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SEAT No. \_\_\_\_\_

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**SARDAR PATEL UNIVERSITY**  
**M.Sc. (Electronics) First Semester**  
**Examination (Under CBCS)**  
**October, 2018**

**PS01CELE22: Applications of ICs and Fuzzy Electronics**

Wednesday, October 24, 2018

Time: 10.00 a.m. to 1.00 p.m.

Total Marks: 70

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| <b>Q. 1</b> | <p><b>Give the correct (nearest) answer (statement) to the following Multiple Choice Questions (Statements).</b></p> <p>(i) A constant magnitude, frequency-dependent Phase Response is the characteristic of</p> <p>(a) All-pass Filter (c) High-pass Filter<br/> (b) Low-pass Filter (d) Band-pass Filter</p> <p>(ii) The Universal Active Filters are</p> <p>(a) State –variable and Biquad Filters (c) Single Op Amp Chebyshev Filters<br/> (b) Multiple feedback Band pass Filters (d) none of these</p> <p>(iii) The roll off rate of a 4<sup>th</sup> order Low Pass filter is</p> <p>(a) - 100 dB/decade (c) -80 dB/decade<br/> (b) - 180 dB/decade (d) 160 dB/decade</p> <p>(iv) Elliptical filters are characterized in terms of</p> <p>(a) <math>f_c, n, A_{max}, A_{min}</math> (c) <math>f_c, n</math><br/> (b) <math>f_c, n, A_{max}</math> (d) none of these</p> <p>(v) In the Phase Locked Loop, Capture Range is</p> <p>(a) bigger than the Lock range (c) equal to the lock range<br/> (b) smaller than the Lock range (d) none of these</p> <p>(vi) A sub circuit in pSPice ends with a command</p> <p>(a) .END (c) .RST<br/> (b) .ENDS (d) .SUBCKT</p> <p>(vii) The subset <math>[0.5, 0.5]</math> represents a</p> <p>(a) maximally fuzzy set (c) empty set<br/> (b) Power set (d) none is correct</p> <p>(viii) The learning model of Artificial Neural Network with the competitive aspect is</p> <p>(a) Hebbian learning (c) Kohonen<br/> (b) Grossberg learning (d) both a and b are correct.</p> | <b>8x1</b><br><b>=</b><br><b>[8]</b> |
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(P.T. O.)

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| Q. 2    | <p>Give short answers to the following: (any seven )</p> <ol style="list-style-type: none"> <li>1) Mention the drawbacks of Active Filters over Passive Filters.</li> <li>2) First Order Low Pass Active filter has a Roll off rate of -20dB/decade. Justify.</li> <li>3) Describe the nature and specifications of Higher Order Chebyshev Filters.</li> <li>4) Draw the circuit of Frequency Dependent Negative Resistor (FDNR) obtained using GIC.</li> <li>5) In IC NE 565, the VCO Output Frequency <math>f_{out} = \pm 2</math> KHz. The Supply Voltage is <math>\pm V = \pm 10V</math>. Find out the Lock Range.</li> <li>6) Describe the types of Output commands for pSpice.</li> <li>7) If <math>f(x,y,z) = xz + \bar{y}z</math>, determine the conditions that must be satisfied by the fuzzy variables <math>x, y</math> and <math>z</math> so that <math>f(x,y,z)</math> belongs to class <math>m</math> i.e. <math>\alpha_m \leq f(x,y,z) &lt; \alpha_{m-1}</math>.</li> <li>8) Draw the truth table of Fuzzy AND operation.</li> <li>9) Draw the electronic model of a biological neuron.</li> </ol> | 7x2 = [14] |
| Q.3 (a) | Draw the circuit diagram of a Second Order Sallen key Unity Gain (SKUG) Low Pass Filter and deduce the equation of its transfer function.  | [6]        |
| (b)     | Design a Second Order SKUG Low Pass Filter for $f_0 = 2$ kHz and $Q=1$ .<br>OR   | [6]        |
| (b)     | For a Multiple Feedback Band pass filter, specify component values to ensure a Centre Frequency of 500 Hz and a bandwidth of 50 Hz. What is the resonant gain?   | [6]        |
| Q.4 (a) | Using proper circuits diagram and equations, describe how a synthetic inductor can be obtained by simulation using Op Amps, Resistors and Capacitor/s.   | [6]        |
| (b)     | Design a 3 <sup>rd</sup> Order 0.1 dB ripple Chebyshev low-pass filter using KRC Equal Component design aspect for $f_0 = 1$ KHz.<br>Given from the Standard Filter Table for 3 <sup>rd</sup> order 0.1 dB ripple Chebyshev low-pass filter, for $n = 3$ , $f_{01} = 1.300$ ; $Q_1 = 1.341$ ; $f_{02} = 0.969$ .<br>OR   | [6]        |
| (b)     | (i) Mention the advantages and drawbacks of Cascade approach over RLC ladder simulation approach for higher order filter designing.<br>(ii) Draw the response curve and explain the characteristics of higher order Bessel Filter.   | [4]<br>[2] |
| Q.5 (a) | Draw the block diagram of PLL. Describe various types of Digital Phase Detectors.  | [6]        |
| (b)     | Explain the application of PLL as a Frequency Multiplier.<br>OR  | [6]        |
| (b)     | Write pspice statements for the following:<br>(i) Resistor- R1 of 800 $\Omega$ connected between the nodes 21 and 22; R2 of 400 $\Omega$ connected between the nodes 22 and 24 and a dummy voltage source Vx (in a DC circuit) connected between nodes 22 and 23.<br>(ii) A DC Voltage Source with Voltage Vs= 5V, 25V, 30V, for each value of Is = 50mA, 100mA and 150mA for a DC circuit.  | [4]<br>[2] |
| Q.6 (a) | For Fuzzy Sets given as $\sim A = 0.6/1 + 0.5/2 + 0.4/3$ and $\sim B = 0.4/1 + 0.3/2$ , perform the following operations: (i) Union (ii) Bounded Sum (iii) Bounded Difference (iv) Algebraic Product (v) Concentration of B (vii) complement of A  | [6]        |
| (b)     | Describe the concept and process of Support and Grade Fuzzification.<br>OR   | [6]        |
| (b)     | The Perceptron cannot distinguish linearly nonseparable patterns. Explain.   | [6]        |