32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

Subject: - Digital Signal Processing *(EX753)*

- ✓ 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 are the applications of digital signal processing? Consider the analog signal, $x(t) = 2\cos 3000\pi t + 3\sin 4000\pi t + 7\cos 6000\pi t$. If sampling rate is 8000 samples per second and quantized at 8 bits, find: [2+5]
   i) Discrete values at any two points
   ii) Quantization errors at those points
2. Explain the properties of LTI systems with suitable examples. [8]
3. Find inverse Z-transform of: [5]

   $X(z) = (z^4 + 2z^3 - z + 4)/(z^2 - 1.5z - 1)$, ROC: $|z| < 0.5$
4. State and prove convolution property of z-transform. Describe causality and stability of system in terms of ROC with suitable examples. [1+3+3]
5. Find the linear convolution of $x_1[n] = \{1,1,1\}$ and $x_2[n] = [2,2,2]$ using circular convolution method. [5]
6. How fast is FFT? Use the FFT Algorithm to compute IDFT of a sequence given by $X(k) = \{6, -2+2j, -2-2-2j\}$ [2+6]
7. Plot Magnitude Response (not to the scale) of the system described by difference equation. $y[n] - 0.4y[n-1] + 0.25y[n-2] = x[n] + 0.5x[n-1]$ [7]
8. Compute Lattice coefficients and draw Lattice structure for given IIR system

   $H(z) = 1/(1 - 0.525z^{-1} + 0.6125z^{-2} + 0.3z^{-3})$. Also check the stability of given system. [4+2+1]
9. Design a low pass digital filter by Bilinear Transformation method to an approximate Butterworth filter, if passband edge frequency is 0.24 π radians and maximum deviation of 1 dB below 0 dB gain in the passband. The maximum gain of -14.9 dB and frequency is 0.57 π radians in stopband, consider sampling frequency 0.5 Hz. [12]
10. Define Gibbs phenomena in FIR filter design. Explain the steps to design the FIR filter using Kaiser Window. [2+7]
11. Explain Bit Serial Arithmetic in Digital Signal Processor. [5]

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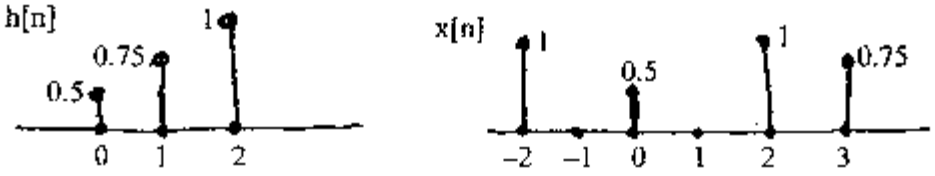
32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

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

Subject: - Digital Signal Processing *(EX753)*

- ✓ 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 DSP? Explain the significance of A/D and D/A conversion in DSP. [3+4]
2. Determine whether the following systems are (a) casual (b) linear. [4]
   a) $y[n] = x[n] - 3x[n-1]$
   b) $y[n] = x[n+1] + 4x[n]$
3. Find the output sequence y[n] and verify it for [7]



4. Explain the properties of ROC of z-transform. [5]
5. Find inverse Z-transform of [6]
   $X(z) = (z^4 + z^3 - 3z + 5) / (z^2 - 1.5z - 1)$, ROC: $|z| < 0.5$
6. Perform circular convolution of: [5]
   $x_1[n] = [1\ 2\ 0\ 3\ 4]$, $x_2[n] = [2\ -1\ 2\ -1\ 2]$
7. Find DFT for {1, 1, 2, 0, 1, 2, 0, 1} using FFT and plot the spectrum. [8]
8. Plot Magnitude Response (not to the scale) of the system described by difference equation. [6]
   $y[n] - 0.3y[n-1] + 0.225y[n-2] = x[n] \quad 0.4x[n-1]$
9. Compute Lattice coefficients and draw lattice structure for given IIR system $H(z) = 1/(1 - 0.3z^{-1} + 0.5z^{-2} + 0.25z^{-3})$. [6+2]
10. Design a low pass digital filter by Bilinear Transformation method to an approximate Butterworth filter, if passband edge frequency is 0.25 π radians and maximum deviation of 1 dB below 0 dB gain in the passband. The maximum gain of –15 dB and frequency is 0.55π radians in stopband, consider sampling frequency 0.5 Hz. [9]
11. Explain about the Gibb's phenomenon. Explain Remez Exchange algorithm with flowchart. [1+8]
12. Explain the Bit-serial arithmetic with suitable diagram. [6]

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32 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

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

Subject: - Digital Signal Processing *(EX 753)*

- ✓ 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 Digital Signal Processing with its advantages and applications. [7]
2. Determine whether the following systems are (a) casual (b) linear and (c) time invariant. [5]
   a) $y(n) = \log_{10}[\{x(n)\}]$
   b) $y(n) = x(-n-2)$
3. Illustrate the significance of convolution summation in digital signal analysis. Find the output sequence y(n) if: [2+4]
   $h(n) = \{1,1,1\}$ and $x(n) = \{1, 2,2,3,4\}$
4. Define region of convergence with its properties. [5]
5. Determine the causal signal x[n] if its z-transform X(z) is given by $X(z) = \frac{1+2z^{-1}+z^{-2}}{1+4z^{-1}+4z^{-2}}$. [6]
6. Compute the 8 point DFT of the sequence $x(n) = \{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$ using radix-2 DIF algorithm. [8]
7. How the computational complexity of FFT is reduced compared to DFT? Explain with suitable derivations. [5]
8. Show how to use a lattice structure to implement the following all pass filter $H(z) = \frac{1+0.4z^{-1}-1.2z^{2}+2z^{3}}{2-1.2z^{-1}+0.4z^{-2}+z^{-3}}$. [8]
9. What are the Round-off effects in Digital Filters? Explain Limit Cycle Oscillation with an example. [2+4]
10. Design a digital low pass butterworth filter by applying bilinear transformation technique for the given specifications. [9]
    Pass band edge = 120 Hz
    Pass band attenuation = 1 dB
    Stop band edge = 170 Hz
    Stop band attenuation = 16 dB
    Assume sampling frequency of 256 Hz.
11. Draw the flow chart of Remez exchange algorithm for FIR filter design. [4]
12. Explain window method of FIR filter design. [5]
13. Explain Bit-serial arithmetic implementation. [6]

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division.
2069 Bhadra

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

Subject: - Digital Signal Processing *(EG773EX)*

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

1. What is a convolution summation? Derive its equation and explain it. [1+3]
2. Why do you need different equation? Consider an LTI system with impulse response $h[n] = (1/2)^n u[n]$. Determine $y[n]$, the output of this system, if the input is $x[n] = Ae^{j\omega/2}$ [2+4]
3. An LTI system is characterized by the system function: [6]

$$H(z) = \frac{(1-1/2\,Z^{-2})}{(1-1/2\,Z^{-1})(1-1/4\,Z^{-1})} \quad |Z| > 1/2$$

   Determine the impulse response of the system.

