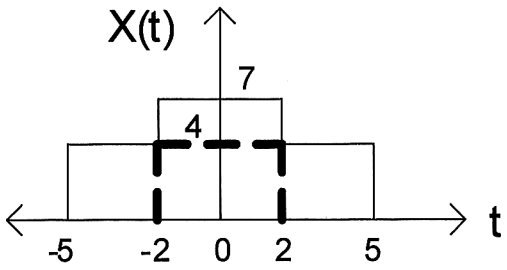
Ref. No.: Ex/IEE/PC/B/T/225/2024

B.E. INSTRUMENTATION AND ELECTRONICS ENGINEERING
SECOND YEAR SECOND SEMESTER EXAM 2024
SIGNAL TRANSMISSION & COMMUNICATION SYSTEM

Time : Three hours **Full Marks: 100**

Module-1:CO1 Answer any one question from module-1 (15 Marks)

1) i) Write the Dirichilet conditions for the Fourier transformation. 3
ii) Discuss the Parseval theorem and Duality property of Fourier transformation. 4+3=7
iii) Find the Fourier transformation of the below signal 5

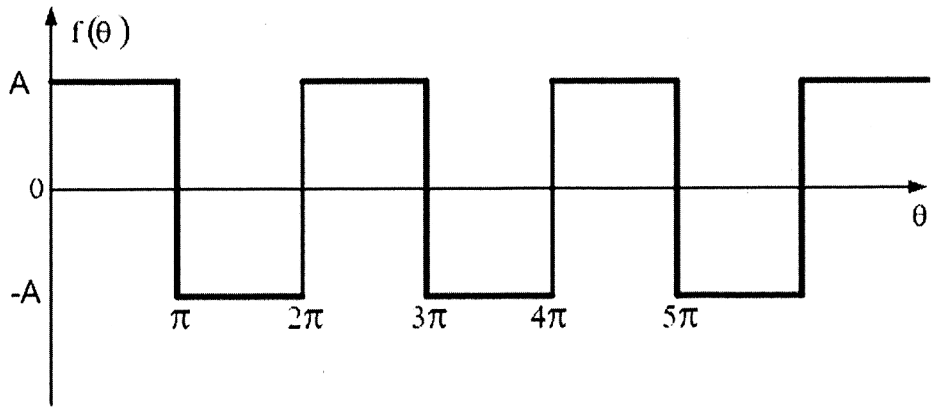


2. a) Prove the following properties of the Fourier Transformation 2+2=4
i) Convolution
ii) Frequency Shifting
b) Find the Fourier transformation of the below signal 6

$x(t) = e^{-at^2}$, a>0

c) Find the Fourier series of the following periodic function.

$$x(t) = \begin{cases} A & when \quad 0 < \theta < \pi \\ -A & when \quad \pi < \theta < 2\pi \end{cases}$$ 5



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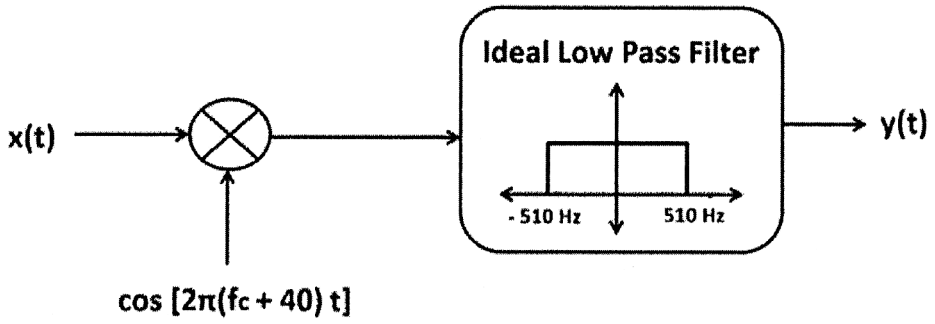
Module 2: CO2 Answer any three from module-2 (3x15= 45 marks)

3) i) Discuss AM signal generation using switching modulator 10

ii) The modulated signal $x(t) = m(t)\cos(2\pi f_c t)$ with carrier frequency 1MHz and $m(t) = 4\cos(1000\pi t))$ is transmitted by the transmitter. At the receiver, the signal x(t) is passed through the demodulator as shown in the figure . The output demodulator y(t) is 5



