routing Protocol. [4+4]
5. What is private IP address? Company Allegro hired an IT expert. The expert was given task to perform logical design of the company with an IP block of 206.100.100.0/24. The company had 40,20,8,100 and 5 employees in its sales, admin, finance, support and HR departments respectively. Show how he was able to perform subnetting with minimum IP wastage. [2+6]
6. Discuss how multiplexing and de-multiplexing is achieved in Transport layer with examples. How is token bucket algorithm better than Leaky bucket in context with packet loss? Explain. [4+4]
7. Why is HTTPS not used for all web traffic? How FTP works? Explain. [2+6]
8. How extension header is used in IPV6 ? Explain dual stack transition mechanism from IPV4 to IPV6. [3+5]
9. Draw the block diagram of DES algorithm. Explain RSA with examples. [3+5]
10. Write short notes on: (Any Two) [2×4]
    a) Deffie Hellman Algorithm
    b) PGP
    c) ATM
    d) 802.3 CSMA.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

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

Subject: - Computer Network *(CT 613)*

- ✓ 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 Client-Server model and Peer-to-Peer model. Compare TCP/IP model with OSI reference model. [4+4]
2. What are the factors to be considered while selecting transmission media? Explain optical fiber cable in detail with its advantages and disadvantages. [2+6]
3. Compare Flag byte with byte stuffing and bit stuffing in Framing. Detect the error (if any) using CRC, if received frame is 0101101101 and generator polynomial is 1001. [2+6]
4. What are the criteria for good routing? Explain the general operation of RIP with timers. [2+6]
5. What is the Network address and broadcast address in IPv4 addressing? How do you assign the sub-net IP addresses to three LANs each 12,5 and 29 computers respectively? (Assume 202.35.91.32/25). [2+6]
6. Why do we need a transport layer? Draw the segment of UDP. Compare TCP with UDP. [2+2+4]
7. Draw the architecture of Email Agent. Why is DNS distributive in nature? Explain iterative query vs recursive query of DNS with examples and diagrams. [2+6]
8. Discuss any-cast and multi cast addresses in IPv6 with use cases. If there are IPv4 networks in between two IPv6 endpoints, what type of transition strategies will you suggest? Explain with examples and diagrams. [2+6]
9. What is IPSEC? Encrypt the plain text " MACHINE" using RSA algorithm. [2+6]
10. Write short notes on(Any Two) [2×4]
    a) HTTP methods
    b) VPN
    c) IDS.
    d) Token bucket Algorithm

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

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

Subject: - Computer Network *(CT 613)*

- ✓ 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 data encapsulation? Explain OSI reference model with suitable diagram. [2+6]
2. Define Throughput and Delay. Compare different types of guided transmission media with appropriate figures. [2+6]
3. Explain Selective repeat and Go back N ARQ with example. A bit string 01101110111111111011111110 needs to be transmitted with flag 7E at the data link layer. What is the string actually transmitted after bit stuffing? [6+2]
4. Why are different inter-AS and intra-AS protocols used in the internet? Compare and contrast link state and distance vector routing algorithms. [2+6]
5. Design a network for a company having 5 departments with 60, 42,30,10 and 12 hosts. Specify the network address, valid host range, broadcast address and subnet mask for each department from the given address 202.17.11.0/24. [10]
6. What are the differences between TCP and UDP? How do you implement packet congestion Control for better QOS? [4+4]
7. What is port address and socket address? Explain working principle of E-mail system with a proper diagram. [2+6]
8. What are the features of IPv6 header. Explain the strategies used for transition from IPv4 to IPv6. [3+5]
9. When can you say your network is compromised? And, how is it caused? How can you make your network secure using public key cryptography? [2+2+4]
10. Write short notes on: (Any Two) [2×3]
    a) X25 Network
    b) DHCP
    c) ALOHA

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Computer Network *(CT 613)*

- ✓ 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 layering is important? Explain Open System Interconnection (OSI) model and compare OSI with TCP/IP reference model. [2+6]
2. What are the factors to be considered while selecting media? Differentiate between datagram switching and virtual circuit switching approach. [2+6]
3. What are the services provided by data link layer? How does CSMA/CA protocol work to avoid the collision during hidden station problem? Explain with diagram. [2+4+2]
4. Suppose an ISP has 200, 250, 500 and 100 customers in the four different places say, A, B, C and D and need four point-to-point links. Provided an IP 10.0.48.0/21, you are required to perform subnetting with minimum waste of IP. Find out the subnet masks, network address, broadcast address, usable IP range and unusable IP range for each location. [10]
5. Define unicast and multicast routing. Compare distance vector and link state routing protocols with example. [2+6]
6. What is significance of port address? Discuss about different classes of port addresses defined by IANA. How can traffic congestion controlled by token Bucket method? [1+3+4]
7. What is DNS? Explain the working principle of DNS with a proper diagram. Compare IMAP and POP3 protocols. [1+4+3]
8. What are the factors that lead to the deployment of IPv6? Explain briefly about the process involved in transition of IPv4 to IPv6. [2+6]
9. What are the properties of secure communication? Encrypt and decrypt the message "BEIE" using RSA algorithm. [2+6]
10. Write short notes on: (Any Two) [2×3]
    a) Go back N ARQ
    b) Virtual circuit switching
    c) CRC