4. Explain how the poles and zeros of H(z) affect the stability and the gain response of a system. Given H(z) for a digital signal processing system with the following difference equation: $y[n]=x[n]+1.21x[n-2]-0.8y[n-1]$ [3+3+2+4]
   Plot its poles and zeros on the Z-plane, determine whether it is causal and stable and sketch its gain response.
5. For the given system, $H[z] = \frac{1}{1-0.9Z^{-1}+0.64Z^{-2}-0.576Z^{-3}}$ [8]
   Compute and draw the lattice structure.
6. Why do you need anti-aliasing filter? Describe the effect of sample and hold circuit at the input of the A/D conversion of Discrete Time Processing of continuous time signal. [2+5]
7. Why is Remez exchange algorithm is generally considered superior to the windowing method as a design technique for digital FIR filters? Explain about Remez exchange algorithm with suitable derivation and flowchart. [3+10]
8. Design a low pass discrete time filter by applying impulse invariance to an approximate Butterworth continuous time filter, if passband frequency is 0.25π radians and maximum deviation of 0.5 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is 0.55π radians in the stopband. Consider sampling frequency 1 Hz. [12]
9. Define one's complement, 2's complement and sign magnitude representation of numbers. Represent -192/220 in 8 bit 1's complement and 2's complement form. [3+4]
10. Find the FFT of the signal $x[n]=(3.6, 5.5, 3.3, 6.3)$ [5]

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3I TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division.
2069 Bhadra

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

Subject: - Digital Signal Processing *(EG773EX)*

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

1. What is a convolution summation? Derive its equation and explain it. [1+3]
2. Why do you need different equation? Consider an LTI system with impulse response $h[n] = (1/2)^n u[n]$. Determine $y[n]$, the output of this system, if the input is $x[n] = Ae^{jn\pi/2}$ [2+4]
3. An LTI system is characterized by the system function: [6]

$$H(z) = \frac{(1-1/2\,Z^{-2})}{(1-1/2\,Z^{-1})(1-1/4\,Z^{-1})} \quad |Z| > 1/2$$

Determine the impulse response of the system.

4. Explain how the poles and zeros of H(z) affect the stability and the gain response of a system. Given H(z) for a digital signal processing system with the following difference equation: y[n]=x[n]+1.21x[n-2]-0.8y[n-1] [3+3+2+4]
Plot its poles and zeros on the *Z*-plane, determine whether it is causal and stable and sketch its gain response.

5. For the given system, $H[z] = \frac{1}{1-0.9Z^{-1}+0.64Z^{-2}-0.576Z^{-3}}$ [8]
Compute and draw the lattice structure.

6. Why do you need anti-aliasing filter? Describe the effect of sample and hold circuit at the input of the A/D conversion of Discrete Time Processing of continuous time signal. [2+5]
7. Why is Remez exchange algorithm is generally considered superior to the windowing method as a design technique for digital FIR filters? Explain about Remez exchange algorithm with suitable derivation and flowchart. [3+10]
8. Design a low pass discrete time filter by applying impulse invariance to an approximate Butterworth continuous time filter, if passband frequency is 0.25π radians and maximum deviation of 0.5 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is 0.55π radians in the stopband. Consider sampling frequency 1 Hz. [12]
9. Define one's complement, 2's complement and sign magnitude representation of numbers. Represent -192/220 in 8 bit 1's complement and 2's complement form. [3+4]
10. Find the FFT of the signal x[n]=(3.6, 5.5, 3.3, 6.3) [5]

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division.
2069 Bhadra

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

Subject: - Digital Signal Processing *(EG773EX)*

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

1. What is a convolution summation? Derive its equation and explain it. [1+3]
2. Why do you need different equation? Consider an LTI system with impulse response $h[n] = (1/2)^n u[n]$. Determine y[n], the output of this system, if the input is $x[n] = Ae^{j\pi n/2}$ [2+4]
3. An LTI system is characterized by the system function: [6]

$$H(z) = \frac{(1-1/2\,Z^{-2})}{(1-1/2\,Z^{-1})(1-1/4\,Z^{-1})} \quad |Z| > 1/2$$

Determine the impulse response of the system.

4. Explain how the poles and zeros of H(z) affect the stability and the gain response of a system. Given H(z) for a digital signal processing system with the following difference equation: y[n]=x[n]+1.21x[n-2]-0.8y[n-1] [3+3+2+4]
Plot its poles and zeros on the Z-plane, determine whether it is causal and stable and sketch its gain response.
5. For the given system, $H[z] = \frac{1}{1-0.9Z^{-1}+0.64Z^{-2}-0.576Z^{-3}}$ [8]
Compute and draw the lattice structure.
6. Why do you need anti-aliasing filter? Describe the effect of sample and hold circuit at the input of the A/D conversion of Discrete Time Processing of continuous time signal. [2+5]
7. Why is Remez exchange algorithm is generally considered superior to the windowing method as a design technique for digital FIR filters? Explain about Remez exchange algorithm with suitable derivation and flowchart. [3+10]
8. Design a low pass discrete time filter by applying impulse invariance to an approximate Butterworth continuous time filter, if passband frequency is 0.25π radians and maximum deviation of 0.5 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is 0.55π radians in the stopband. Consider sampling frequency 1 Hz. [12]
9. Define one's complement, 2's complement and sign magnitude representation of numbers. Represent -192/220 in 8 bit 1's complement and 2's complement form. [3+4]
10. Find the FFT of the signal x[n]=(3.6, 5.5, 3.3, 6.3) [5]

