BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTech **SEMESTER: II**
BRANCH: ECE **SESSION: SP/22**

SUBJECT: EC551 RF Circuit Design

TIME:2 Hrs **FULL MARKS: 50**

INSTRUCTIONS:

1. **The question paper contains 5 questions each of 10 marks and total 50 marks.**
2. **The missing data, if any, may be assumed suitably.**
3. **Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.**

Q.1(a) Considering copper as the conductive medium, compute the skin depth at 60Hz and 1MHz, respectively? [4]

Q.1(b) Draw the equivalent circuits for high frequency inductor and capacitor. [6]

Q.2 Design and implement a third order band-pass filter having maximally flat response. The bandwidth of the filter should be 15% with a centre frequency of 2.4 GHz. The filter must be matched to 50Ω impedance at both sides. Assume suitable substrate parameters required. [$g_1 = g_3 = 0.6180$; $g_2 = 1.6180$; $g_4 = 1.0000$] [10]

Q.3 Develop a 2-component matching network for a Z_L = (40 + j10) ohm load and a 50 ohm source. How many network topologies exist that can be used? Draw their configurations. Find the components if a perfect match is desired at f_0 = 1.2 GHz for any one configuration. [10]

Q.4 A MESFET is used as a single stage amplifier at 2.25 GHz. The S-parameters at the frequency and under given bias conditions are reported as $S_{11} = 0.83\angle -132^0$, $S_{12} = 0.03\angle 22^0$, $S_{21} = 4.9\angle 71^0$, $S_{22} = 0.36\angle -82^0$. For the required gain, use the unilateral assumption and (i) determine if the circuit is unconditionally stable. (ii) find the maximum power gain under the optimal choice of the reflection coefficients. (iii) estimate the error that is introduced by making the unilateral design approximations. [10]

Q.5(a) With the help of suitable diagram, explain the design parameters and operation of a dielectric resonator oscillator. [6]

Q.5(b) Compare Single-balanced and Double-balanced High Frequency Mixer Circuits. [4]

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