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Computer Network (*CT 613*)

- ✓ 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 features of the client/server Architecture? What are headers and trailers and how do they get added and removed? [4+4]
2. What is multiplexing? What are the two approaches of packet switching? [2+6]
3. What is the difference between Error Correcting and Error detection process? A bit string 01111011111011111110 needs to be transmitted at the data link layer what is string actually transmitted after bit stuffing, if flag pattern is 01111110. [5+3]
4. What is privet IP address space in IPv4? If IP address is 192.168.20.60/29, find the maximum subnets, network address, broadcast address and useful hosts per subnets. Also find first subnet and last subnet. [3+5]
5. What do you mean by autonomous system? Explain how routing loops are prevented in Distance Vector Routing with examples. [2+6]
6. Explain the TCP segment structure. Why TCP is known as reliable protocol and also describe how reliability is provided by TCP? [4+4]
7. What do you mean by DNS query? Show how mail is transferred over internet. What are the protocols used on it? [2+2+4]
8. "IPv4 and IPv6 coexistence" what does this mean? Explain what you mean by address family translation in IPv4/IPv6 migration process with an appropriate figure. [3+5]
9. What id pretty Good Privacy (PGP)? How does it provide email security through the use of Digital Signature? [2+6]
10. Write short notes on: (Any Two) [2×4]
    a) MPLS
    b) Delays in Networking
    c) ICMP message type and their significance
    d) Instruction Detection System (IDSs) of Fire Walls

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Computer Network *(CT 613)*

- ✓ 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 OSI reference model with suitable diagram. Differentiate between physical topology and logical topology. [6+2]
2. Why the telephone companies developed ISDN? Explain the working principle of ISDN with its interface and functional group. [2+6]
3. What are the services provided by Data Link Layer? Explain selective-repeat ARQ and Go-Back-N ARQ with diagram. [3+5]
4. Suppose the network 202.70.64.0/24 is subnetted to create 7 subnetworks and an IP address 202.70.64.167 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. [8]
5. Define Interior gateway and exterior gateway routing Protocols with examples. How entries are placed in the routing table? Differentiate between Distance Vector Routing and Link State Routing. [2+2+4]
6. Write about TCP synchronization with diagram? Compare TCP and UDP. [3+5]
7. Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why? [8]
8. How is extension header used in IPv6? What are the three strategies used for transition from IPv4 to IPv6? [8]
9. Explain briefly the desirable properties of secure communication. Explain how Packet filtering firewall works. [4+4]
10. How does Digital Signature work? Explain different types of firewalls. [3+5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

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

Subject: - Computer Networks *(CT 667)*

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

1. What is computer network? What are the applications of computer networks? Explain the differences between OSI and TCP/IP reference model. [1+2+5]
2. Define latency and throughput for a transmission channel? Explain the characteristics of twisted pair, coaxial and optical fiber cable. [2+6]
3. What are the different sub-layers of data link layer? Explain the functions of each sub-layer. [2+6]
4. Suppose you are given the IP address block of 202.101.8.0/24 from your ISP. How can you divide this IP address for four different departments of your organization requiring 50, 10, 25, 100 number of hosts with minimal wastage of IP addresses in each department? List out the subnet mask, network address, broadcast address and usable host addresses for each subnet. [8]
5. What is routing? What is static and dynamic routing? Differentiate between distance vector and linked state routing. [1+3+4]
6. What is the importance of addressing at transport layer? Explain the TCP connection establishment, data transfer and connection termination process with necessary diagrams. [2+6]
7. What is DNS? Why is it used Internet system? Explain recursive and iterative query with suitable diagrams and their applications. [1+2+5]
8. What are the advantages of IPv6? How both IPv4 and IPv6 networks are interoperable? Explain. [2+6]
9. What is network security? Explain the symmetric key and public key cryptography. [3+5]
10. Write short notes on: (Any two) [2x4]
    a) PPP
    b) BGP
    c) WEP

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26 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

