**DPP-1430**

**M. Sc. (Sem. II) Examination**  
March/April – 2016  
**EL - 424 : Electronics**  
(Electronic Communication-I)

**Time : 3 Hours**

[Total Marks : 70]

**Instructions :**

1. Fill up strictly the details of signs on your answer book.

2. Assume the data if required.

3. Figures to the right hand side indicate marks of each question.

4. Attempt any two of each question.

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<table>
<thead>
<tr>
<th>Q. No.</th>
<th>Question</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (a)</td>
<td>Show that the autocorrelation function &amp; the power spectral density of a periodic waveform are in a Fourier transform pair.</td>
<td>7</td>
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<tr>
<td>(b)</td>
<td>(i) Define the power spectral density &amp; explain its physical meaning.</td>
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<td></td>
<td>(ii) Show that if the power spectral density &amp; the power of a signal ( v(t) ) are ( \Gamma_0(f) ) and ( P_1 ) respectively, then the power spectral density &amp; the power of a signal ( av(t) ) are ( a^2 \Gamma_0(f) ) and ( a^2 P_1 ) respectively, where ( a ) is constant.</td>
<td>2</td>
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<td>(c)</td>
<td>Find the energy spectral density of the signal ( v(t) = e^{2t} u(t) ) Where ( u(t) = 1 ) for ( t \geq 0 ) Also find the total energy contained in this signal.</td>
<td>7</td>
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<td>2 (a)</td>
<td>The modulating signal ( m(t) ) is a sinusoid of the form ( m(t) = a \cos 2\pi f_m t ) ( f_m &lt; f_c ) Determine the DSB-SC AM signal, its upper &amp; lower sidebands.</td>
<td>7</td>
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<td>(b)</td>
<td>Describe the methods for generation of DSB-SC signals.</td>
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<td>(c)</td>
<td>Give the comparison of various amplitude modulation systems.</td>
<td>7</td>
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</table>
(a) How does the PLL act as FM & PM demodulators.  
(ii) What are the disadvantages of FM over AM?

(b) What is the importance of second order PLL? Explain the operation of it.

(c) A 30 MHz, 12V carrier is modulated by a 500 Hz Sinewave. The maximum frequency deviation is 12KHz & the same modulation index is obtained for both FM & PM. Write the expressions for the modulated wave for FM & PM. Next if the modulating frequency is increased to 3 KHz, the other things remaining the same, write new expressions for FM & PM.

4(a) In a multistage amplifier, derive the expression for the net equivalent noise resistance in terms of resistances $R_1, R_2, R_3$ etc. at the input of first, second & third stages respectively & the voltage gain of individual stages.

(b) The noise output across a resistor of 1 MΩ is amplified by a noiseless amplifier having gain of 50 & bandwidth of 10 KHz.  
(i) If the resistor is operated at 27°C, what is the meter reading at the output of the amplifier?  
(ii) If the bandwidth of the amplifier is increased to 40 KHz, its gain remaining the same, what will be the meter reading now?

(c) A receiver having overall voltage gain $A_{in}$, output resistance $R_o$, bandwidth B operates at temp. T °K. The receiver input resistance is $R_i$ & it is fed from an antenna having resistance $R_a$. Derive a formula for noise power. Also show that the Noise Figure :  
\[ F = 1 + \frac{R_{eq}}{R_o} \cdot \frac{R_a}{R_a + R_i} \]  
Where $R_{eq}$ is the equivalent input noise resistance excluding $R_a$.

5(a) What is Comanding? Explain input-output characteristics of the compressor. Compare Comanded & Uncomanded systems.

(b) Explain how Adaptive delta modulation improves the system’s tolerance to the slope overload.

(c) State & prove the sampling theorem & explain its importance in pulse communication system. Discuss the different cases of sampling theorem.

Use the following physical data if required:  
- Boltzmann constant $k_B = 1.38 \times 10^{-23} \text{ J}^\circ \text{ K}$
- Electron volt $e = 1.602 \times 10^{-19} \text{ J}$
- Electron charge $q = 1.602 \times 10^{-19} \text{ C}$
- Ratio of charge to mass of an electron $e/m = 1.759 \times 10^{11} \text{ C/ Kg}$
- Planck’s constant $h = 6.626 \times 10^{-34} \text{ J-s}$
- Electron mass $m = 9.109 \times 10^{-31} \text{ Kg}$