 **ST. ANNE’S**

**COLLEGE OF ENGINEERING AND TECHNOLOGY**

(An ISO 9001:2015 Certified Institution)

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**QUESTION BANK**

**PERIOD:** JULY - NOV 2018 **BATCH**: 2016– 2020

**BRANCH:** ECE **YEAR/SEM:** III/V

**SUB CODE/NAME:** EC6503 – TRANSMISSION LINES AND WAVEGUIDES

**UNIT I TRANSMISSION LINES THEORY**

**PART – A**

1. What is characteristic impedance **[D][Apr/May-2016]**
2. Define reflection loss. **[D][Apr/May-2016]**
3. What is meant by distortion less line? **[D][Nov/dec-2016]**
4. Find the characteristic impedance of a line at 1600HZ if zoc=750<-30Ω and zsc=600<-20Ω. **[ID][Apr/May-2016]**
5. A transmission line has zo=745<-12Ω and is terminated in zR=100Ω, calculate Reflection factor **[ID][ Nov/Dec -2017]**
6. Define Smooth line. **[D][ Nov/Dec -2017]**
7. What is meant by distortion less line? **[D][Apr/May-2018]**
8. Define reflection loss. **[D][Apr/May- 2016,2018]**
9. What is meant by infinite line? **[D][Nov/dec-2010]**
10. For a symmetrical network, define propagation constant and characteristic impedance? **[D][Apr/May-2011]**
11. Define propagation constant of a transmission line. . **[D][Apr/May-2013], Nov/dec-2012]**
12. What is the significance of the reflection co efficient? **[D][Nov/dec-2010]**
13. For a symmetrical network, define propagation constant and characteristic impedance? **[D][Nov/dec-2012]**
14. Write the relationship between Neper and decibel.[D]
15. What is meant by inductance loading of telephone cables?[D]
16. What is the relationship between characteristic impedance and propagation constant?[D]
17. Write the expressions for the phase constant and velocity of propagation for telephone cable.[D]
18. What is meant by finite and infinite line?[D]
19. How can you overcome delay distortion?]ID]
20. What are the different types of loading?[D]
21. What are the primary and secondary constants of transmission lines?[D]
22. Find the reflection coefficient of a 50 ohm transmission line when it is terminated by a load impedance of 60+40j ohm **[ID][Apr/May-2013].**
23. When does a finite line appear as a infinite line. **[ID]**
24. What is the significance of the reflection co efficient[D]
25. What is meant by inductance loading of telephone cables? **[ID]**
26. Define cutoff wave length?[D]
27. Give the general equation of the transmission line?[D]
28. Draw the equivalent electrical circuit of a unit length of a transmission line[D]
29. What are the primary and secondary constants of a transmission line?[D]
30. Define Reflection factor?[D]

**PART – B**

**[First Half]**

**[General theory of transmission lines – General solution]**

1. The constants of a transmission line are R= 6ohms/km, L=2.2m H/km, C=0.005×10ˉ⁶ and G=0.25×10ˉ⁶ mho/km. Determine the characteristics impedance and propagation constant at 1000 Hz.(7)[D]
2. A generator of 1v, 1000HZ supplies power to a 100km open wire line terminated in z0 and having following parameters. R= 10.4hms/km, L=0.00367 H/km, C=0.8×10ˉ⁶ and G=0.00835×10ˉ⁶ mho/km. Determine the z0, α, β, λ, v also find the received power. **(13)[D][Nov/dec-2016]**
3. Derive the general transmission line equation for the voltage and current at any point on a line. **(13)[D][May/Jun-2016], [Apr/May-2018]**
4. A transmission line has the following per unit length parameters: L = 0.1μ H, R =5 ohms, C = 300 pF and G = 0.01 mho. Calculate the propagation constant and characteristic impedance at 500 MHz. Derive expression for the attenuation and phase constant of transmission line in constant R, L, G and C. (6)[D] **(13)[D][Apr/May2018]**
5. A transmission line operating at 500 MHz has Z₀=80Ω, α= 0.04 Np/m, β=1.5 rad/m. Find the line parameter series resistance (R Ω/m), series inductance (L H/m), shunt conductance (G mho/m) and capacitance between conductors (C F/m). **(13)[D]**
6. A communication line has. R= 10.4hms/km, L=0.00367 H/km, C=0.8×10ˉ⁶ and G=0.00835×10ˉ⁶ mho/km. Determine the characteristics impedance and propagation constant ,velocity of propagation ,sending end current given frequency=1000HZ,sending end voltage is 1v and transmission line length is 100Km. **[D][Apr/May-2017]**
7. Discuss the general solution of a transmission line in detail(10) **[D][Apr/May-2017]**
8. The constants of a transmission line are R= 6ohms/km, L=2.2m H/km, C=0.005×10ˉ⁶ and G=0.25×10ˉ⁶ mho/km. Determine the characteristics impedance and propagation constant at 1000 Hz. **(13)[D]**
9. Derive expression for the attenuation and phase constant of transmission line in constant R, L, G and C. **(13)[D]**