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.*

1. What are the reasons for using layered protocol? How the process of data encapsulation occurs in transmission mode described by seven layers of OSI model. [3+5]
2. What is switching? Compare between Circuit switching and packet switching. [3+5]
3. What are the different methods of framing? Explain any one method of framing with example. [2+6]
4. Why do we use dynamic routing? Explain with example how distance vector routing is used to route the packet and why count-to-infinity problem arises and how does it get solved. [2+6]
5. What is private IP address? You are given an IP address block of 201.40.58.0/24. Perform subnetting for four departments with equal hosts. [2+6]
6. What are the functions of transport layer? Explain the TCP segment format in detail. [3+5]
7. What is the function of proxy server? Explain the working of FTP in detail. [2+6]
8. Distinguish between IPv6 and IPv4. Explain about tunneling in IPv6. [4+4]
9. What do you mean by cryptography? Encrypt the message "MISCELLANEOUS" using RSA algorithm. [2+6]
10. Why network security is very important? Explain different types of firewall that can be used to secure the network. [2+6]

36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

Exam.	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 are the reasons for using layered protocols? Compare OSI reference model and TCP/IP model. [3+5]
2. Differentiate between wired and wireless media with their benefits and drawbacks. Discuss Packet and Circuit switching concepts with example. [3+5]
3. Explain different types of ALOHA. Differentiate between Token bus and Token ring networks. [4+4]
4. What are the factors effecting the Congestion? Explain the operation of Link State Routing Protocol. [3+5]
5. Compare IMAP and SMTP. How a request initiated by a HTTP client is served by a HTTP server? Explain. How HTTP$ works? [3+3+2]
6. Explain Transmission Control Protocol with its Header Formate? Compare it with User Datagram Protocol. [6+2]
7. Compare the header fields of IPV6 and IPV4. Explain about the process to simplify the writing of addresses of IPV6? [4+4]
8. Compare symmetric key encryption method with asymmetric key encryption. Describe the operation of RSA algorithm. [3+5]
9. What are digital signatures? Explain the operation of Data Encryption Standard algorithm. [2+6]
10. Write short notes: (Any two) [4+4]
    a) HUB, Switch and Routers
    b) Firewalls and their types
    c) Flow control / Mechanism of DLL

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

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.*

1. Explain about the designed issues of Computer Network software. Distinguish between physical channel and physical layer. [5+3]
2. What do you mean by switching in communication? Compare Virtual Circuit and datagram approach with suitable diagram. [2+6]
3. Why do you think that the issues of media access is very important in data link layer? Explain about the operation of CSMA/CD. How can you make it more efficient? [3+5]
4. Institute of Medicine has 4 colleges. They need to be connected in same network. Allocate following numbers of IP addresses: 25, 68, 19 and 50 to those colleges by reducing the losses. The IP address provided to you to allocate is: 202.61.77.0/24. List the range of IP Addresses, their network address, broadcast addresses and corresponding subnet mask. [8]
5. What is congestion? What are the techniques for congestion control? Explain TCP three way handshaking process. [1+3+4]
6. Differentiate following points in the context of layers of TCP/IP. [3+2.5+2.5]
   a) SMTP and IMAP
   b) HTTP and DNS
   c) Port and socket
7. Why network layer is the key layer in OSI reference model? Describe the working principle of OSPF routing protocol. [2+6]
8. Explain IPV6 with its frame format. What methods are used so that IPV6 and IPV4 networks are interoperable? [4+4]
9. List the properties of secure communication. Encrypt and decrypt "BEX" using RSA algorithm. [8]
10. Write short notes on: (Any Two) [2×4]
    a) Medium Access Sub layer
    b) DNS Queries
    c) Firewalls

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Bhadra

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.*

1. Explain the importance of layered architecture of computer networking. Explain the function of following devices in brief: [4+6]
   i) Hub
   ii) Bridge
   iii) Router
2. A frame having size of 100 bits is transmitted through a channel having capacity of 200 KB/Sec. Calculate the percentage of idleness of the channel assuming the round trip time of the channel to be 20 ms. Is the channel efficient? What is your recommendation further? [5+1+4]
3. Explain HDLC with its frame format. Explain the fault tolerance mechanism of Fiber Distributed Data Interface. [4+4]
4. What are the mechanisms adapted for optimization of uses of IP address. Explain with your example the use of sub-netting showing network address, broadcast address and sub-net mask. [4+6]
5. What is socket? Explain connection management of TCP. [1+7]
6. What is the difference between POP and IMAP? Explain DNS servers and its query types. [3+5]
7. Why the world has decided to migrate to new internet addressing scheme IPV6? Which method do you suggest for the migration of IPv4 to IPv6 and why? [3+5]
8. What are the properties of secure communication? Encrypt and Decrypt "OIE" message using RSA algorithm. [3+7]
9. Write short notes on: (any two) [4×2]
   i) Token Bucket algorithm
   ii) E_1 Telephone Hierarchy
   iii) Distance vector routing