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Bhadra

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

Subject: - Digital Signal Processing

- ✓ 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. If the input sequences x[n] are [–3] = 0.75, x[–2] = 0.5, x[0] = 1, x[1] = 0.75, x[3] = –0.5, and h[n] as h[0] = 0.25, h[1] = 0.5, h[2] = 0.75 and h[3] = 1 then calculate and plot the output response y[n]. Check your results. [7]
2. Explain the use of difference equation. Draw the block diagram for given system. y(n)-3y(n–1) + 4y(n–2) + 5y(n–3) = 2x(n) + 4x(n–1) –7x(n–2) + 3x(n–3). [2+6]
3. Explain partial fraction expansion method to calculate inverse Z– transform with suitable example. Why the inverse Z– transform calculation is required? [5+2]
4. For a system with complex conjugate zeros at 0.1 ± j0.4 and 0.3± j0.8, and complex conjugate pole at 0.2 ± j0.9, draw magnitude and phase response of the system. [12]
5. What do you mean by dead bands? Explain it with derivations and suitable example. [2+5]
6. Calculate and draw the lattice structure of given FIR filter. [7]

   $H(z) = 1 + 0.5z^{-1} + 0.4\,z^{-2} + 0.55z^{-3} + 0.87z^{-4}$
7. How can you represent numbers? Explain different types of errors. [3+5]
8. Explain about optimal method algorithm with necessary derivation and flow chart. [8]
9. Design a low pass discrete time filter by applying impulse invariance to an approximate Chebyshev type I filter, if pass band frequency is 0.2π radians and maximum deviation of 1dB below 0dB gain in the passband. The maximum gain of –15dB and frequency is 0.3π radians in the stopband, consider sampling frequency of 1 Hz. [12]
10. Find the DFT of the signal x[n] = (3.2, 4.7, 5.8, 6.9) [4]

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Mangsir

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

Subject: - Digital Signal Processing

- ✓ 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 stability. Explain it with suitable derivations and examples. (2+4)

2. Define LTI system. Explain any four properties of LTI systems with suitable examples. (2+5)

3. Why difference equation is required? Draw the block diagram for given system. $y(n)=3y(n-1)-4y(n-2)+2y(n-3)-4x(n)+5x(n-1)-6x(n-2)$ (2+5)

4. Given a system with complex conjugate zeros at $0.3 \pm j0.7$ and $0.2 \pm j0.5$, and complex conjugate poles at $0.8 \pm j\ 0.6$. Draw the diagram in z-plane and plot the magnitude response of the system. (3+8)

5. What is inspection method for finding inverse z-tranform? Explain it with suitable example. (2+5)

6. Compute and draw the lattice structure of given FIR filter. (7)
   $H(z) = 1 + 0.3\ z^{-1} + 0.6\ z^{-2} + 0.2\ z^{-3} + 0.7\ z^{-4}$

7. Define One's complement, 2's complement and sign magnitude representation of numbers. Represent 152/177 in 8 bit 2's complement form. (4+2)

8. Explain about Remez exchange algorithm with suitable derivation and flow chart. (8)

9. Design a low pass discrete time filter by applying impulse invariance to an approximate Butterworth continuous filter, if passband frequency is 0.2π radians and maximum deviation of 1dB below 0dB gain in the passband. The maximum gain of -15dB and frequency is 0.3π radians in the stopband, Consider sampling frequency 1 Hz. (16)

10. Find the FFT of the signal x[n] = (3, 2.5, 1.6,3.2) (5)

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

Exam.	Regular		
Level	BE	Full Marks	40
Programme	All (Except B. Arch)	Pass Marks	16
Year / Part	IV / II	Time	1 ½ hrs.

Subject: - Engineering Professional Practice *(CE752)*

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

1. What is social change? What are the factors causing social change? Describe the role of technology in social change. [8]
2. What is profession? Describe the code of ethics for engineers. Explain tort and liability. [8]
3. What is contract? Explain tendering process and contract agreement. Describe essential elements of contract. [8]
4. "Engineering profession always emphasizes on safety first in engineering delivery" Describe with typical examples. [8]
5. Write short notes on: (any four) [4×2]
   a) Impact of computers in society
   b) Labour and business law
   c) Professional institutions
   d) Conflict and dispute management
   e) Building codes and by laws

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

Subject: - Engineering Professional Practice *(CE752)*

- ✓ 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) Discuss on the impact of technology into the society. [4]
   b) Discuss about the engineering practice in Nepal. [4]
2. a) How does a moral dilemma occur? What are the bases to solve moral dilemma? [4]
   b) What are the codes of ethics for engineers according to Nepal Engineering Council? [4]
3. Sub-contractor Mr. A was severely beaten by his labors because he had not paid them for more than seven months. During investigation it was revealed that client did not pay to the contractor and contractor did not pay to the subcontractor. The client didn't pay because consultant did not submit the necessary bill report. The consultant says the work is defective and quality of the work is not as per specifications. While the contractor does not agree because it was not informed on site and blames that the consultant wants covert money. Discuss the case considering contract law, tort, liability and negligence whatsoever applicable. [8]
4. a) Describe briefly the elements of contract? [4]
   b) Define Tender, what are the essential informations to be given in the Tender Notice? [4]
5. a) Differentiate Patent right and Trademark right. Write down the characteristics of company business organization. What are the sources of business law in Nepal? [4]
   b) How the PPP model help in any development activities? What is its significance in a developing country like Nepal? [4]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	All (Except B.Arch.)	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

Subject: - Engineering Professional Practice ***(CE752)***

- ✓ 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 society necessary for engineers? What are the roles that an engineer can play in the society? [5]
   b) What are the job description of a fresh engineer that can been appointed in a public organization. [5]
2. a) What do you understand by ethics? Why are code of conducts required for professionals? [5]
   b) What are the detailed duties of an engineer in the profession? [5]
3. a) Define tender. Explain the purpose of tender. List the essential informations to be contained in the tender notice. [5]
   b) What kind of liability that engineers most suffer from? Explain. [5]
4. Globalization has been an eye open opportunity for developing country. It helps transfer technology and development process but also a culture that loosens confidence on nationality. How can people work for development within their own culture with others as guide? Explain. [10]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2069 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