**[Infinite line-wavelength, velocity of propagation]**

1. Prove that an infinite line equal to finite line terminated in its characteristics impedance.(6) **[D][May/Jun-2016]**

**[Second Half]**

**[Waveform Distortion, Distortion less line]**

1. Derive the condition for minimum attenuation in a distortion less line. (8) **[D][Nov/dec-2016]**
2. A distortion less transmission line has attenuation constant α=1.15×10ˉᶟ Np/m, and capacitance of 0.01 n F/m. the characteristic resistance L/C=50Ω find the resistance inductance and conductance per more of the line.(16)[D]
3. Derive the conditions required for a distortion less line.(10)[D]
4. Explain in detail about the wave form distortion and also condition for distortion less line. **(10) [D][Nov/dec-2016]**

[**Loading and different methods of loading**]

1. Discuss in detail about lumped loading and derive the Campbell’s equation. (10)[**D][Apr/May-2017]**
2. A transmission line operating at 10⁶ rad/s has α= 8 d B/m, β= 1 rad/m. and z₀= 60+ j40ohms, and is 2meter long. The line is connected to a source of 10 v, Zg=40ohms and terminated by a load of 20 + j50ohms. Determine the current at the middle of the line. (8)[**D][Apr/May-2017]**

[**Line not terminated in z0, Reflection coefficient**]

1. Explain in detail about the reflection on a line not terminated by its characteristics impedance **z0.** (8)[**D][Apr/May-2017], [Nov/dec-2016]**
2. A low loss transmission line of 100 ohms characteristic impedance is connected to a load of 200ohm. Calculate the voltage reflection coefficient and the standing wave ratio.(16)[D]

[**Calculation of current voltage, power delivered and efficiency of transmission, input transfer impedance**]

1. Discuss the theory of open and short circuited lines with voltage and current distribution diagram and also get the input impedance expression.(16)[D]
2. A communication line has. R= 13.4hms/km, L=0.00467 H/km, C=0.9×10ˉ⁶ and G=0.00735×10ˉ⁶ mho/km. Determine the characteristics impedance and propagation constant ,velocity of propagation ,sending end current for given frequency=3000HZ,sending end voltage is 3v and transmission line length is 10Km. **[D][Apr/May-2013]**