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 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: - 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. How the client-server model works? Differentiate it with peer-to-peer network with advantages and disadvantages. [3+5]
2. List guided and unguided media used in computer network. Explain Ethernet cable standards. [2+6]
3. What is PPP? Explain fault tolerance mechanism of FDDI. [2+6]
4. What is the importance of routing in computer networking? Explain how distance vector routing algorithm operates dynamically? What is its problem? [2+6+2]
5. What is physical address? You are given the IP address block 201.40.58.0/24. Design the subnet for 49, 27, 1145 hosts group so that IP address wastage is minimum. Find subnet mask, network ID, broadcast ID, assigned IP and unassigned IP range in each department. [2+6]
6. Define UDP with its header structure. Explain the leaky Bucket algorithm for traffic shaping. [4+4]
7. What is DNS? How can you transfer mail over internet? What are the protocols used on it? [1+4+3]
8. Explain IPV6 Headers with its features. Compare it with IPV4. [2+6]
9. What is cryptography? How Deffi Hellman algorithm negotiate a shared key between the receiver and transmitter. Explain with example. [2+6]
10. Write short notes on: (any two) [3×2]
    i) Hypertext transfer protocol
    ii) Flow control mechanism
    iii) Web Server

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 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: - Computer Network *(CT567)*

- ✓ 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 advantages of computer network? Differentiate between TCP/IP and OSI model. [3+5]
2. Explain different types of multiplexing used in communication system. Differentiate between Virtual-Circuit switching and datagrams. [4+4]
3. Write down the importance of error detection and correction bits. What is the different type of ALOHA? [3+5]
4. Explain the following terminologies Network Layer; Shortest Path routing algorithm, link State Routing Protocol, Interior Gateway Routing protocol, ICMP. [4×2]
5. Design IPv4 sub network for an organization having 16, 48, 61, 32 and 24 computers in each departments. Use 192.168.5.0/24 to distribute the network. [8]
6. What is the importance of socket in internet? Explain the Transmission control protocol along with its frame format. [3+5]
7. Define SMTP. What are the importance of DNS and HTTP while you are browsing any website? [2+6]
8. Explain and draw the frame format of IPV6. Describe tunneling in IPV6. [4+4]
9. Show the working of RSA algorithm with suitable example. [8]
10. Explain SSL in brief. Describe the type of firewalls in detail. [3+5]

36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

Subject: - Computer Network *(CT567)*

- ✓ 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 protocol. Why do we need layered protocol architecture? Explain each layer of TCP/IP protocols architecture in detail. [1+2+5]
2. Write down the transmission media used for networking. Differentiate between circuit switching and packet switching. [4+4]
3. What are the methodologies used in data framing? How a complete link is established during the dialup connection? Explain. [4+4]
4. What are the interconnecting devices used for networking, explain in brief. [8]
5. Design a network for the Institute of Engineering central campus, Pulchowk 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. Explain TCP and UDP. Describe longestion control algorithm with example. [3+5]
7. Write down the process of e-mail transfer. Explain SMTP, POP3 and IMAP. [5+3]
8. Compare the header structure of IPv6 with IPv4. Write down the major advantages of IPv6 over IPv4. [4+4]
9. What are the types of cryptography and why it is needed? Explain RSA algorithm with appropriate example. [4+4]
10. Explain the Deffi Helman Alogorithm with example. [8]

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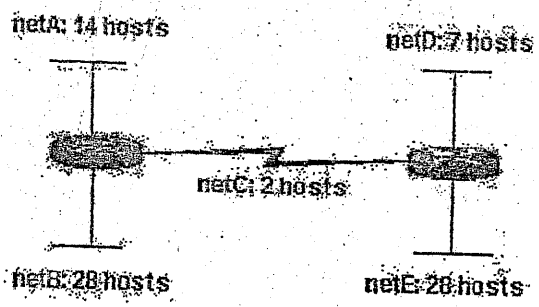
36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

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 IVP6 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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31 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: - Computer Network *(CT657)*

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

1. Explain OSI reference model. Differentiate between OSI and TCP/IP model. [5+3]
2. Compare packet switched networks and circuit switched networks. Which kind would you prefer and why? Explain various cabling techniques used in IEEE 802.3 standard. [2+2+4]
3. Explain IEEE 802.4. How carrier sense multiple access with collision detection (CSMA/CD) is better than CSMA? [3+5]
4. Compare and contrast between Hub, Switch, Bridge and Router. [8]
5. What is subnet mask? If there are 5 departments which require 27, 28, 7, 12, 8 hosts respectively, Design the subnet with minimum loss of IPs and write the starting and ending address of each subnet. [1+7]
6. Explain leaky bucket algorithm for traffic shaping. Differentiate between TCP and UDP. [3+5]
7. Write short notes on: [8]
   a) DNS
   b) Web Server
8. Draw the header structure of IPV6. Explain about the major improvement of IPV6. How IPV4 address is converted into IPV6 address. [3+2+3]
9. What is cipher text? Explain the Symmetric key and public key encryption. [2+6]
10. What are uses of Firewall? Write down features of IPSec and WEP. [8]