Subject: - Engineering Professional Practice *(EG766CE)*

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

1. a) What are the differences between community and society? Briefly describe the theories of social change. [2+3]
   b) What are the impacts of technology and its changes on society in this 21st century? [5]
2. a) How do you describe engineering profession? Explain the significant features of profession. [2+3]
   b) What are Factors affecting the morale of a professional engineer? Describe in brief to justify and satisfy yourself in the context of Nepal, to have and maintain the professional and moral ethics. [2+3]
3. a) Recently Nepal Engineer's Association (NEA) celebrated its golden jubilee years 2069. In this regard, are you satisfied with role played by NEA in enhancing and upgrading engineering profession and welfare of the engineering till date or not? Justify your thoughts. [5]
   b) Elaborate the differences between void and voidable contract. Explain briefly about general conditions of contract and its essential contents. [2+3]
4. a) Explain tort. What are the reasons behind introducing tort law in the society? How do you distinguish copyright with paten right? [1+1+3]
   b) Differentiate between public limited company and private limited company. [5]
5. Write short notes on: [2.5×4]
   a) Impact of engineering profession
   b) Nepal Engineering Council
   c) Benefits of prequalification
   d) Trade mark

OR

Recently Samsung Korea was asked to pay compensation of billions of dollar to Apple Inc. by an American court. What do you know about this case? Are you satisfied with the verdict? Express your opinion clearly. [10]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2068 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BEI, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

Subject: - Engineering Professional Practice

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

1. a) Write five most important rules of conduct for a professional engineer considering code of ethics prevalent in Nepal. [4]

   b) In a telecommunication project, you are the engineer from client's side. The contractor requests you for preparing his final bill of works done, assuring you to pay a handsome amount for your effort, as his engineer recently quit the job. How should you respond? Explain your arguments. [6]

2. a) After being an engineer, what type of business concern should you establish if your team comprising of five engineers wish to be a design/supervision consultant in Nepal and why? Write disadvantages of public limited company. [5]

   b) Number of severe cracks appeared in a building designed by an engineer and also approved by the Municipality within one year of its construction. The house owner approached you for your suggestion about the course of action he should take to get remedy. Explain your suggestion in view of liability and negligence. [5]

3. a) Assume yourself as a recently appointed engineer-in-charge of a newly established brick factory. How do you regulate working hours and overtime hours? What facilities should you provide to the laborers considering the requirements of prevailing labor law on Nepal? [5]

   b) What is negligence? Explain vicarious liability. [5]

4. What is copyright and patent right? Discuss their importance. Explain major features of copyright Act in Nepal. [2+4+4]

5. Write short notes on any two. [2×5]

   a) Theories of social change
   b) Role of engineers in social development
   c) Nepal Engineering Council
   d) IT specific crimes in the society

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2067 Mangsir

Exam.	Regular / Back		
Level	BE	Full Marks	40
Programme	BCE, BEL, BEX, BCT, BME	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

Subject: - Engineering Professional Practice

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

1. a) Define society. Describe how engineers can contribute in the development of the rural society. [1+4]
   b) Differentiate between copy right and patent right. [5]
2. a) Define profession. Describe the characteristics of profession. [1+4]
   b) How do you judge the ethical standard of engineers in Nepal? Describe the role of Nepal Engineering Council in maintaining ethical standard of Nepalese Engineers. [2+3]
3. a) Define contract. Describe any four importance elements of contract. [1+4]
   b) Explain the detailed duties and liabilities of Designers/Professionals. [2+3]
4. During quality control visit in a remote village, it has been found that a building is being constructed on the bank of a river, and it will be damaged due to flood. Approximately 20% of the construction was completed. The survey was done by your friend with the consent of the local people. However, the quality of construction was as per specification. Your job is limited to control the quality of the building only. Discuss the case and recommend your views on whether to continue the construction or not. [10]
5. Write short notes on: (any four) [2.5×4]
   a) Conflict theory of social change
   b) Code of conduct
   c) Objectives of Nepal Engineers Association
   d) Welfare provisions in labor law
   e) Characteristics of Private Ltd. Company
   f) Trademark

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05 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Baishakh

Exam.	Back		
Level	BE	Full Marks	40
Programme	All	Pass Marks	16
Year / Part	IV / II	Time	1½ hrs.

Subject: - Engineering Professional Practice

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

1. a) Define social change and its theories. Discuss on the various roles to be played by the Engineers in the transformation of Nepalese society towards 'New Nepal'. [1+4]
   b) What do you mean by intellectual property right? Differentiate between 'Copyright' and 'Patent right'. [2+3]
2. a) What is profession? Do you agree with the statement 'Engineers are professional'? Give reasons. [1+4]
   b) Define ethics. Describe 'Utilitarianism' theory and 'Distributive Justice' theory in making right decision. [1+4]
3. a) What do you mean by professional association? How do you evaluate the role of Nepal Engineers' Association as a professional association of Nepalese Engineers? Discuss. [2+3]
   b) Define and discuss on various conditions regarding 'Offer and Acceptance' which is an essential element of contract. Name other essential aspects of contract. [3+2]
4. a) List the information which should customarily appear in an advertisement for tenders. [5]
   b) Define 'Employees' and 'Workers' as per labor act in Nepal. Discuss "health and safety" of labors covered by Labor Act. [1+4]
5. You are appointed as a consulting engineer in a project where your best friend is supplying material. The community people knew the fact and asked you to quit the job because you cannot control the quality of the material. How do you cope with this situation? Discuss ethical aspects related to this situation. [10]

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

Subject: - Wireless Communication *(EX751)*

- ✓ 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.*

33

1. Differentiate between 2G and 3G with examples of appropriate technologies used. Explain the terms prioritized handoff and cell dragging. [4+2]
2. State the difference between large scale and small scale propagation model. Explain the different propagation mechanisms which have impact on propagation in mobile environment. [3+6]
3. A BS transmitter has a power output of 10 watts operating at a frequency of 250 MHz. The transmitter is connected by 20 m of an RF coaxial cable, which has a loss of 3-dB/100 m specification, to an antenna that has a gain of 9dBi. The receiving antenna is 25 km away and has a gain of 4 dBi. There is negligible loss in the receiver feeder line, but the receiver is mismatched; the receiving antenna and feeder cable are designed for 50 ohm impedance. The receiver impedance loss due to mismatch is of about 0.2 dB. Calculate the power delivered to the receiver, assuming free-space propagation. [8]
4. What do you understand by RACK receiver? Explain the working of a M branch RACK receiver. [8]
5. What are the different characteristics of speech signals? How they are used in designing of coders? [8]
6. What is self jamming problem in CDMA? Explain the operation of FHMA with the help of block diagram. Explain any two hybrid spread spectrum multiple access technique along with their advantage and disadvantage. [2+4+6]
7. Explain the working of all traffic and control channels used in GSM. [8]
8. Explain with block diagram the concept of Maximum Likelihood Sequence Estimation. Define time diversity. Explain two implementations of time diversity. [6+1+5]
9. Write short notes on: [3×3]
   a) WiMax
   b) LTE
   c) Viterbi decoding algorithm