**UNIT II HIGH FREQUENCY TRANSMISSION LINES THEORY**

**PART-A**

1. **A loss** less transmission line has a shunt capacitances 100 pf/m and series inductances 0f 4µH/m, find the characteristics impedances.[D] **[Nov/dec-2015]**
2. For the line of zero dissipation what will be the values of attenuation constant and characteristics impedances. .[ID] **[Nov/dec-2015]**
3. Write the expression for standing wave ratio in terms of reflection coefficient. [**D][ May /june-2016]**
4. Why a quarter wave line is considered as a impedance inverter? justify.[ID] **[Nov/dec-2016]**
5. Write the expression for the input impedance of open and short circuited dissipation line.[D] **[Nov/dec-2016]**
6. Calculate the standing wave ratio and reflection coefficient on a line having the characteristics impedances Z₀=300Ω and terminating impedances ZR=300+j400Ω. .[D] **[Nov/dec-2016]**
7. Define Standing wave ratio. **[D][Apr/May-2017]**
8. A low loss line has a characteristic impedance of 400ohms determine the SWR if the receiving end impedance is 650-j475Ω **[D][Apr/May-2017]**
9. State the relation between standing wave ratio and reflection coefficient**.[D] [Nov/dec-2017**]
10. At a frequency of 80 *MHz,* a lossless transmission line has a characteristic impedance of 300 \_ and a wavelength of 2.5 m. Find L and C**. [Nov/dec-2017]**
11. What are assumptions to simply the analysis of line performances at high frequencies? **[D][Apr/May-2018]**
12. Write the expression for the input impedances and open and short circuited dissipation less line. **[D][Apr/May-2018]**
13. Find the reflection co efficient of the 50 ohm Transmission line when it is terminated by the load impedance of 60+j40 ohm.[D] **[Nov/dec-2010]**
14. When does a finite line appear as an infinite line? .[D] **[Nov/dec-2010]**
15. A 50 ohm coaxial cable feeds a 75 + j20 ohm. Dipole antenna. Find reflection coefficient and standing wave ratio. [**D]** **[Nov/dec-2012]**
16. A transmission line has Z0=745 12degree ohms and is terminated is Zs=100ohms calculate the reflection loss in Db. [**D]** **[Nov/dec-2012]**
17. At a frequency of 80 *MHz,* a lossless transmission line has a characteristic impedance of 300 \_ and a wavelength of 2.5 m. Find L and C**. [May /june-2013]**
18. How can distortion be reduced in a transmission line? **[Nov/dec-2012]**
19. What are the properties of infinite length?[D]
20. Why is quarter wave line called as copper insulator?[ID]
21. Give the minimum and maximum value of SWR and reflection coefficient.[D]
22. If a line is to have neither frequency nor delay distortion how do your relate attenuation constant and velocity of propagation to frequency?[D][ **Nov/dec-2010]**
23. A low loss line has a characteristic impedance of 400ohms determine the SWR if the receiving end impedance is 650-j475Ω **[D][ Nov/dec-2010]**
24. Write the expressions for the phase constant and velocity of propagation for telephone cable? **[D][ Nov/dec-2010]**
25. What is the application of the quarter wave matching section? [D]
26. Bring out the significance of a half wavelength line. [ID]
27. Give reasons for preferring a short- circuited stub when compared to an open circuited stub[.D]
28. Give the input impendence of eighth wave line terminated in a pure Resistance [D]
29. List parameters of the open wire line at High frequency. [D]
30. What are nodes and antinodes on a line? [D]

**PART-B**

**(First Half)**

[**Transmission line equation at radio frequencies-Line of zero dissipation-voltage and current on the dissipation less line**]

1. Derive the line constant of a dissipation less line(8) **[D][May/June2016]**
2. Discuss the various parameters of open-wire and co-axial lines at radio frequency. (16**)[D][Nov/Dec2015]**
3. Discuss in detail about the voltages and currents on the dissipation less line(16**)[D][Apr/May2017**]
4. Derive the expression that permit easy measurements of power flow on a line of negligible losses. (10) **)[D][Nov/Dec2017]**
5. A line with zero dissipation has R=0.006 ohm per m, C=4.45pF per m, L=2.5µ10 per m , if the line is operated at 10MHz , find R0,α,β,λ,v.(8**)[D][May/June2016]**
6. Discuss in detail about the variation of input impedance along lines open and short circuit lines with relevant graph(10**)[D][May/Jun2016] May/Jun2018]**
7. A loss less line has a standing wave ratio of 4. The R0 is 150 ohms and the maximum voltage measured in the line is 135v.Find the power delivered to the load.(6**)[D][May/June2016]**
8. A radio frequency line with z0=70Ω is terminated by ZL=115-j80Ωat λ=2.5m.Find the VSWR and the maximum and minimum line impedance(6**)[D][Apr/May2017]**

**[Second half**]

**[Input impedance of dissipation less line**]

1. A lossless line in air having a characteristic impedance of 300 n is terminated in unknown impedance. The first voltage minimum is located at 15 cm from the load. The standing wave ratio is 3.3. Calculate the wavelength and terminated impedance. (6) **[D][Nov/Dec2015]**

**[Open and short circuited lines, Power and impedance measurement on line]**

1. Derive the expression that permit easy measurements of power flow on a line of negligible losses. (10) **)[D][Nov/Dec2015]**
2. Derive an expression for the input impedance of a dissipation less line and also find the input impedance is maximum and minimum at a distance ‘S’(8)[**D][Nov/Dec2016]**
3. Draw the input impedance pattern for a lossless line when short circuited and open circuited.(6)[D**][Nov/Dec2016]**
4. Find the sending end line impedance for a HF line having characteristics impedance of 50Ω. The line is of length(1.185λ) and is terminated in a load of(110+j80)Ω(8**)[ID][Nov/Dec2016]**
5. Discuss in detail about voltages and currents on the dissipation less line(16**)[D][Aprl/May2017**]
6. 'Briefly explain on' :i) Standing Waves ii) Reflection loss(4+4)**)[D][Aprl/May2017**]
7. A generator of 1v, 1kHz supplies power to a 100km open wire line terminated in 200 ohms resistance The line parameter are R= 10ohm/km, L=3.8 Mh/km G= 1×10 mho/km. c=0.0085 μF/km calculate the impedance, reflection coefficient power and transmission efficiency. (13) [D**][Nov/Dec2017]**