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

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.*

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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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 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: - 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 Deffi 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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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 structure and function of a computer system. Daw instruction cycle state diagram with interrupt. [4+2]
2. Write down the code to evaluate $X = \frac{A - B + C \times (D \times E - F)}{G + H \times k}$ in three address, two address, one address and zero address instruction formats. [8]
3. What are the different types of addressing modes? Compare them with advantages and disadvantages. [2+6]
4. Differentiate between hardwired and micro programmed control unit. Explain with block diagram of micro programmed control unit. [5+5]
5. How can we prove that pipelining improves the performance of a computer? Explain the operation of instruction pipeline for processing four segment instruction cycle with the help of space-time diagram. [4+6]
6. Explain non-restoring division algorithm with flow chart and also divide 12/5 using same algorithm. [5+5]
7. Multiply -6×7 using Booths multiplication algorithm. [6]
8. What is set associative mapping? Explain how it combines the feature of direct and associated mapping technique. Explain different replacement algorithm techniques used in cache memory. [2+3+3]
9. Explain CPU-IOP Communication with diagram. Explain DMA controller with suitable block diagram. [5+5]
10. Explain the crossbar switch interconnection structure with block diagram. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 about the structural and functional viewpoint of a computer. Explain different elements of bus design. [4+2]
2. Write a code for X = ((A+B)/C) + (D – E) using three addresses, two addresses, one address and zero address instruction format. [8]
3. List out the different types of addressing modes and explain each of them with suitable example. [8]
4. Describe the operation of hardwired control unit with a typical block diagram. Explain the operation of microprogram sequencer used in microprogrammed control unit. [5+5]
5. Explain arithmetic pipelining with example. Describe different types of pipeline hazards with example. [4+6]
6. Draw the flowchart for Non-Restoring Division. Perform 13/5 using restoring division. [4+6]
7. Explain floating point addition and subtraction algorithm with an example. [6]
8. Describe how Set-Associative Mapping works in Cache memory mapping. Explain different write policy techniques in cache memory. [3+5]
9. Elaborate the roles of I/O interface in a computer system. Explain how data transfer is performed with programmed I/O technique with necessary diagram. [10]
10. Compare and contrast the interconnection structures used in multiprocessing environment. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

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

Subject: - Computer Organization and Architecture (*CT 603*)

- ✓ 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 performance balance and why it is required? Explain different elements of bus design. [2+4]
2. Describe the instruction cycle state diagram. Write down the code to evaluate Y = (A-B+C)*(E+F/G) in three addresses, two address, one address and zero address instruction formats. [4+6]
3. List out the different types of addressing modes and explain them with suitable example for each. [8]
4. Differentiate between control memory and main memory. Draw the block diagram of Microprogram Sequencer for a control memory, explain its operations. [3+7]
5. What is vector processing? How pipelining improves the performance of a computer? Explain with an example. [10]
6. Explain restoring division algorithm. Use this algorithm to divide 31 (Dividend) by 13 (divisor). [8]
7. Explain floating point multiplication algorithm with an example. [6]
8. What do you mean by write policy? Discuss and differentiate direct mapping and associative mapping functions in cache design. [8]
9. What are the functions of I/O Module? Why priority interrupt is needed for data transmission between COU and I/O device. Explain the types of priority interrupt in detail. [10]
10. Compare and contrast the interconnection structures used in multiprocessing environment. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 different types of bus arbitration and compare them. [6]
2. Explain different types of data manipulation instructions with example. [8]
3. Explain the component of CPU. Comparison between RISC and CISC architecture. [2+6]
4. Explain the organization structure of a microprogram control unit and the generation of control signals using microprogram. [10]
5. What is meant by hazard in pipelining? Explain with example data and control hazards in pipeline conflict. [4+6]
6. Explain the non-restoring division algorithm for division. Divide 10/5 using non-restoring division. [5+5]
7. Explain the floating point addition and subtraction process using flow chart. [3+3]
8. Explain Least Recently Used (LRU) replacement algorithm in case of hit and miss with suitable example. [8]
9. Differentiate between isolated and memory mapped Input-output. Explain with block diagram of DMA transfer in a computer system. [4+6]
10. Compare and contrast the interconnection structures used in multiprocessor system. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Kartik