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31 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	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX751)*

- ✓ 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 evolution of cellular radio 1G to 3G. [4]
2. Prove that for a hexagonal geometry the co-channel reuse ratio is given by $Q = \sqrt{3N}$; Where $N = i^2 + j^2 + ij$. A cellular service provider decides to use a digital TDMA scheme which can tolerate a Signal-to-Interference Ratio of 15 dB in the worst case. Find the optimal value of N for [4+4]
   a) Omni directional antennas
   b) 120° Sectoring
   c) 60° Sectoring

   [Use path loss exponent of 4 and consider trunking efficiency]
3. Derive the expression for phase difference in two ray free space propagation model. [8]
4. A mobile is located 5 km away from a base station and a vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive cellular radio signals. The electric field at 1 km from the transmitter is measured to be 10^{-3} V/m. The carrier frequency used for this system is 900 MHz. [6]
   a) Find the length and effective aperture of the receiving antenna.
   b) Find the received power at the mobile using two ray ground reflection model assuming the height of the transmitting antenna is 50 m and the receiving antenna is 1.5 m above ground.
5. What is the difference between path loss and fading of signal? Explain time dispersion fading and its types. [2+6]
6. Explain the transmitter and receiver of OQPSK modulation. Discuss why $\pi/4$-QPSK is more preferred than OQPSK modulation. [5+2]
7. Why diversity is important in wireless communication system? Explain different types of diversity techniques. [2+6]
8. Explain the operation of formant vocoder. What are the characteristics of speech signal? [4+4]
9. Explain the terms Multiple access, Time Division CDMA (TCDMA) and Time Division Frequency Hopping as related to wireless communication system. [7]
10. What is a multiple access technique? Explain TDMA, CDMA and SDMA. [2+6]
11. What are the basic signal processing operations to be performed to convert a speech signal into a radio signal and back in GSM? Describe briefly. [8]

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10/16 1).

32 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	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX751)*

- ✓ 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 the evolution from 1G to 2G, 2.5G in the case of cellular network based on TDMA. [4]
2. Describe the techniques used for enhancing the capacity and coverage in cellular radio network. [8]
3. a) With appropriate expressions, distinguish between Rayleigh fading channel and Rician fading channel. [2]
   b) A wireless channel is characterized by the following power-delay profile: [6]

Power [dB]	0	-10	-20	-23
Delays [ns]	0	100	200	400

   Determine the root mean square (rms) delay spread and the 90% coherence bandwidth of the above channel. Is this channel flat fading or frequency selective fading for:
   i) An AMPS system with transmission bandwidth 30 kHz?
   ii) A GSM system with transmission bandwidth 200 kHz?
4. Explain any two outdoor propagation models used in mobile network environment. [3+3]
5. What are the parameters of mobile multipath channel? Explain. [7]
6. What is an OFDM? Generalize the modulation and demodulation technique of OFDM. [8]
7. a) Discuss and compare different types of antenna diversity technique. [4]
   b) Explain with block diagram the concept of Maximum Likelihood Sequence Estimation equalization. [4]
8. What is a channel coding? Explain types of linear predictive coder. [2+6]
9. a) Define near-far effect. Briefly describe any one hybrid spread spectrum multiple access technique which can mitigate the near-far problem. [2+2]
   b) What are the advantages of TDMA cellular system over FDMA cellular system? [4]
10. Explain the principle of FHMA. What do you mean by near-far effect in CDMA? How is it solved? Explain. [3+4]
11. What is GSM and CDMA standard? Explain the architecture of GSM. [4+4]

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

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

Subject: - Wireless Communication *(EX751)*

- ✓ 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 significant improvements introduced in the second, third and beyond third generation standards of cellular communication systems. [6]
2. Explain the difference between co-channel and adjacent channel interference. Prove that the co-channel reuse ratio is given by $Q = \sqrt{3N}$, where $N = i^2 + ij + j^2$ is the cluster size. If 20 MHz of total spectrum is allocated for a duplex (i.e. bidirectional) wireless cellular system and each simplex (i.e. one-way) channel has 25 KHz of bandwidth, find [3+4+3]
   a) The number of duplex channels, and
   b) The total number of channels per cell, assuming a cluster size of N = 4.
3. Explain indoor propagation models (any two). [8]
4. Determine the radio coverage range of a base station that transmits a RF signal at 150 W, given the receiver threshold level is –104 dBm. Assume that the path loss at the first meter is 15 dB in a mobile radio propagation condition. (Path loss exponent = 4) [6]
5. Discuss the principle of Orthogonal Frequency Division Multiplexing modulation scheme. Briefly explain different types of spread spectrum modulation techniques. [4+4]
6. What is diversity? Explain any two types of diversity techniques in detail. [2+6]
7. What is vocoder? Explain any two predictive coders. [2+6]
8. Define multiple access. What are the merits and demerits of Code Division Multiple Access? If a normal GSM time slot consists of 6 trailing bits, 8.25 guard bits, 26 training bits, and 2 traffic bursts of 58 bits of data, find the frame efficiency. [2+6+4]
9. Draw and explain the frame structure for GSM. Describe how various traffic and control channels are used while making a call in GSM system. [4+4]
10. Write short notes on: (any two) [6]
    a) Viterbi Decoding Algorithm
    b) Doppler Spread and Coherence Time
    c) GMSK Modulation Technique

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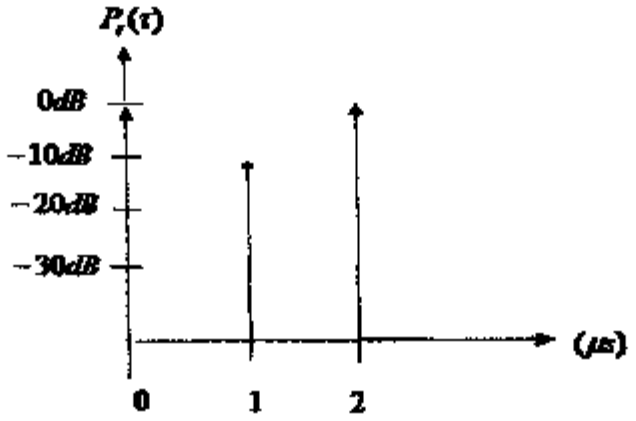
31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