**[Standing waves, Nodes, Standing wave Ratio]**

1. Briefly explain on; Standing waves (4**)[D][Nov/Dec2016]**
2. A loss less line has a Standing Wave ratio of 4~The Ro is 15.0ohms and the maximum voltage measured in the line is 135 V. Find the power delivered to the load(6**)[ID][May/june 2017]**

**[Measurement of VSWR and Wavelength]**

1. Describe an experimental set up for the determination of VSWR of an RF transmission(8**)[D][Nov/Dec2016]**
2. A radio frequency line with Zo = 70 D is terminated by ZL = 115 - j80 n at

A =,2.5.m. Find the VSWR 'Rapid the maximum and minimum line impedances(6) **[D][Aprl/May2017**]

[**Reflection losses**]

1. Briefly explain on' :i) Reflection loss(4) **[D][Apr/May2017**]

**UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES**

**PART A**

1. What is the relationship between standing wave ratio and reflection coefficient?[D][**Nov**/**Dec2017**]
2. What are the assumptions for the analysis of radio frequency line? [D][Nov/Dec2017]
3. Distinguish between Single Stub and Double Stub matching in a transmission line. [D][**Nov**/**Dec2016**]
4. Give the application of eight wave line. [D][**Nov**/**Dec2016**]
5. Express standing wave ratio in terms of a reflection coefficient.[D][**Apr**/**May2017**]
6. Mention the application of quarter wave line.[D][**Apr**/**May2017**]
7. What is the relationship between standing wave ratio and reflection coefficient?[D][**Nov**/**Dec2017**]
8. What are the assumptions for the analysis of radio frequency line ?[D][**Nov**/**Dec2017**]
9. Give the formula to calculate the length of the short circuited stub.[D]
10. What is the input impendence equation of a dissipation less line? [D]
11. Give the equation for the radius of a circle diagram.[D]
12. Write the expression for the input impedance of open and short circuited dissipation less line.[D][Nov/Dec2010]
13. A lossless line has a characteristic impedance of 400 ohms. Determine the standing wave ratio if the receiving end impedance is 800+j0.0 ohms [**ID**][**Nov**/**Dec2010**]
14. What are the applications of smith chart[**D**][**Nov**/**Dec2010**]
15. A loss less line has a shunt capacitance of 69 pF and a series inductance of 0.387pH .Calculate the characteristic impedance.[ID][**Apr**/**May2011**]
16. Write the value of SWR of the following loads (a) Open circuit (b) short circuit (c) matched load.[D][**Apr**/**May2011**]
17. Express SWR in terms of reflection coefficient.[D][**Nov**/**Dec** **2012**]
18. What is impedance matching in stub?[D][**Apr**/**May2018**]
19. What are the uses of smith chart?[D][**Apr**/**May2018**]
20. Distinguish between Single Stub and Double Stub matching in a transmission line.[D][**Apr**/**May2016**]
21. Give the applications of eight wave lines[D][**Apr**/**May2016**]
22. What are the assumptions for the analysis of radio frequency line?[D][**Apr**/**May2017**]
23. What are the difficulties in single stub matching?[D]
24. How is the circle diagram useful to find the input impedance of open and short circuit lines[D]
25. Give the equation for the radius of a circle diagram.[D]
26. What is double stub matching?[D]
27. Give reason for an open line not frequently employed for impedance matching [ID]
28. Why double stub matching preferred over single stub matching?[ID]
29. What is the input impedance equation of a dissipation less line[D]
30. Mention the application of quarter wave line[D**][Apr/may2012]**