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 computer organization and architecture. Compare and explain the bus structure of typical computer system. [2+4]
2. Write down the code for Y = (A-B/C) × (D+E×G) / F using three address, two address, one address and zero address instruction format. [8]
3. Comparison between different types of addressing modes with its advantages and disadvantages. [10]
4. Write down the symbolic microprogram for fetch routine and addition execute routine. Explain with diagram the working of microprogram sequencer for control memory. [4+6]
5. How pipeline processing is done in an instruction pipeline? Explain four segment instruction pipeline with timing diagram. [3+5]
6. Describe the procedure for floating point addition and subtraction with help of flowchart and example. [6]
7. Draw the flowchart of Booth's multiplication algorithm and multiply –7 × –10 using Booth's multiplication algorithm. [4+4]
8. Explain various mapping methods used in cache memory organization and compare each of them with example. [10]
9. Explain with block diagram of DMA controller. How DMA techniques is different from programmed Input-Output? [6+4]
10. Differentiate between tightly coupled multiprocessor and loosely coupled multiprocessor. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 instruction cycle state diagram with example. [6]
2. Write down the code to evaluate Y = (A - B/C)*[D + (E*G)] in three address, two address, one address and zero address instruction formats. [8]
3. Define addressing modes. Mention the different types of addressing modes and comparison between them. [2+6]
4. How address of micro instruction is generated by next address generator in control unit? Explain with suitable diagram. [8]
5. Explain four stage instruction pipeline and also draw a time-space diagram for four segments having six tasks. [10]
6. Explain the Booth's algorithm for multiplication. Multiply 10 × (-5) using Booth's multiplication algorithm. [5+5]
7. Comparison between restoring and non-restoring division algorithms with example. [6]
8. Define cache mapping techniques. Explain direct mapping technique with suitable diagram. Why replacement algorithm is necessary in associative mapping? Justify. [2+4+4]
9. Comparison between program I10, Interrupt driven I10 and direct memory access. Why data communication processor is required in an I10 organization. [8+2]
10. Discuss about hypercube interconnection network with example. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 PCI? Explain the design goals and performance metrics for a computer system regarding its organization and architecture. [1+5]
2. Write the arithmetic statement Y=(W+X)*(Y-Z) using Zero, One, Two and Three address instruction format. [8]
3. Explain the different types of addressing modes and compare each of them. [8]
4. Explain block diagram of micro-programmed control organization. Describe various fields in micro-instruction format with diagram showing different fields. [4+6]
5. Describe the hazard in a pipeline. Explain the different types of hazards. How can these be overcome? [2+4+2]
6. Write an algorithm of booth multiplication. Perform 8×4 using booth multiplication algorithm. [10]
7. Differentiate between restoring division and non-restoring division and non-restoring division algorithm. [6]
8. Describe cache operation in briefly. Explain about associative mapping technique. Give reasons why replacement algorithm is not required in direct mapping technique. [2+6+2]
9. Explain the DMA operation with block diagram. How does DMA have request over the CPU when both request a memory transfer? [8+2]
10. Discuss about tightly-coupled multiprocessor with block diagram. [4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

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

Subject: - Computer Organization and Architecture *(CT 603)*

- ✓ 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 computer architecture. Discuss the limitations of using single bus system to connect different devices. What does width of address bus represent in a system? [2+2+2]
2. Design an 2-bit ALU that can perform subtraction, AND, OR and XOR. [8]
3. Write a code for Y=(A+B)/C + D/(E*F) using three address, two address, one address and zero address instruction format. [8]
4. Differentiate hardwired and micro-programmed control unit. Draw and explain block diagram of micro-programmed sequencer for control memory. [10]
5. Derive expression showing speed up ratio equals number of segments in pipeline. Discuss in detail about data dependency problem that arises in pipelining along with its solution. [3+5]
6. Write an algorithm for non restoring division. Perform the 10/3 using restoring division algorithm. [3+7]
7. Multiply -6×-11 using Booths Multiplication algorithm. [6]
8. Write characteristics of memory system? Suppose main memory has 64 blocks and cache memory has 8 blocks when 10 blocks of main memory are used, show how mapping is performed in direct mapping technique. [4+6]
9. Explain three reasons behind the requirement of I/O interfaces. Why memory address spaces are reduced memory mapped I/O ? Describe DMA controller with suitable block diagram. [3+2+5]
10. Explain inter-processor synchronization with example. [4]

