Course Title: Complex and Special Functions	Year: 2nd Communications	Code: PM1201
Date: 2010 (2nd term)	Allowed time: 3 hrs	No. of Pages: (2)

Problem number (1) (10)

(a)Find all values of: (i) $\sqrt[3]{1+i}$ (ii) $\cosh\sqrt{z} = 0$.

(b) Show that if $f(z) = u(x,y) + iv(x,y)$ is analytic, then u(x,y) and v(x,y) are harmonics.

(c) Determine c such that the function is harmonic U = sinx coshcy and find its conjugate harmonic.

Problem number (2) (16 M)

(a) Prove that If f (z) is analytic in a simply-connected region D, then for every simple closed curve C in D, $\oint_C \frac{f(z)dz}{(z-z_0)} = 2\pi i f(z_0)$

(b)Evaluate $\oint_C \frac{z^3+1}{(z-1)(z-2)}dz$ around $C: |z| = 3$.

(c) Find Taylor expansion of $f(z) = \frac{z}{5-z}$ on the region $|Z| \le 5$ and using it to find

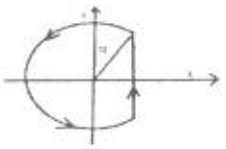
$\sum_{n=1} \frac{r^n}{5^n}\cos n\theta$, $\sum_{n=1} \frac{r^n}{5^n}\sin n\theta$

Problem number (3) (16 M)

(a) Evaluate

(i) $\int_{|z|=3} (z+1)e^{\frac{1}{z}}\,dz$ (ii) $\oint_{|z|=2} z^2 \sin\frac{2}{z-1}\,dz$

(b) Using Bromwich contour



To find inverse Laplace transform of $F(s) = \frac{\cosh x\sqrt{s}}{s\cosh\sqrt{s}}$, $0 < x < 1$

c) Find the image of the region $2 \le |z| \le 3$, $\frac{\pi}{6} \le \arg z \le \frac{\pi}{3}$ by the map $w = z + \frac{1}{z}$.

Problem number (4) (14 M)

a) Using series solutions to solve the following equations

(ii) $x^2y'' - xy' + (x^2 - \frac{4}{9})y = 0$ near x=0

b) Evaluate the integrations using Gamma and Beta functions

(i) $\int_0^{\infty} x^3 \; e^{-2x} \cosh x \; dx$ (ii) $\int_0^{\frac{1}{2}} x^{m-1} \left(\ln \frac{1}{2x} \right) dx$

(iii) $\int_0^{\frac{\pi}{2}} \sqrt{\frac{\sin\theta}{\cos\theta}}^{3} \; d\theta$ (v) $\int_0^{\infty} \frac{1}{1+x^4} \; dx$

Problem number (5) (14 M)

(a) Use Generating function $e^{x(t-\frac{1}{t})} = \sum_{-\infty}^{\infty} J_n(x) t^n$ to prove that:

(i) $e^{\alpha \sin\theta} = J_0(x) + 2\sum_{n=1}^{\infty} J_{2n}(x) \cos 2n\theta + 2i \sum_{n=0}^{\infty} J_{2n+1}(x) \sin(2n+1)\theta$

(ii) $1 = J_0(x) + 2\sum_{n=1}^{\infty} J_{2n}(x)$ (iii) $x = 2\sum_{n=0}^{\infty} (2n+1) J_{2n+1}(x)$

(b) Prove that $J_{\frac{1}{2}} = \sqrt{\frac{2}{\Pi x}} \sin x$, $J_{-\frac{1}{2}} = \sqrt{\frac{2}{\Pi x}} \cos x$ and using these to express $J_{\frac{3}{2}}(x)$, $J_{-\frac{3}{2}}(x)$ in term of sinx and cosx.