**PART** **B**

**[FIRST SECTION]**

**[Impedance matching Quarter wave transformer]**

1. Determine length and location of a single short circuited stub to produce' an impedance match on a transmission line with characteristic impedance of 600n and terminated in 1800 n. (8)[**D**][**Nov**/**Dec2016**]
2. Explain the 'operation of quarter wave transformer and mention it's .important applications. (8)[**D**][**Nov**/**Dec2016**]
3. Derive an expression for the input impedance of dissipation less lines. Deduce the input impedance of open and short circuited, dissipation less lines, (10)[D**][Apr**/**may2017**]
4. A lossless line in a ir having a characteristic impedance.e of 300 ohm is terminated in un known impedance. The first voltage minimum is located at 15em from the load. the standing wave ratio is 3.3, calculate the wavelength and terminated impedance.(6)[D][**Apr**/**May2017**]
5. Prove that input impedance of a quarter wave line Zn=Ro2/ZR.(6)[D][**Apr**/**May2017**
6. Design a quarter wave transformer to match a load a 200Ω to a source resistance of 500Ω. Operating frequency is 200MHz.(7)[D][**Apr**/**May2018**]
7. Determine length and location of a single short circuited stub to produce an impedance match on a transmission line with characteristic impedance of 600Ω and terminated in 1800Ω(8)[ID][**Nov**/**Dec2016**]
8. Explain the operation of quarter wave transformer and mention its important applications(8)[D][**Nov**/**Dec2016**]
9. Antenna with impedance 40+j30 0 is to be matched to a 1000 loss less line with a shorted stub. Determine the required stub admittance, distance between the stub, stub length and standing wave ratio on each ratio of the system using smith chart. (16)[ID][**Nov/Dec2017**]

**[SECOND PART]**

**[Impedance matching by stubs-single stub and double stub]**

1. A lossless transmission line with characteristic impedance Zo= 300 n is connected to a load ZL = 120 - j600 . Calculate input impedance (Zin) , standing wave ratio, r (Reflection coefficient) and input current. Given, length of the transmission line = 2 m ,phase velocity (vp) = 2.5x108m/s, operating frequency (f) = 100 MHz, source impedance (Zs) = 3000 and source voltage(Vr) = 60V.(16)[D]]Nov/Dec2017]
2. Discuss the principle of double- stub matching with neat diagrams and expressions. (8)[D][**Apr**/**May2017**]
3. Describe single stub matching technique, Derive the expression for length and location of stub.(10)[ID][**Nov**/**Dec2012**]
4. Discuss the following i) Impedance matching ii) Single and stub matching) Standing wave(16)[D][**Nov**/**Dec2013**]
5. Discuss the following i) Input impedance ii) Single and stub matching iii) Standing wave (5+5+6=16)[D][**May**/**Jun2013**]
6. Explain the technique of single stub matching and discuss operation of quarter wave transformer(16)[D][**Nov**/**Dec2012**]

**[Smith chart- solution of problems using smith chart]**

1. Finding the, sending end impedance of a line with negligible losses when Find characteristic impedance is 55 n and the load impedance is 115 + j75 n length of the line is 1.18,3wave length .by using smith chart. (10)[D][**Nov**/**Dec2017**]
2. Explain the significance of smith chart and its application of a transmission –lines. (6)[D][**Nov**/**Dec2017**]
3. A 300 ohm transmission line is connected to a load impedance of (450 -j600) n at 10 MHz. Find the position and length of a short circuited stub required to match the line using Smith chart.(8)[D][**Apr**/**May2017**]
4. Find the sending end impedance of a line with negligible losses when characteristic impedance is 55Ω and the load impedance is (115+j75)Ω length of the line is 1.183 wave length by using smith chart.(8)[ID][**Apr**/**May2018**] (10)[**Nov**/**Dec2016**]
5. Explain the application of smith chart .A 30m long lossless transmission line with Zo=50Ω operating at 2MHz is terminated with a load ZL=60+j40Ω if U=0.6C on the line , find the reflection coefficient , the standing wave ratio S and the input impedance(16)[ID][**Nov**/**Dec2012**]