4) i) Discuss the operation of the envelope detection circuit for the demodulation of AM signal. 5

ii) Consider the wave obtained by adding a non-coherent carrier $A_C \cos(\omega_c t + \varphi)$ to the DSB-SC wave, $(t)cos\omega_c t$, where m(t) is the message waveform. This waveform is applied to an ideal envelope detector. Find the resulting detector output. Evaluate the output for
$(i)\varphi = 0\ and\ (ii)\ \varphi \neq 0\ and\ |m(t)| \ll A_c/2$ 10

5) i) Deduce the mathematical equations for FM and PM 2+2=4

Define the terms a) instantaneous frequency b) frequency sensitivity c) phase sensitivity d) frequency deviation 1x4=4

ii) Using suitable diagram differentiate FM and PM 3

iii) An angle-modulated signal is given by $x_c(t) = 6\cos[2\pi 10^7 t + 0.2\sin(10^4)\pi t]$ 2+2

(a) If $x_c(t)$ is a peak modulated signal with k_p = 5 rad/volt; and

(b) If $x_c(t)$ is a frequency modulated signal with k_f= 5 x 10^2 Hz/volt,

in each case, determine the modulating signal x(t).

6) i) Deduce the mathematical expression of Narrow band FM 4

ii) Discuss the generation FM signal by Direct method 5

iii) A phase modulator with k_p = 4 rad/V is fed with a sine wave modulating signal of 3 V peak amplitude and 2 kHz frequency.

What is the peak frequency deviation produced in the carrier frequency? 3

iv) An FM signal with single-tone modulation has a frequency deviation of 15 kHz and a bandwidth of 50 kHz. Find the frequency of the modulating signal. 3

Module 3: CO3 Answer any one question from module-3 (10 Marks)

7) With diagram discuss super heterodyne AM receiver in detail. 10

8) Discuss slope detection circuit for the detection of FM signal 10

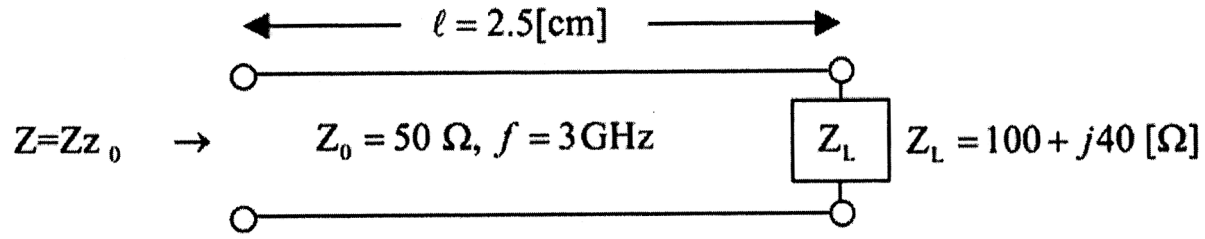
Module 4: CO4 Answer any two questions from module-4 (30 Marks)

9. i) Describe different types of transmission lines.
ii) Derive voltage and current equations for the transmission line. 5+10

10 . i) Explain the basis for construction of Smith chart.
ii) Discuss the characteristic features of the Smith Chart. 10+5

11. i) Discuss the steps to calculate reflection co-efficient at a distance from the load using smith Chart.
ii) For a low-loss transmission line derive the expressions for attenuation constant, phase constant and characteristic impedance
iii) Derive the relations between VSWR and reflection coefficient. 6+6+3=15

12.