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

Subject: - Wireless Communication *(EX751)*

- ✓ 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 evolution of wireless communication in terms of technology and worldwide market penetration. [6]
2. What is hand off? Explain its strategy used in GSM. [8]
3. Determine the propagation path loss for signal at 800 MHZ, with a transmitting antenna height of 30 m and a receiving antenna height of 2 m, over a distance of 10 km, using two-ray mobile point-to-point propagation model. How is it compared with that of free-space propagation path loss model? [4+4]
4. Define Doppler spread. Describe the types of small scale fading based on Doppler spread. Calculate the mean excess delay and rms delay spread for the multipath profile given below. Estimate the 90% and 50% coherence bandwidth of the channel. [4+4]



5. What are MSK and GMSK modulation techniques? Draw the block diagram of OFDM modulator and demodulator and explain them. [8]
6. Describe the fundamentals of equalization with respect to communication system? Explain with block diagram the function of Rake receiver. [4+4]
7. Why we need speech coding techniques? Explain the basic concept of VOCODER. [4+4]
8. What is multiple Access technique? Compare FDMA with CDMA. [2+4]
9. Draw the architecture of GSM and explain it. [8]
10. Write short notes on: [4×3]
    a) Rayleigh and Ricean fading distribution
    b) Regulatory issues in wireless systems
    c) Viterbi decoding algorithm

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34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

Subject: - RF and Microwave Engineering *(EX752)*

- ✓ 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 Formulas and Smith Charts are attached herewith.***
- ✓ *Assume suitable data if necessary.*

(40)

1. What are the advantages and disadvantages of microwaves over acoustic waves? [5] 4
2. What is admittance chart? A load impedance of $Z_L = 80+j100$ is connected to a microstrip transmission line. Find the size and placement of the matching stub. Use single stub shunt tuning short and open stubs. [2+8] 1+3
3. Define the use of S-parameters for three-port analysis. Define the term return loss and insertion loss. [5+2] 1
4. What are waveguide junctions? Describe the operational principles of magic tee based on s-parameters. [3+3] 2+1
5. What is density modulation? Describe the working principle of a multi-cavity klystron oscillator. [2+7] 2+5
6. Justify that a transistor having following S-parameters $S_{11} = 0.894 \angle -60.6°$, $S_{12} = 0.020 \angle 62.4°$, $S_{21} = 3.122 \angle 123.6°$ and $S_{22} = 0.781 \angle -27.6°$ is conditionally stable while designing an amplifier. Considering unilateral model calculate maximum gain. [5+5] 3+3
7. How can you implement low pass filter using micro-strip? How they are prototyped? [3+5] 2
8. Describe how standing waves and microwave powers are measured with VSWR meter and low power measurement. [2+8] 2+5
9. Write short notes on: (any three) [3×5] 2+4
   a) Dominant mode in waveguide
   b) Circulators
   c) LNA cavity device inserting loss method for filter designing
   d) Insertion loss method for filter designing

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Supplied Formula

$$K = \frac{1-|S_{11}|^2-|S_{22}|^2+|\Delta|^2}{2|S_{12}S_{21}|} \qquad \mu = \frac{1-|S_{11}|^2}{|S_{22}-S_{11}^*\Delta|+|S_{12}S_{21}|}$$

$$\Delta = S_{11}S_{22}-S_{12}S_{21} \qquad \Gamma_S = \frac{B_1 \pm \sqrt{B_1^2-4|C_1|^2}}{2C_1} \qquad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2-4|C_2|^2}}{2C_2}$$

$$R_L = \left|\frac{S_{12}S_{21}}{|S_{22}|^2-|\Delta|^2}\right| \qquad B_1 = 1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2 \quad C_1 = S_{11}-\Delta S_{22}^*$$

$$B_2 = 1+|S_{22}|^2-|S_{11}|^2-|\Delta|^2 \quad C_2 = S_{22}-\Delta S_{11}^*$$

$$C_L = \frac{(S_{22}-\Delta S_{11}^*)^*}{|S_{22}|^2-|\Delta|^2} \qquad G_{TU} = \frac{|S_{21}|^2(1-|\Gamma_S|^2)(1-|\Gamma_L|^2)}{|1-S_{11}\Gamma_S|^2|1-S_{22}\Gamma_L|^2}$$

$$R_S = \left|\frac{S_{12}S_{21}}{|S_{11}|^2-|\Delta|^2}\right| \qquad G_T = \frac{|S_{21}|^2(1-|\Gamma_S|^2)(1-|\Gamma_L|^2)}{|1-\Gamma_S\Gamma_{in}|^2|1-S_{22}\Gamma_L|^2}$$

$$C_S = \frac{(S_{11}-\Delta S_{22}^*)^*}{|S_{11}|^2-|\Delta|^2}$$

Supplied Formula

Design For Maximum Gain (Conjugate Matching)

$$\Gamma_{in} = \Gamma_S^*$$

$$\Gamma_{out} = \Gamma_L^*$$

$$G_{T\max} = \frac{1}{1-|\Gamma_S|^2}|S_{21}|^2\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2-4|C_1|^2}}{2C_1} \qquad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2-4|C_2|^2}}{2C_2}$$

$$B_1 = 1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2 \quad C_1 = S_{11}-\Delta S_{22}^*$$

$$B_2 = 1+|S_{22}|^2-|S_{11}|^2-|\Delta|^2 \quad C_2 = S_{22}-\Delta S_{11}^*$$

For Unilateral $S_{12} = 0, \Gamma_S = S_{11}^*$ and $\Gamma_L = S_{22}^*$

$$G_{TU\max} = \frac{1}{1-|S_{11}|^2}|S_{21}|^2\frac{1}{1-|S_{22}|^2}$$

$$R_S = \left|\frac{S_{12}S_{21}}{|S_{11}|^2-|\Delta|^2}\right| \qquad K = \frac{1-|S_{11}|^2-|S_{22}|^2+|\Delta|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22}-S_{11}^*\Delta|+|S_{12}S_{21}|} \qquad \Delta = S_{11}S_{22}-S_{12}S_{21}$$

34 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	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX752)*

- ✓ 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 formulas and Smith Charts are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Describe field equations and other related parameters of a rectangular waveguide in TM mode. Compare TE_{10} and TE_{20} in terms of cut-off frequency and dominant mode. [8+2]

2. Design a double stub matching network using three-eighths wavelength $\left(\frac{3\lambda}{8}\right)$ separation that match an antenna having load of 300+j300 Ohm connected to a 300 Ohm transmission line. [10] Justify your design.