**UNIT IV PASSIVE FILTERS**

**PART A**

1. What are the dominant modes for TE and TM waves in parallel plane wave guide?[D][**Nov**/**Dec2017**]
2. Write the expression for cutoff wavelength of the wave which is propagated in between two parallel planes.[D][**Nov**/**Dec2017**]
3. Why a composite filter is designed and what are the various sections of the composite filter?[D][**May**/**Jun2016**]
4. What are the major draw backs of a constant - k prototype filter?[D][May/Jun2016]
5. What are the dominant modes for TE and TM waves in parallel plane wave guide?[D][**Nov**/**Dec2017**]
6. Write the expression for cutoff wavelength of the wave which is propagated in between two parallel planes.[D][**Nov**/Dec2017]
7. A wave is propagated in the dominant mode in a parallel plane waveguide. The frequency is 6 GHz and the plane separation is 4 em, Calculate the cutoff wavelength and the wavelength in the waveguide.[D][**Apr**/**May2017**]
8. Give the equations for the propagation constant and a wavelength for TEM waves between parallel planes.[D][**Apr**/**May2017**]
9. A constant-K, T section high pass filter has a cut off frequency of 10 KH and the design impedance \_is 600 Ohm. Determine the value of shunt inductance L' and series Capacitance C. [D] [ **Nov** / **Dec2016**]
10. Define propagation constant in a symmetrical network.[D][**Nov**/**Dec2016**]
11. What are the major drawbacks of constant-K prototype filter?[D][**May**/**Jun2018**]
12. Define propagation constant in a symmetrical network. [D][**May**/**Jun2018**]
13. State the significance of crystal filters in communication system [D][**Nov**/**Dec2012**]
14. What are the advantages of m-derived filters[D][**Nov**/**Dec2012**,**Apr**/**May2011**]
15. A waveguide can be called as high pass filter. Why?[ID][**Apr**/**May2011**]
16. A constant-K high pass filter has a cut off frequency of 10 KH and the design impedance is 600 Ohm. Determine the value of L.' [D] [ **Nov** / **Dec2010**] [**May**/**Jun2013**]
17. Why constant k filters are also known as proto type filters?[ID]
18. Define cut off frequency of a filter?[D]
19. What are the features of crystal filter?[D]
20. What is importance of terminating half section?[ID]
21. Give relationship between decibel and neper.[D]
22. What are the major disadvantages of proto type k-filters.[D]
23. What are the characteristics of ideal filters?[D]
24. Draw the equivalent circuit of a piezoelectric crystal.[D]
25. Define propagation constant.[D][Nov/Dec2012]
26. Define composite filters. [D]
27. What is the condition for occurrence cut of frequency of a filter.[D]
28. What is band elimination filter?[D]
29. Mention the condition for stop band and pass band of a filter.[D]
30. If the short circuit impedance is 100 Ohm, and open circuit impedance 400 Ohm, what is characteristic impedance of symmetrical network.[ID]

PART B

**[First Half]**

**[Characteristic impedance of symmetrical network]**

1. Design a symmetrical bridge T attenuator with an attenuation of 40 dB and impedance of600 ohm**.(10)[D][Nov/Dec2017]**
2. A π-section filter network consists of series arm inductance of 20 mH and two shunt capacitor of 0.16µF each. Calculate the cut off frequency, attenuation and phase shift at 10 KHz. What is the value of normal impedance in the pass band(6)[**D**][**Apr**/**may2018**]
3. Design T and π section low pass filter which has series inductance 80 MHz and shunt capacitance 0022µf. Find the cut off frequency and design impedance.(16)[**D**][**May**/**Jun2013**]

**[Design of filters, constant K, LP, HP, BPF, BSF]**

1. Sketch the reactance curve of a constant- K low pass filter. Determine attenuation constant and phase constant in pass band and stop band plot it.(16)[**D][Nov/Dec2017**]
2. Derive the design equations of a constant k low pass filter.(8)[**D][May/Jun2016]**
3. Design constant- K band stop filters (both T and 1r -sections) for the cutoff frequencies of 2 KHz and 6 KHz. The. design impedance is 500 ohm.(10)[**D**][**Apr**/**May2017**]
4. Derive the design equations of a constant K low pass filter?(7)[**D**][**Apr**/**May2018**]
5. Design a T section and π section constant K high pass filter having cut off frequency of 12KHz and nominal impedance R0=500 ohm, Also find: i) Z0, ii) Phase constant at 24 KHz, iii) Attenuation constant at 4 KHz(16)[D]
6. Draw a constant –K T section band elimination filter and explain the operations with necessary design equations.(8)[**D**][**Nov**/**Dec2010**]
7. Design a constant K-T section band pass filter with cut off frequency 1KHz, the design impedance is 600 ohms(8)[**D**][**Nov**/**Dec2010**]

**[Second Half]**

**[ m-derived section low pass and high pass filter]**

1. Design a m-derived low pass filter (T and 1t section) having a design resistance of Ro = 500 n and the cut off frequency (fc) of 1500 Hz and an infinite attenuation frequency (fc) of 2000 Hz. (16**)[D][Nov/Dec2017**]
2. What is m-Derived filter? Draw a m-Derived T-section and *π*-section low pass filter and explain the analysis of m-Derived low pass filter with, respect to attenuation,' phase shift and characteristic , impedance with frequency profile respectively. (16)[**ID**][**Nov**/**Dec2010**]
3. What is m-derived filter? Draw a m-derived T-section and π section low pass filter and explain the analysis of m-derived low pass filter with respect to attenuation, phase shift and characteristic impedance with frequency profile respectively(16).[**ID**][**Nov**/**Dec2016**]
4. Design m-derived T-type low pass filter connected to a load of 500Ω with cut off frequency 4 KHz and peak attenuation at 4.15 KHz. (13)[**D**][**Apr**/**May2018**]
5. Draw and explain the design and operation of m-derived T-section band pass filter with necessary equations and diagrams.(8)[**D**][**Apr**/**May2017**]
6. Design a m-derived LPF, with fc= 5000 Hz, design impedance 600 ohm, f∞ is 1.25(fc).(16)[D]
7. Derive the relevant equations of m-derived low pass filter and design m-derived T type low pass filter to work the load of 500Ω with cut off frequency at 4 KHz and peak attenuation at 4.15nKHz(16)[**D**][**Nov**/**Dec2012**]

