



M.E DEGREE EXAMINATIONS: JUNE 2016

(Regulation 2015)

Second Semester

COMMUNICATION SYSTEMS

P15COTE14: RF System Design

COURSE OUTCOMES

- CO1: Describe The various passive and active components for radio frequency circuits
- CO2: Analyze micro strip line filters
- CO3: Analyze the biasing methods for RF amplifiers
- CO4: Compare the various RF oscillators for their performance.
- CO5: Design matching networks using smith charts

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Assertion (A):The Mobile phone is a RF system CO1 [K₄]
Reason (R):Since people can talk to persons who are at very long distances
a) Both A and R are individually true and R is the correct explanation for A b) A is true but R is false
c) Both A and R individually true but R is not correct explanation of A d) A is false but R is true

2. The frequency range of ultra high frequency is CO1 [K₂]
a) 300-3000 MHz b) 3000-30000 MHz
c) 30-300 MHz d) 3-30MHz

3. A type of RF filter is CO2 [K₂]
a) Resonant filter b) Active filter
c) Digital filter d) Passive filter

4. Matching list I with list II and select the correct answer using the codes given below CO2 [K₃]
the list

List I	List II
A. Flat pass band filter	1 RF filter
B. ripples in the pass band filter	2. elliptic filter
C. ripples in the stop and pass bands	3 Butterworth filter
D. coupled filter	4 chebyshev filter

- | | A | B | C | D |
|----|---|---|---|---|
| a) | 1 | 2 | 3 | 4 |
| b) | 3 | 4 | 1 | 2 |
| c) | 3 | 4 | 2 | 1 |
| d) | 1 | 4 | 3 | 2 |

5. Assertion (A): Varactor diode is a 2 terminal Semiconductor device CO1 [K₃]
Reason (R):Therefore it can be used as a capacitor since capacitor is also a 2 terminal device

- a) Both A and R are individually true and R is the correct explanation for A
b) A is true but R is false
c) Both A and R individually true but R is not correct explanation of A
d) A is false but R is true

6. MESFET is a CO1 [K₃]

- a) Metal semiconductor field effect transistor
b) Metal Enhancement Semiconductor field effect transistor
c) Micro Enhancement semiconductor field effect transistor
d) Milli Enhancement Semiconductor field effect transistor

7. Smith chart is a CO5 [K_L]

- 1.Impedance chart
2.voltage variation chart.
3.current variation chart.
4.Admittance chart.

Which of the following statements are correct.

- a) 2,3
b) 3,4
c) 1,2
d) 1,4

8. Assertion (A): A smith chart is used to design matching network CO5 [K₃]

Reason (R): A matching network uses transistors

- a) Both A and R are individually true and R is the correct explanation for A b) A is true but R is false
c) Both A and R individually true but R is not correct explanation of A d) A is false but R is true

9. Mixer is used in a COL [K_L]

- a) RF receiver b) RF transmitter
c) RF switch d) RF modulator

10. The following are various circuits from antenna to LP filter in a heterodyne receiver system incorporating a mixer. CO4 [K₂]

1. LNA ,2Detector,3Combiner ,4 LP filter 5 antenna

The correct sequence from antenna to LP filter is

- a) 1,3,5,4,2 b) 5,1,3,2,4
c) 2,4,5,3,1 d) 1,3,4,1,2

PART B (10 x 2 = 20 Marks)

11. Select a suitable capacitor for radio frequency operation from the four capacitors by Stating the reasons CO1 [K₄]

i)electrolytic capacitor, ii)tantalum capacitor, iii)surface mounted ceramic capacitor and iv)parallel plate capacitor.

12. Describe with a figure an RF inductor. CO1 [K₂]

13. Analyze Kudoras identity CO2 [K₃]

14. What is unit element where it is used? CO2 [K₃]

15. Explain the diagram of the two component matching network CO5 [K_L]

16. Draw and explain the inter digitated structure of high frequency BJT. CO1 [K_L]

17. Explain a biasing method used in RF amplifier CO3 [K_L]

18. Describe Rollett factor CO3 [K_L]

19. Explain are the various types of mixers used in RF . CO4 [K_L]

20. Select a suitable oscillator for radio frequency operation from the four oscillators stating the reasons CO4 [K_L]

- i) R C phase shift oscillator ii) Blocking oscillator iii) dielectric resonator oscillator iv) clapps oscillator.

PART C (10 x 5 = 50 Marks)

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|--|-----|-------------------|
| 21. Explain the diagram of a generic RF system | CO1 | [K ₂] |
| 22. Analyse and obtain normalized input impedance z_{in} equation in terms of Γ_i and Γ_r real and imaginary parts of Reflection coefficient $\Gamma(d)$ of a transmission line as a function of distance. | CO1 | [K ₄] |
| 23. Analyze and obtain equation for Band pass resonant filter transfer function | CO2 | [K ₃] |
| 24. Analyze and obtain equation for $V_e, I_e; V_{od}, I_{od}; Z_{oe}, Z_{oo}; C_{od}$ for a coupled filter. | CO2 | [K ₃] |
| 25. Explain cross sectional view of schottky diode and a circuit model of typical Schottky diode | CO1 | [K _L] |
| 26. Analyze and obtain I the forward current and C_d the diffusion capacitance of PIN diode. | CO1 | [K _L] |
| 27. Draw the block diagram of a Generic amplifier system and explain its features. | CO3 | [K _L] |
| 28. Explain constant VSWR circles in RF amplifier design | CO3 | [K _L] |
| 29. Draw and analyse the circuit of any RF oscillator and explain its working | CO5 | [K _L] |
| 30. Describe any one type mixer used in RF receivers. | CO5 | [K _L] |

Answer any TWO Questions

PART D (2 x 10 = 20 Marks)

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|--|-----|-------------------|
| 31. Design a low pass filter whose input and output are matched to a 50 ohm impedance and that meets the following specification
Cut off frequency of 3 GHz; equi ripple of 0.5 db ; and rejection of at least 40 db at approximately twice the cut of frequency; Phase velocity is 60 % of the speed of light. | CO2 | [K ₄] |
| 32. Describe with figures and equations
High frequency resistors, High frequency capacitors and high frequency inductors. | CO1 | [K ₂] |
| 33. Analyze and obtain equations for an active biasing network for a BJT transistor in common emitter configuration. | CO3 | [K ₃] |