3. What is bunching effect? Describe the working principle of a klystron oscillator. [2+8]

4. Using the given S-parameters $S_{11}=0.55\angle 150°$, $S_{12}=0.04\angle 20°$, $S_{21}=2.82\angle 180°$, $S_{22}=0.45\angle -30°$ and required assumptions, calculate maximum gains of this transistor amplifier for bilateral and unilateral modes. [10]

5. Draw a flow diagram to describe the design procedure of a microwave amplifier. Define the stability of an amplifier having $C_S=1.15\angle 10°$, $R_S=0.85$, $C_L=1.10\angle 80°$, $R_L=1.10$. [5+5]

6. How microwave measurements are different to low frequency measurements? Describe how static calorimeter works to measure power. [3+7]

7. Design a two-port network model and derive the required parameters. [10]

8. Write short notes (Any TWO) [2x5]
   a. Design procedures of microwave filters
   b. Microwave radiation hazards and safety practices
   c. Backward Wave Oscillator
   d. Merits of S-parameters in microwaves

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Supplied Formulas:

$$K=\frac{1+|\Delta|^2-|S_{11}|^2-|S_{22}|^2}{2|S_{12}||S_{21}|},\quad \Delta=(S_{11}S_{22})-(S_{12}S_{21}),$$

$$\mu=\frac{1-|S_{11}|^2}{S_{22}-\Delta S_{11}^*|+|S_{21}S_{12}|},\quad \Gamma_{in}=\frac{B_1\pm\sqrt{B_1^2-4|C_1|^2}}{2C_1},$$

$$\Gamma_L=\frac{B_2\pm\sqrt{B_2^2-4|C_2|^2}}{2C_2},\text{ where}$$

$$B_1=1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2,$$

$$B_2=1+|S_{22}|^2-|S_{11}|^2-|\Delta|^2,$$

$$C_1=S_{11}-\Delta S_{22}^*,\text{ and}$$

$$C_2=S_{22}-\Delta S_{11}^*$$

$$C_L=\frac{(S_{22}-\Delta S_{11}^*)^*}{|S_{22}|^2-|\Delta|^2}$$

$$C_S=\frac{(S_{11}-\Delta S_{22}^*)^*}{|S_{11}|^2-|\Delta|^2}$$

$$R_L=\frac{|S_{12}S_{21}|}{|S_{22}|^2-|\Delta|^2},$$

$$R_S=\frac{|S_{12}S_{21}|}{|S_{11}|^2-|\Delta|^2}$$

$$G_{max}=\left(\frac{1-|\Gamma_S|^2}{|1-S_{11}\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

10/13 D

34 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	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX752)*

- ✓ 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 figures and Smith Charts are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Differentiate the behaviors of the systems at microwave and conventional low frequency bands. [6]
2. Describe how TE mode is different from TM mode in a circular waveguide. [10]
3. Describe the working principle of a cavity magnetron. [10]
4. Why S-parameter is important in microwave network analysis? Define S-parameters for a two-port network. [4+5]
5. By arbitrarily assuming a suitable load that connects to a 50-ohm transmission line find the lengths and spacing for a two-stub impedance matching system. Assume also a suitable separation between the stubs. [10]
6. Using the following S-parameters of $S_{11}=0.55\angle{-150°}$, $S_{12}=0.04\angle{20°}$, $S_{21}=2.82\angle{180°}$ and $S_{22}=0.45\angle{-30°}$, calculate and compare maximum power gain for unilateral and bilateral modes. [15]
7. Discuss the difference between an amplifier circuit and an oscillator circuit in terms of stability factor. [5]
8. Write short notes (Any THREE) [3 x 5]
   a. Microwave magic tee
   b. Microwave radiation fields
   c. Microwave strip-lines against micro-strips
   d. Static calorimeter

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Supplied Formulas:

$$K=\frac{1+|\Delta|^2-|S_{11}|^2-|S_{22}|^2}{2|S_{12}||S_{21}|},\qquad \Delta=(S_{11}S_{22})-(S_{12}S_{21}),$$

$$\mu=\frac{1-|S_{11}|^2}{|S_{22}-\Delta S_{11}^*|+|S_{21}S_{12}|},\qquad \Gamma_S=\frac{B_1\pm\sqrt{B_1^2-4|C_1|^2}}{2C_1},$$

$$\Gamma_L=\frac{B_2\pm\sqrt{B_2^2-4|C_2|^2}}{2C_2},\ \text{where:}$$

$$B_1=1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2,$$

$$B_2=1+|S_{22}|^2-|S_{11}|^2-|\Delta|^2,$$

$$C_1=S_{11}-\Delta S_{22}^*,\ \text{and}$$

$$C_2=S_{22}-\Delta S_{11}^*,$$

$$C_L=\frac{(S_{22}-\Delta S_{11}^*)^*}{|S_{22}|^2-|\Delta|^2},\qquad C_S=\frac{(S_{11}-\Delta S_{22}^*)^*}{|S_{11}|^2-|\Delta|^2},$$

$$R_L=\frac{|S_{12}S_{21}|}{|S_{22}|^2-|\Delta|^2},\qquad R_S=\frac{|S_{12}S_{21}|}{|S_{11}|^2-|\Delta|^2},$$

$$G_{Tmax}=\left(\frac{1-|\Gamma_S|^2}{|1-S_{11}\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