(c) Evaluate $\int x^3 J_0 dx$

With my best wishes

Tanta University

Department: Electronics and Electrical Communication Eng.
Total Marks: 90 Marks

Faculty of Engineering

Course Title: Communication Engineering	Course Code: EEC2207	Year: 2nd
Date: 7/6/2010 (Second term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches)

Attempt all questions — Neat answers and boxed results are appreciated

Problem number (1)

a. List the major types of external and internal noise.
b. Explain the fundamental limitations of any communication system.
c. Derive an expression for thermal voltage in a resistor at temperature T °K.
d. What is the equivalent noise resistance when the measured noise is 300 μV, the temperature is 300 °K, and bandwidth is 3 kHz?

Problem number (2)

a- Define selectivity, sensitivity, fidelity, and image frequency.
b- List the benefits of a superheterodyne over a TRF receiver. Identify the function of each component of a superheterodyne.
c- It is required to receiver single tone signal of frequency 15 kHz modulating a carrier 100 MHz. Draw the superheterodyne receiver indicating the spectrum of the signal output from each block.

Problem number (3)

(a) Describe, aided with sketch of circuit diagram, the function of mixer, limiter and frequency discriminator

(b) Figure 1 shows a block diagram of a typical FM transmitter used to transmit audio signal contain frequencies in the range (100 Hz – 15 kHz) and the desired output signal has carrier frequency of 100 MHz and maximum frequency deviation. Determine the multiplication factor of the first and second multiplier, the carrier frequency, and frequency deviation at each block diagram, (Hint: The modulation index = 0.2).

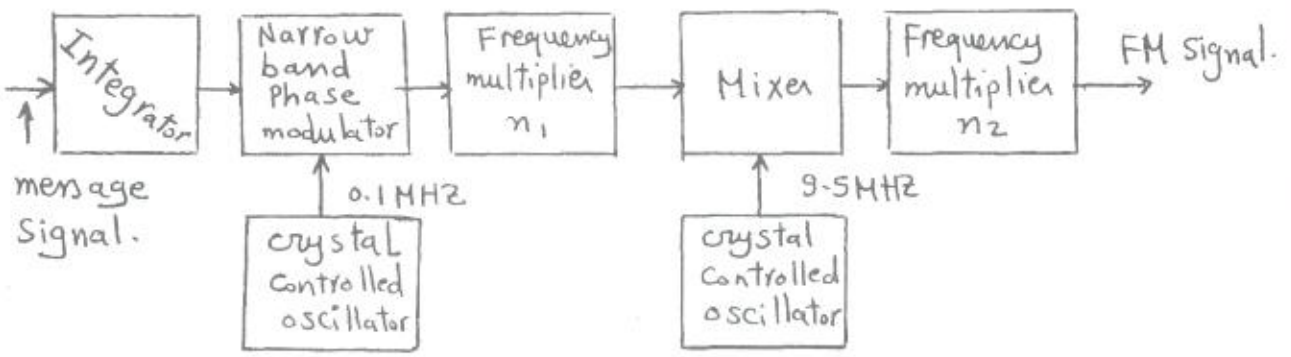


Figure 1

Problem number (4)

(a) Sketch the block diagram of stereophonic and monophonic FM (transmitter and receiver). Sketch the spectrum of signal output at each block diagram.

(b) Design the block diagram of an Armstrong indirect FM modulator to generate an FM signal with a carrier frequency of 96 MHz and Δf of 20 kHz. A narrow band FM generator with $f_c = 200\ kHz$ and adjustable Δf in the range of 9 to 10 Hz is available. The adjustable frequency range for oscillator is from 9 to 10 MHz, there is a bandpass filter with any center frequency, and only frequency doublers are available.

Problem number (5)

(a) Sketch the block diagram of a PLL and describe how loop acquisition is accomplished with PLL from an initial unlocked condition until frequency lock is achieved.

(b) Explain the function of PLL as an FM detector.

(c) Sketch the block diagram of a SSB transmitter using the phase shift method.

Best Wishes of Success