Find the following parameters from the smith chart
i) VSWR
ii) Reflection Coefficient
iii) Input impedance. 15

13. i) What is an antenna? Write down the properties of an antenna.
ii) What is the radiation pattern of an antenna? Discuss different radiation patterns with a diagram.
iii) Discuss the basic parameters of the radiation pattern with a diagram. 1+2+1+5+6=15

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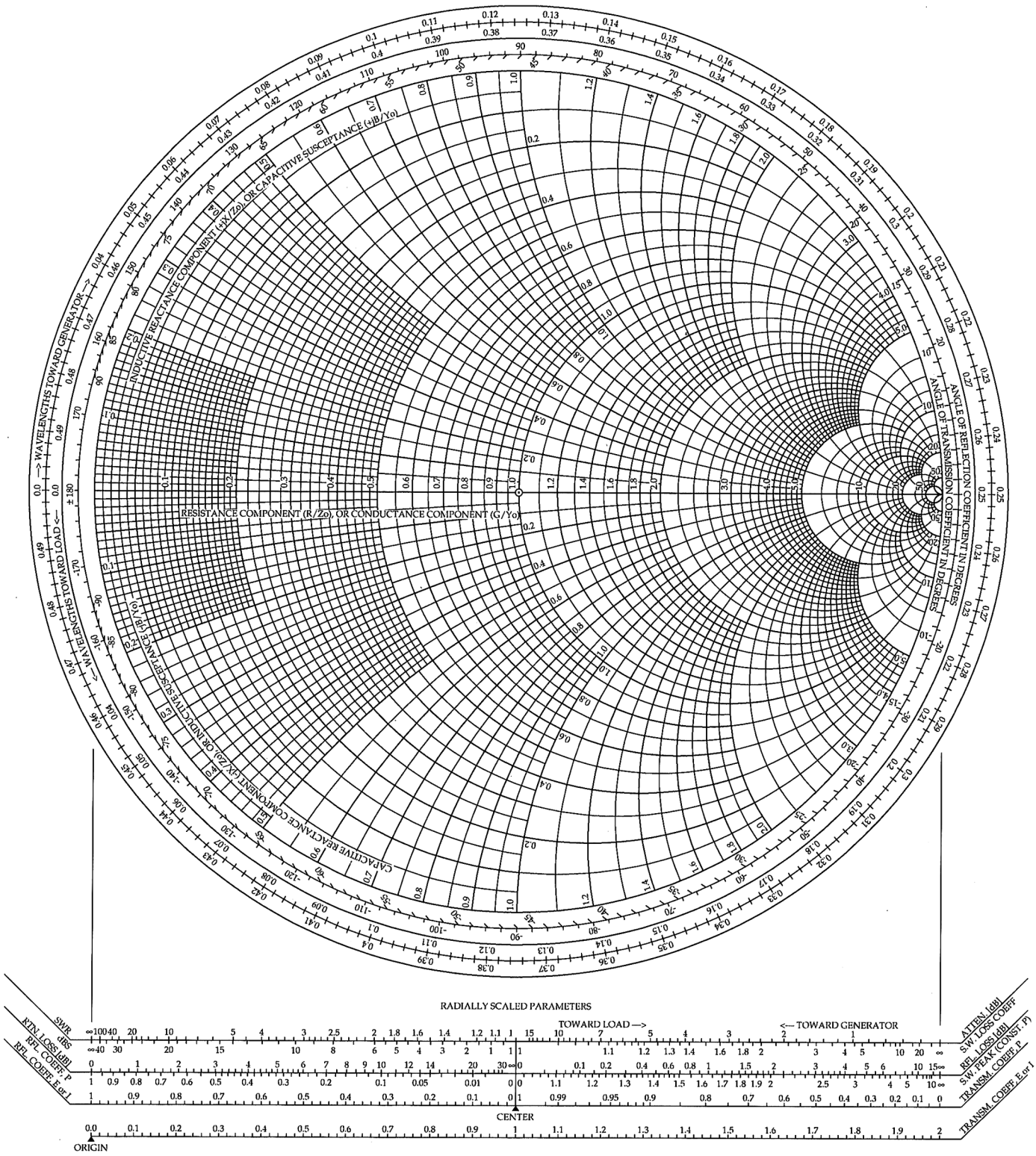
Smith Chart


RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
RADIALLY SCALED PARAMETERS
TOWARD LOAD —>
<— TOWARD GENERATOR
SWR
dBS
RTN. LOSS (dB)
REFL. COEFF: P
REFL. COEFF: E or I
ATTEN. (dB)
S.W. LOSS COEFF
REFL. LOSS (dB)
S.W. PEAK (CONST. P)
TRANSM. COEFF: P
TRANSM. COEFF: E or I
CENTER
ORIGIN