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 instruction cycle state diagram with interrupt. [6]
2. Write codes using 3, 2, 1 and 0 address instruction formats to perform given operation. [8]
   $X = (A*B/C) - (D+E/F)$
3. Describe various fields in microinstruction format. Explain about the sequencing techniques used in microinstruction format with necessary diagram. [10]
4. Explain microinstruction format showing all the fields in detail. Write symbolic microprogram for fetch cycle. [10]
5. Explain arithmetic pipeline with an example of 4 segments. Describe different types of array processing. [6+4]
6. Write an algorithm flow chart and hard ware design of restoring division with example. [10]
7. Draw a flow chart for floating point multiplication algorithm. [4]
8. Explain about associative mapping technique. Give reasons why replacement algorithm is required in associative mapping technique? [8]
9. Explain the block diagram of DMA controller and also explain how DMA is used to transfer data from peripheral. [10]
10. Differentiate between tightly coupled multiprocessors and loosely coupled multiprocessors. [4]

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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.*

Feb 2075

1. Explain instruction cycle state diagram with interrupt. [6]
2. Write a code for Y = A/(B+C) + (D+E)*F using three address, two address, one address and zero address instruction format. [8]
3. Explain different types of data manipulation instructions with examples. [10]
4. Why is micro-programmed control unit more flexible as compared to hardwired control unit? Explain the sequencing technique used in control memory. [10]
5. Explain the function of four segment pipeline and also draw a space diagram for four segment pipeline with example. [10]
6. Write an algorithm for division of floating point number. [4]
7. Explain Booth algorithm of multiplication with hardware implementation diagram and multiply-10×6. [10]
8. Explain major characteristics of memory. Explain LRUC (Least Recently Used) replacement policy with example. [8]
9. Why I/O processor is necessary in an input-output organization? Explain about DMA control with necessary diagram. [10]
10. Design for 4×4 omega switching network and show the switch setting required to connect input 3 to output 1. [4]

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37 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 mean by interconnection structure? Explain different types of interconnections indeed required in Computer Architecture. [2+4]
2. Write a code for $Y = A*(B+D/C)+(G*E)/F$ using three addresses, two address, one address and zero address instruction format. [8]
3. Following instructions are given: [10]

   i) LDA 2000H
   ii) MVI B, 32H
   iii) STAX D
   iv) MOV A, B

   Which addressing modes are used in the above instructions? Explain briefly about them.
4. Explain microinstruction format used in microprogramming Control unit and write micro program for fetch cycle. [6+4]
5. Explain in detail how the arithmetic pipeline increases the performance of a system. [7]
6. "RISC has the ability to use efficient instruction pipeline". Justify the statement. [3]
7. Explain signed binary division algorithm. Use the non-restoring division algorithm to devide 15 by 4. [8]
8. Explain floating point addition and subtraction algorithm with example. [6]
9. Describe how set associative mapping combines the feature of direct and associated mapping technique. Explain different write policy techniques in cache memory. [5+3]
10. Why input-output processor is needed in an input-output organization? How does a computer know which device issued the interrupt; if multiple devices, how does the selection take place? [5+5]
11. Describe how the multiprocessor systems increase the performance level and reliability. [4]

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 computer architecture and computer organization. How can we maintain a performance balance between processor and memory? Discuss the limitations of using single bus system to connect different devices in any given system. [2+2+2]
2. What do you mean by instruction format? Write codes for given operation using 3-,2-,1- and 0- address instruction format. [4+8]

   X=(A-B*F)*C+D/E
3. Differentiate between RISC and CISC. [6]
4. What factors cause micro-programmed control unit to be selected over hardwired control unit. Explain with relevant block diagram, how address of control memory is selected in micro-programmed control unit. [3+7]
5. Describe Flynn's classification. Explain control pipeline hazard and its solutions. [4+6]
6. Explain Booth's multiplication hardware algorithm with diagram. Multiply -5×-9 using Booth's multiplication algorithm. [5+5]
7. Draw the flowchart for division of floating point numbers. [4]
8. Draw the memory hierarchy. Explain direct cache mapping with its merits and demerits. [2+6]
9. Differentiate between Isolated I/O and Memory-mapped I/O. Describe DMA controller with suitable block diagram. [4+6]
10. Discuss about inter process synchronization with the suitable mechanism? [4]

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36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 computer architecture and computer organization. Explain the computer functions with different cycles. [3+3]
2. Write a code for Y = (A+B)*(C+D)+G/E*F using three address, two address one address and zero address instruction format. [8]
3. Mention the different types of addressing mode and compare each other. [10]
4. Explain the address sequencer with the help of a block diagram. Explain about microinstruction format in detail. [5+5]
5. Define pipeline and explain its types. Describe different pipeline hazards with example. [4+6]
6. Draw the flowchart for restoring division method. [4]
7. Explain Booth multiplication algorithm. Multiply -6×12 using Booths algorithm. [4+6]
8. Draw the memory hierarchy. Explain Associative Cache Mapping with example. [2+6]
9. What are the different types of priority interrupt? Explain the communication between CPU and IOP with necessary block diagram. [4+6]
10. Explain about multiprocessor and multiprocessing in brief. [4]

