Government College of Engineering, Amravati
(An Autonomous Institute of Government of Maharashtra)

Sixth Semester B. Tech.
(Electronics and Telecommunication)

Summer – 2016

Course Code: ETU601

Course Name: Electromagnetic Fields

Time: 2 hrs. 30min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. **a)** Explain the spherical coordinate system and illustrate the transformation procedure by transforming the vector field $\mathbf{G} = (xz/y)\mathbf{a}_x$ into spherical components and variables. **6**

Or

b) Transform the following vectors to spherical coordinates at the points given: (a) $10\mathbf{a}_x$ at $P(x = -3, y = 2, z = 4)$;(b) $10\mathbf{a}_y$ at $Q(\rho = 5, \Phi = 30°, z = 4)$; (c) $10\mathbf{a}_z$ at $M(r = 4, \Theta = 110°, \Phi = 120°)$. **6**

c) With the help of expression explain the application of Gauss's law to differential volume element. **6**

Cont.

2 a) Calculate the total electric flux leaving the cubical surface formed by the six planes x, y, z = ± 5 if the charge distribution is:(a) two point charges, 0.1μC at (1,-2, 3) and $\frac{1}{7}$ μC at (-1,2,-2); (b) a uniform line charge of π μC/m at x=-2, y=3; (c) a uniform surface charge of 0.1μC/m^2 on the plane y= 3x. 6

Or

b) Given the potential field, $V = 2x^2y - 5z$, and a point $P(-4,3,6)$,we wish to find several numerical values at point P: the potential V, the electric field intensity **E**, the direction of **E**, the electric flux density **D** ,and the volume charge density ρ_v. 5

c) With the help of expression explain Maxwell's first equation and its application. 6

3 a) State and explain Ampere's circuital law and its application. 6

Or

b) A solid conductor of circular cross section is made of a homogenous nonmagnetic material. If the radius a = 1 mm, the conductor axis lies on the z axis, and the total current in the $\mathbf{a}_z$ direction is 20A, find:(a) H_ϕ at ρ =0.5 mm;(b) B_ϕ at ρ =0.8 mm; (c) the total magnetic flux per unit length inside the conductor; (d) the total flux for $\rho < 0.5$ mm;(e) the total magnetic flux outside the conductor. 6

c) Explain with suitable sketch plane wave reflection at oblique incidence angles. 6

4 a) With the help of expressions explain electromagnetic wave propagation in good conductors. 6

b) Explain with suitable sketch and expression dominant mode in the rectangular waveguide. 6

5 a) Calculate the power radiated and its radiation resistance by λ/16 dipole in free space if it carries a uniform current I = 10 cos (wt) Amperes. 6

b) With the help of neat sketches and expressions explain concept of radiation of electromagnetic energy from a simple dipole antenna. 6

Government College of Engineering, Amravati
(An Autonomous Institute of Government of Maharashtra)

Sixth Semester B. Tech.
(Electronics and Telecommunication)

Summer – 2016

Course Code: ETU603

Course Name: Electronic Measurements

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. **Solve the Following**

a) i) In general, what are the static characteristics of an instrument? Explain. **04**

ii) A 600 V voltmeter is specified to be accurate within ±2% at full scale. Calculate the limiting error when the instrument is used to measure a voltage of 250V. **02**

b) By giving an example, explain the principle of successive approximation analog-to-digital (A/D) converter. **06**

2. **Solve any TWO** **12**

a) What are the different types of errors? Giving example of each, State the three types of systematic errors.

b) Explain the working principle of Q-meter. Also outline the factors that cause errors during a Q measurement.

c) With the aid of block diagram explain staircase-Ramp Digital Voltmeter (DVM).

3. **Solve any TWO** **12**

a) With the aid of neat diagram explain phase sensitive detector (or phase meter) for comparing an AC with reference signal.

b) Using analog schematic and operational detail, explain any one type of analog frequency meter also discuss its applications.

c) Draw the block diagram of digital LCR meter and explain the function of each block.

4. **Solve any TWO** **12**

a) With the help of neat functional block diagram and typical attenuation curve explain audio range wave analyzer.

b) List the various types of printer. Explain any one of them with suitable diagram.

c) With the appropriate block diagram of the vertical section of an oscilloscope, explain vertical deflection system.

