BITS, PILANI – DUBAI CAMPUS

I SEMESTER 2012 – 2013

Course Code: **ECE C452** **COMPREHENSIVE EXAMINATION-III YR ECE** Date: **31.12.2012**

Course Title: **ELECTROMAGNETIC FIELDS AND MICROWAVE ENGG.** Duration: 3 Hrs

Max.marks:**80** Weightage: **40%**

Instructions: 1.ANSWER all questions in sequence of their order.

2. Make assumptions, if any, but explicitly indicate the assumptions made

1.	a) Find electric field intensity at point (1,1,0) due to point charges Q_1=3/√2 nC at (0,0,0) .Find the potential at that point . b) Apply differential form of ampere law to find current density $\hat{J}$ at point P (0, 1, 0) if magnetic filed intensity in the region is $4\Pi\left(xy.\hat{a}_x + yz.\hat{a}_y + zx.\hat{a}_z\right)\mu A/m$	4M 4M
2.	a) Derive solution in differential form and integral form for $\oint \hat{D}.\hat{ds}$ in static and time varying field. b) Derive wave equation and find its solution for conducting medium	4M 4M
3.	a. A certain medium has following parameters: Relative Permeability $\mu_r = 10$; relative permittivity $\varepsilon_r = 2.5$ and conductivity of medium $\sigma = 10^{-4} mho/m$ .Determine attenuation constant ,Phase constant ,wave length ,velocity of propagation and wave impedance at 1GHz b. Electromagnetic wave has $\hat{E} = \left(4.\hat{a}_x - .\hat{a}_y + 2.\hat{a}_z\right)$ V/m and $\hat{H} = \left(6.\hat{a}_x + 18.\hat{a}_y - 3.\hat{a}_z\right)$ A/m. i) Power flow vector ii) Direction of transmission iii) Relative permittivity ε_r if relative permeability $\mu_r = 1$	5M 5M
4.	a. Derive the characteristic impedance of lossless line and distortion less line as $Z_o = \sqrt{\frac{L}{C}}$ b. Transmission line has Z_R=200 Ω and Z_0=100 Ω Derive the expression for SWR and calculate its minimum and maximum values	6M 5M
5.	a. Input impedance of transmission line having length $\ell = 0.2\lambda$ and Z_0=10 Ω has $K = 0.6\angle 50^0$. Calculate (i) Input impedance and (ii) single stub matching parameters. b. A load impedance Z_R=10 Ω is to be matched with source having internal impedance Z_{IN}=2.5 kΩ Design a matching network to match Z_R with Z_{IN}	6M 4M
6.	a. Obtain expression for magnetic field intensity at a distance of ' r ' m from a small radiating source b. Calculate directions corresponding to Maxima, Minima and Half power for a broad side array having two elements separated by distance λ/2 and plot its radiation pattern in polar chart.	6M 6M
7.	a. Explain the operation of parabolic antenna and design it to have gain of 30 dB to receive signal at 6 GHz from satellite b. Draw Non resonant antenna and explain its operation	6M 5M
8.	Write short notes on any two : i. Reflex klystron ii. Tunnel diode iii. Parametric Amplifier iv. Microwave Circuit isolator	10 M

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Course Code: **ECE C452** ..... **III Year ECE - Test-2[OPEN BOOK]** Date: **18.11.2012**

Course Title: **ELECTROMAGNETIC FIELDS AND MICROWAVE ENGG.** Duration: **50 minutes**

Instructions: 1.ANSWER all questions in sequence of their order.
2. Make assumptions, if any, but explicitly indicate the assumptions made

1.	a. Find velocity of propagation through telephone line which has R=13 Ω/km, L=3 mH/km, G=0 mho and C=0.5 μF. Assume 4 kHz signal is passed through line. b. The attenuation constant of line is $\alpha = \sqrt{\frac{1}{2}(\sqrt{(R^2+\omega^2L^2).(G^2+\omega^2C^2)}.+(RG-\omega^2LC))}$. Obtain the expression $\frac{R}{L}=\frac{G}{C}$ for line to be distortion less by giving appropriate changes only in capacitance.	4 M 6 M
2.	a. Write minimum and maximum value of reflection coefficient 'K' and SWR 'S'. Obtain these values using appropriate expression. b. Calculate the value of reflection coefficient and standing wave ratio if the line has $Z_R = 100 + j200\Omega$ and $Z_0 = 100\Omega$.[Note: Do not use smith chart]	4 M 6M
3.	a. Obtain the expression $Z_{IN} = Z_0 \frac{1+Ke^{-2Pl}}{1-Ke^{-2Pl}}$ from standard expression of Z_{IN} where K is reflection coefficient and P is propagation constant. b. A lossless line has velocity of propagation 1.5×10^8 m/sec. Find the value of inductance if the capacitance of line 150 nF/m	6 M 2M
4.	a. A transmission line having characteristic impedance Z_o=600 Ω is to be matched with terminating load impedance of Z_R=900+j400 Ω for a frequency 600 MHz. Find required single stub matching parameters using smith chart. b. Using Smith chart, find the unknown terminating impedance of line if input impedance of the transmission line is Z_{IN}=75+j75 Ω and the characteristic impedance of line is Z_O=75 Ω. The first maximum is located at a distance 8.30λ from the load.	6 M 6M