01 / 10

36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

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

Subject: - Computer Organization Architecture *(CT603)*

- ✓ 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 major differences between computer architecture and computer organization? What does the width of data bus and address bus represent in a system? Why is bus hierarchy required? [2+2+2]
2. Explain the general organization of register in CPU. Describe the operation of LD (load) instruction under various addressing modes with syntax. [6+4]
3. What are the different types of instructions? How can you perform X = (A+B) × (C+D) operation by using zero, one, two and three address instruction format. Assume A, B, C, D, X are memory address. [3+5]
4. What is address sequencing? Explain the selection of address for control memory with its block diagram. [3+7]
5. Explain the Arithmetic pipeline and instruction pipeline with example. [10]
6. Draw the flowchart for floating point Division. [4]
7. Design a booth multiplication algorithm hardware. Multiply 5 and -6 using booth multiplication algorithm. [4+4]
8. Explain cache organization. Explain the cache mapping techniques with example. [4+6]
9. Highlight the role of I/O interface in a computer system. Describe the drawbacks of programmed I/O and interrupt driven I/O and explain how DMA overcomes their drawbacks. [4+6]
10. How can multiprocessor be classified according to their memory organization? Explain. [4]

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37 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 Bus Interconnection? What are the driving factors behind the need to design for performance? [2+4]

2. Explain Instruction Format with its types? Illustrate the code to evaluate to evaluate: Y = (A+B) * (C+D) using three address, two address, one address and zero address instruction formats. [2+6]

3. Describe the instruction cycle state diagram? Design a 2-Bit ALU that can perform addition, AND, OR operations. [3+3]

4. Explain the organization of a control memory. Discuss the microinstruction format with the help of a suitable example. [4+6]

5. Discuss about parallel processing? How parallel processing can be achieved in pipelining, explain it with time-space diagram for four segments pipeline having six tasks. [4+6]

6. Write down the detail algorithm of Booth Multiplication. Illustrate the multiplication of (9) and (-3) using 2's complement method. [5+5]

7. What is Memory Hierarchy and why it is formed in computer system? Explain the Direct cache memory mapping technique using organization diagram and appropriate example. [2+6]

8. What are the functions of I/O Module? What is the purpose of priority interrupt; explain priority interrupt types with key characteristics. [3+7]

9. Differentiate the following [4x3]

   a. RISC and CISC
   b. Restoring and Non-Restoring Division
   c. Crossbar Switch and Multistage Switching Network

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01 /10

36 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 the interconnection of CPU with Memory and I/O devices along with different operations over them. [3+3]
2. Write down the Y = A/B+(C×D) + F(H/G) equation in three address, two address, one address and zero address instruction. [8]
3. Mention the different types of addressing modes. Compare each of them with algorithm as well as advantages and disadvantages. [10]
4. Differentiate between hardwired and micro-programmed control unit. How does a sequencing logic work in micro-programmed control unit to execute a micro-program? [4+6]
5. Explain the arithmetic pipeline and instruction pipeline with example. [10]
6. Explain the non-restoring division along with its algorithm, flowchart and example. [8]
7. Explain the Booth algorithm and multiply Y = 8×9 using Booth algorithms. [6]
8. Mention the characteristics of computer memory. Differentiate between associative mappings and set associative mapping with example. [3+5]
9. How does DMA overcome the problems of programmed I/O and interrupt-driven I/O techniques? Explain. [5]
10. Why IOP is use in I/O organization? Explain. [5]
11. Explain the characteristics of multiprocessors. [4]

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37 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Ashad

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

Subject: - Computer Organization and Architecture *(CT603)*

- ✓ 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 performance balance and why is it required? Explain different elements of bus design. [6]
2. Define the addressing mode and explain the different types of addressing modes with example. [10]
3. What are the stages of ALU design? Explain with the example of 2-bit ALU performing addition, subtraction, OR and XOR. [8]
4. What are the differences between hardwired implementation and micro-programmed implementation of control unit? Explain with steps involved when you are designing micro-program control unit. [4+6]
5. What is instruction hazard in pipeline? What is the four segment instruction pipeline? Explain with example. [2+8]
6. How division operation can be performed? Explain with its hardware implementation. [10]
7. Draw a flowchart of floating point subtraction. [4]
8. What are the major differences between different cache mapping techniques? Suppose main memory has 32 blocks and Cache memory has 8 blocks when 10 blocks of main memory are used, show how mapping is performed in direct mapping technique. [6+2]
9. Differentiate between programmed I/O, interrupt-driven I/O and direct memory access (DMA). [10]
10. Explain the interprocessor synchronization with example. [4]

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