5. **Solve the Following** **12**

a) Draw the simplified block diagram of random noise generator and explain the function of each block. Also sketch its frequency response curve.

b) Draw the block diagram of digital storage oscilloscope and explain the function of each block. And Write any two applications of oscilloscope.

Government College of Engineering, Amravati
(An Autonomous Institute of Government of Maharashtra)

Sixth Semester B. Tech.
(Electronics and Telecommunication)

Summer – 2017

Course Code: ETU601

Course Name: Electromagnetic Fields

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory. Attempt any TWO from question 2, 3 and 4.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.
6) All symbols have their usual meaning

1. **a)** Given $A(r = 20, \theta = 30^0, \varphi = 45^0)$ and $B(r = 30, \theta = 115^0, \varphi = 160^0)$, find $|R_{AB}|$. **6**

Find $|R_{AC}|$, given $C(r = 20, \theta = 90^0, \varphi = 45^0)$

Find distance from A to C on a circle path.

b) The surfaces $r = 2$ and $4, \theta = 30^0$ and 50^0, and $\varphi = 20^0$ and 60^0 identify a closed surface. **6**

a) Find the enclosed volume,

Contd..

b) Find the total area of the enclosing surface,
c) Find the total length of the twelve edges of the surface.

2. a) The volume charge density $\rho_V = \rho_0 e^{-|x|-|y|-|z|}$ exists over all free space. Calculate the total charge present. 6

A $100nC$ point charge is located at $A(-1,1,3)$ in free space. Find the locus of all points $P(x,y,z)$ at which $E_x = 500V/m$.

b) Within the spherical shell $3 < r < 4m$, the electric flux density is given as 6
$D = 5(r-3)^3 a_r C/m^2$
a) What is the volume charge density at $r = 4m$?
b) What is the electric flux density at $r = 4m$?
c) How much electric flux leaves the sphere $r = 4m$?
d) How much charge is contained within the sphere $r = 4m$?

c) It is known that the potential is given as $V = 80r^{0.6}$ V. Assuming free space conditions, find: 6
a) E
b) the volume charge density at $r = 0.5\ m$:
c) the total charge lying within the surface $r = 0.6m$:

Two uniform line charges, $8\,nC/m$ each, are located at $x = 1,\ z = 2$, and at $x = -1, y = 2$ in free space. If the potential at the origin is $100V$, find V at $P(4,1,3)$

3. a) Given the current density 6
$$J = -10^4[\sin(2x)\, e^{-2y} a_x + \cos(2x)\, e^{-2y} a_y] kA/m^2$$
a) Find the total current crossing the plane $y = 1$ in the a_y direction in the region $0 < x < 1,\ 0 < z < 2$.
b) Find the total current leaving the region $0 < x, y < 1, 2 < z < 3$ by integrating $J \cdot dS$ over the surface of the cube
c) Repeat part b) but use the divergence theorem
d) Comment on both the results

b) A filament is formed into a circle of radius a, centered at the origin in the plane $z = 0$. It carries a current I in the a_φ direction. Find H at the origin. 6
A filament of the same length is shaped into a square in the z = 0 plane. The sides are parallel to the coordinate axes and a current I flows in the general a_φ direction. Again, find H at the origin

c) The time domain expression for the magnetic field of a uniform plane wave travelling in a free space is given by $H(z,t) = 2.5\cos(1.257 \times 10^9 t - k_0 z)\, a_y mA/m$. Find 6
a) the direction of wave propagation

Contd

b) the operating frequency
c) the phase constant
d) the time domain expression for the electric field $E(z,t)$

4. a) A uniform plane wave in air, $E_{x1}^{+} = E_{x10}^{+}\cos(10^{10}t - \beta z)V/m$, is normally-incident on a copper surface at z = 0. What percentage of the incident power density is transmitted into the copper? 6

b) Derive TE field equations in circular waveguide. 6

c) An air filled rectangular waveguide has dimensions of $a = 6cm$ and $b = 4cm$. The signal frequency is $3GHz$. For TE_{10}, TE_{01} modes, compute 6
   a) Determine the cutoff frequency
   b) Determine the wavelength in the guide
   c) Phase constant

5. a) For a oscillating Electric Dipole, Prove that, 'only r and θ components of Electric field and φ component of magnetic field is present' 6

b) Given the fields $V = 80z\cos x \cos 3 \times 10^{8}t\ kV$ and $A = 26.7z \sin x \sin 3 \times 10^{8}t\, a_x\ mWb/m$ in free space, find E and H 6