34 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

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

Subject: - RF and Microwave Engineering ***(EX752)***

- ✓ 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 formulas and Smith charts are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Based on operational principles, compare microwave systems with conventional low frequency systems. Lists the areas of application of microwave systems. [4+4]
2. What makes S-parameters useful in microwave network analysis? Define S parameters for a two-port network. Justify that the Butterworth and Chebyshev filter responses are common to prototype microwave two-port filter network using insertion loss method. [4+4+4]
3. Design a double-stub impedance matching network for a given load of 80 + j180 Ohm connected to a 100-Ohm transmission line at 3 GHz with a three-eights wavelength separation between the stubs. Illustrate necessary diagrams to show physical connections. [8+2]
4. Define expressions for various field components of a rectangular waveguide in TE mode. Show that a 1 GHz signal cannot propagate in TE_{10} mode in a rectangular waveguide with a wall separation of 5 cm. [7+3]
5. Find the maximum gain for a microwave transistor amplifier with $S_{11} = 0.656\angle 146.7°$, $S_{12} = 0.122\angle 46.1°$, $S_{21} = 2.3\angle 44.7°$, $S_{22} = 0.172\angle -117.1°$. [10]
6. What is bunching effect? Briefly describe the construction and operational features of a cavity magnetron. [2+8]
7. Describe how standing waves and microwave powers are measured with VSWR meter and bolometry respectively. [4+6]
8. Write short notes on: (any two) [2×5]
   a) Mixer theory
   b) Circulators
   c) Microwave radiation hazards and safety practices

***

Supplied Formulas:

$$K = \frac{1+|\Delta|^2-|S_{11}|^2-|S_{22}|^2}{2|S_{12}||S_{21}|}, \quad \Delta = (S_{11}S_{22})-(S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22}-\Delta S_{11}^*|+|S_{12}S_{21}|}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2-4\cdot C_1^2}}{2C_1}, \quad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2-4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2,$$

$$B_2 = 1+|S_{22}|^2-|S_{11}|^2-|\Delta|^2,$$

$$C_1 = S_{11}-\Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22}-\Delta S_{11}^*$$

$$C_L = \frac{(S_{22}-\Delta S_{11}^*)^*}{S_{22}^2-|\Delta|^2}$$

$$C_S = \frac{(S_{11}-\Delta S_{22}^*)^*}{|S_{11}|^2-|\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2-|\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2-|\Delta|^2}$$

$$G_{T\max} = \left(\frac{1}{1-|\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

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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	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX752)*

- ✓ 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 formulas and Smith charts are supplied herewith.</u>***
- ✓ *Assume suitable data if necessary.*

1. Differentiate between conventional low frequency and microwave systems based on their working principles. Lists the area of application of microwave systems. [4+4]
2. Justify that S-parameters are used in microwaves instead of h-parameters for network analysis. Define S-parameter for a two-port network. Why the Butterworth and Chebyshev filter responses are common to prototype microwave two-port filter network insertion loss method? [4+4+4]
3. Design a double-stub impedance matching network for a given load of 190+j 110 Ohms connected to be 100-Ohm transmission line at 10 GHz with a three-eight wavelength separation between the stubs. Illustrate necessary diagrams to show physical connections. [8+2]
4. Define expressions for various field components of a rectangular waveguide in TM mode. Prove that TM_{01} and TM_{10} modes do not exist in a rectangular waveguide. [7+3]
5. Justify that a transistor having following S-parameters $S_{11} = 0.894\angle -60.6°$, $S_{12} = 0.020\angle 62.4°$, $S_{21} = 3.122\angle 123.6°$ and $S_{22} = 0.781\angle -27.6°$ is conditionally stable while designing an amplifier. [10]
6. What is transit time effect? Briefly describe the construction and principle of operation of a two-cavity klystron amplifier. [2+8]
7. What is calorimetry in microwave? Differentiate between circulating and flow calorimetries based on principles of operation. [2+8]
8. Write short notes: (any two) [2+8]
   a) Hybrid tee
   b) Microwave oscillator theory
   c) RF radiation hazards and safety standards

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Supplied Formulas:

$$K = \frac{1+|\Delta|^2-|S_{11}|^2-|S_{22}|^2}{2|S_{12}||S_{21}|},$$

$$\Delta = (S_{11}S_{22})-(S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22}-\Delta S_{11}^*|+|S_{21}S_{12}|}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2-4|C_1|^2}}{2C_1},$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2-4|C_2|^2}}{2C_2}, \text{ where}$$

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$$C_1 = S_{11}-\Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22}-\Delta S_{11}^*$$

$$C_L = \frac{(S_{22}-\Delta S_{11}^*)^*}{|S_{22}|^2-|\Delta|^2}$$

$$C_S = \frac{(S_{11}-\Delta S_{22}^*)^*}{|S_{11}|^2-|\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2-|\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2-|\Delta|^2}$$

$$G_{T\,max} = \left(\frac{1}{1-|\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

36T TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

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

Subject: - RF & Microwave Circuits, Systems & Devices *(EG785EX) (Elective II)*

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

1. Classify microwave frequency bands and state their major applications. Describe how microwave transmission lines are different from the conventional low frequency transmission lines. [4+4]
2. Describe microwave radiation hazards based on the radiation fields. [8]
3. Describe rectangular waveguide based on modes on propagation and other critical parameters. [8]
4. Describe why S-parameter is important in microwave network analysis. Using a two-port network derive S-parameters. [4+6]
5. What is double-stub tuner? Assuming a load of 75 + *j*75 ohm is connected to a 50-ohm transmission line, find the lengths and spacing for a two-stub impedance matching system with three-eights wavelength separation between the stubs. [3+15]
6. Design an amplifier to attain maximum gain at 4.0 GHz using a GaAs FET having following S-parameters: $S_{11} = 0.72\angle{-116°}$, $S_{12} = 0.03\angle{57°}$, $S_{21} = 2.60\angle{76°}$ and $S_{22} = 0.73\angle{-54°}$. Consider the characteristic impedance, $Z_o = 50$ Ohm. [18]
7. Write short notes (Any TWO)
   a. E-plane tee against H-plane tee
   b. PROBE-coupling against LOOP-coupling
   c. Microstrips
   d. Two-cavity klystron

[2 x 5]

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$$\Delta = (S_{11}S_{22})-(S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22}-\Delta S_{11}^*|+|S_{21}S_{12}|}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2-4|C_1|^2}}{2C_1},$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2-4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2,$$

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$$C_1 = S_{11}-\Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22}-\Delta S_{11}^*$$

$$C_L = \frac{(S_{22}-\Delta S_{11}^*)^*}{|S_{22}|^2-|\Delta|^2}$$

$$C_S = \frac{(S_{11}-\Delta S_{22}^*)^*}{|S_{11}|^2-|\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2-|\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2-|\Delta|^2}$$

$$G_{T\max} = \left(\frac{1}{1-|\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$