**[Composite filters]**

1. Explain the structure and application of crystal filter. Design a low pass filter with cut off at 2600 Hz to match 550Ω use one derived section with infinite attenuation of 2850 Hz(16)[**D**][**Nov**/**Dec2012**]
2. What is composite filter? Design' a constant –K low pass filter (T-section and π-section) and having cut-off at which 2.5 KHz and design resistance Ro .is 700 n,. Also find the frequency at which this filter produces attenuation of 19.1 dB. Find its characteristic impedances and phase constant ~t pass band and stop or attenuation band.(2 + 14)[ID][**May/Jun2016]**
3. Design a low pass composite filter. to meet the following specifications fc =2000 Hz, foo = 2050 Hz, Rk = 500 ohms. (16)[D]**May**/**Jun2016**]

**UNIT V WAVE GUIDES AND CAVITY RESONATORS**

**PART A**

1. Define - Phase Velocity and Group Velocity.[D][**Nov/Dec2017**]

1. What are the characteristics of TEM waves? .[D][**Nov**/**Dec2017**]
2. Define dominant mode. What is the dominant mode of a rectangular wave guide? .[D][**Nov**/**Dec2016**]
3. How a cavity resonator is formed? .[ID][**Nov**/**Dec2016**]
4. A rectangular waveguide with a 5 cm x 2 ern cross is used to propagate TMr. mode at 10 GHz. Determine the cut off wave length.[D][**Apr**/**May2017**]
5. Mention the cavity of resonators. [D][**Apr**/**May2017**]
6. Justify, why 'TM 01 and TM 10 modes in. a rectangular waveguide do not exit.[**ID**][**Nov**/**Dec2016**]
7. An air-filled rectangular waveguide of inner dimensions 2.286 x 1.016 in centimeters operates in the dominant TE lO modes. Calculate the 'cut-off frequency and phase velocity of a wave in the guide at a frequency of 7 GHz .[ID][**Nov**/**Dec2016**]
8. What is dominant mode?[D][**Apr**/**May2016**]
9. Calculate the cut-off frequency of a rectangular waveguide whose inner dimensions are a = 2.5 em and b = 1.5 em operating at TElO mode.[ID][**Apr**/**May2015**]
10. Why is circular or rectangular form used as wave guides. [ID]
11. What is relationship between loaded , unloaded , and external Q of a cavity resonator?[D][**Apr**/**May2011**]
12. Why is the Bessel function of the second kind (Neumann’s function) not applicable for the field analysis inside the circular wave guide?[ID]
13. What are degenerate modes?[**D**][**Apr**/**May2011**]
14. What is resonant frequency of microwave resonator?[D]
15. Distinguish between wave guides and cavity resonator. [D]
16. An air filed resonant cavity with dimension a=5cm, b=4cm, c=10 cm is made of copper find the resonant frequency for lowest order mode. [ID]
17. A rectangular waveguide of cross section 5cm×2cm is used to propagate TM11 mode at 10 GHz determine the cut off frequency. [ID]
18. What is the need for guide termination? [D]
19. Write the expression for the wave impedance and guide wavelength for TEM mode? [D]
20. What is the dominant mode of a rectangular waveguide? Why? [ID]
21. Calculate the cutoff wavelength for the TM11 mode in a standard rectangular waveguide if a = 4.5 cm.[ID]
22. Why TEM waves is impossible in a rectangular Wave guides .[**ID**][**Ape**/**May2011**]
23. What is the dominant TE and TM mode in rectangular waveguide? [D]
24. How to design an air filled cubical cavity to have its dominant resonant frequency at