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I SEMESTER 2012 – 2013

Course Code: **ECE C452** TEST-1 Date: **30.09.2012**

Course Title: **ELECTROMAGNETIC FIELDS AND MICROWAVE ENGG.** Duration: **50 minutes**

Instructions: 1.ANSWER all questions in sequence of their order.
2. Make assumptions, if any, but explicitly indicate the assumptions made

1.	a) Find electric field intensity at (1,1,0) due to a reference point charge $Q_1=3/\sqrt{2}$ nC at (1,0,0), $Q_2=3/\sqrt{2}$ nC at (0, 1, 0) and $Q_3=3$ nC at (0, 0, 0).Find the potential at point (1,1,0). b) Find volume charge density at point P (0, 1, 0) for electric flux density $4\Pi\left(xy.\hat{a}_x + yz.\hat{a}_y + zx.\hat{a}_z\right)\mu C/m^2$	6 M 4 M
2.	a) The scalar potential field in free space given by the expression $V = 2x^2yz$ is established by volume charge density. Find i. the magnitude of volume charge density ii. potential difference between points A(1,4,5) and B(1,2,5) b) Static magnetic filed $\hat{H} = r.\sin\theta..\hat{a}_r$ mA/m is established by current density $\hat{J}$. Find current density $\hat{J}$ at point $P(r=1m, \theta=30^o, \phi=30^o)$.	6 M 6M
3.	a) Write the solution for $\oint \hat{E}.\hat{dl}$ in static and time varying fields b) Solve the following expression for time varying field in lossless medium $\nabla X(\nabla X\hat{E})$,where E is electric field intensity	4 M 6 M
4.	a) Derive Maxwell equation for time varying field in harmonic form. Assume lossless dielectric medium. b) The magnetic field component of EM wave has $\hat{H} = 25.Sin(2.10^8 t - 6y)\hat{a}_x$. i. Find frequency of wave ii. Find electric field intensity $\hat{E}$ iii. Find $\hat{E}$ is normal to $\hat{H}$ iv. Find direction of propagation	6 M 8 M
5.	Write your understanding on following (i) $\nabla.\hat{B} = 0$ (ii) $\nabla x\hat{E} = 0$	4 M

** Good Luck**

BITS PILANI, DUBAI CAMPUS

I SEMESTER 2012 – 2013 Version B

Name:		Id No:	

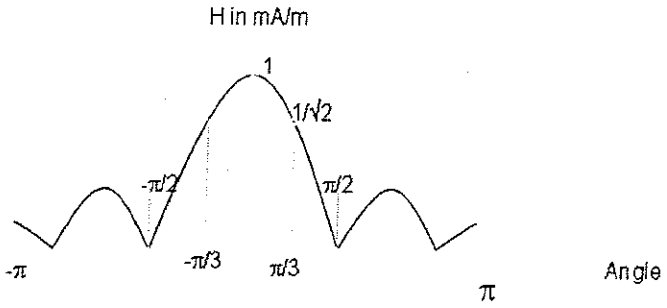
Course Code: ***ECE C452*** *Quiz-2* ***Date: 11.12.2012***

Course Title: ***ELECTROMAGNETIC FIELDS AND MICROWAVE ENGG.*** *Max Marks:* ***14***

Duration: ***20 minutes*** *Weightage:* ***7%***

Instructions: 1.ANSWER all questions **with most appropriate answer(s)**, at the space provided.
2. Make assumptions, if any, but explicitly indicate the assumptions made

1. Calculate HPBW and Beam with between Nulls from following radiation pattern 2 M

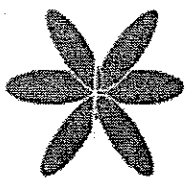


2. Which type antenna is used in mobile communication? 1 M

3. Draw Yagi antenna and design it for 7 MHz bandwidth spread over 61MHz to 68 MHz 2 M

4. Dipole is defined as two opposite charges separated by small distance. Write how to make this dipole to radiate electromagnetic energy. 1 M

5. From the following radiation pattern ,radiation has _____ directional transmission and _____ number of minor lobes 2 M



Name:		**Id No:**	

5. Find propagation constant and characteristic impedance of matched line having end receiving voltage $2.4\angle 2$ and sending end voltage $5\angle 2$ .The receiving end current is $4\angle 1$ mA.

6. Find primary constant of line having secondary constant $Z0 = 600\angle 0.785$ and propagation constant P=1+j1 .Assume w=5000 radians/sec

7. Draw transmission line equivalent circuit in T section and π section symmetrical network form

8. Calculate the value of attenuation constant and phase constant of lossless line having velocity of propagation $2x10^5$ m/sec. Assume w=5000 radians/sec