3 GHz?[D]

1. What is Bessel function? Write Bessel’s functions of first kind of order zero?[D][**Nov**/**Dec2010**]
2. Define quality factor of resonator [D][**Nov**/**Dec2010**]
3. Why transmission line are not usually used as a microwave resonator.[ID][**Nov/Dec2010]**
4. How the resonator is constructed at low frequency. [ID]
5. Enumerate the parameters describing the performance of a cavity resonator.[**ID**][**May**/**Jun2015**]

**PART- B**

**[First Half]**

**[General Wave Behaviours along uniform Guiding structures, Transverse Electromagnetic Waves, Transverse Magnetic Waves, [TM and TE Waves between parallel planes]**

1. Derive an expression for the transmission of TE waves between parallel perfectly conducting planes for field components. (16)[**D**][**Nov**/**Dec2016**]
2. Derive the solution of field equation using cylindrical co-ordinates.(8)[D]
3. Write a brief note on the manner of wave travel and their velocities between parallel planes.(8)[**D**][**Nov**/**Dec2010**]
4. For a frequency of 10 GHz and plane separation of 5cm min: air, find the cut off frequency, cut off wavelength, phase velocity and group velocity of the wave.(16)[**D**][**May**/**Jun2016**]

**[TM and TE Waves in Rectangular Wave guides]**

1. Discuss the propagation of TM waves in a circular waveguide with relevant expression for the field components.(8)[D]
2. Discuss briefly the attenuation of TE and TM wave between parallel planes(8)[**D**][**Apr**/**May2015**]
3. Give a brief note on the transmission of TEM waves between parallel planes(8)[**D][Apr/May2015]**
4. Calculate the cutoff wavelength, guide wavelength and characteristic wave impedance of a circular wave guide with an internal diameter of 4 cm for a 10 GHz signal propagated in it in the TE₁₁ mode.(16)[D]
5. A rectangular wave guide with dimension a=2.5cm, b=1cm is to operate below 15 GHz How many TE and TM modes can the wave guide transmit if the guide is filed with a medium characterized by σ=0, €=4 €0, βr=1? Calculate the cutoff frequency of the modes.(16)[**ID**][**Nov**/**Dec2012**][**May**/**Jun2017**]
6. Explain in detail: i) Excitation of wave guides. ii) Resonant cavities.(8+8)[**D**][**Nov**/**Dec2012**] ][**May**/**Jun2017**]
7. Derive the field equations of Transverse Electric waves travelling in Z direction rectangular wave guide(16)[**D][Nov**/**Dec2017**]
8. Derive the field component of a Transverse Electric wave in Rectangular wave guides.(16)[**D**][**May**/**Jun2016**] (16)

**[Second Half]**

1. Discuss the propagation of TM waves in a rectangular waveguide with relevant expressions and diagrams for the field components.(16)[D]
2. A rectangular waveguide measuring a = 4.5 cm and b = 3 cm internally has a 9 GHz signal propagated in it. Calculate the guide wavelength, phase and group velocities and characteristic impedance for the dominant mode(16)[**D**][**Nov**//**Dec2012**]

**[Bessel’s differential equation and Bessel function]**

1. Derive the expression for TM wave components in wave guides using Bessel function.(16)[D]
2. Derive the TM wave components in circular wave guide using Bessel function?(16)[D]

**[TM and TE Waves in circular Wave guides]**

1. Derive the expression for the field components of TE and TM waves in a circular wave guides(16)[**D**][**Nov**/**Dec2013**]
2. A TEll wave is propagating through a circular waveguide. The'diameter, of the guide is 10 em and the guide' is air-filled. Given Xu = 1.842 Find the cut-off frequency. Find, the wavelength *Ag* In the guide for' a frequency of 3 GHz ',Determine the wave impedance in the guide.(16)[D][**Nov**/**Dec2017**]

[**Rectangular and circular cavity resonators]**

1. Derive expressions for the field components existing in a rectangular cavity.(16)[D][Apr/May2015]
2. Derive the equation for Q-factor of rectangular cavity resonator for TE₁₀₁ mode.(8)[D]
3. Write a brief note on circular cavity resonator and its application.(8)[D**][Nov**/**Dec2016**]
4. A circular air filed copper cavity is excited in the TM₀₁₀ mode at 9.375 GHz. The cavity has ratio length radius = 1.5. Find the Q-factor. (16)[D]
5. Derive the resonant frequency of a rectangular resonator.**(16)[D][Nov/Dec2017]**
6. Calculate the resonant frequency of an air field rectangular resonator of dimensions a=3cm, b=2cm, d=4cm operating in TE₁₀₁ mode.(16)[**ID**]**Nov**/**Dec2013**]

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