Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
NOVEMBER 2018
SUBJECT: RF & MICROWAVE ENGINEERING (ECE - 4102)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** questions
- Missing data may be suitably assumed
- Smith chart will be provided

1A. Draw the neat sketches of voltage and current at radio frequencies on a two wire transmission line, when it is terminated with Z_R equal to (a) R_o (b) $3R_o$ and (c) $R_o/3$

1B. An air filled coaxial line of copper is to have a capacitance of 22 pF/meter. The inner conductor has a diameter of 0.1 cm. Calculate:
(a). inductance of the line
(b). inner radius of the outer conductor
(c). Characteristic Impedance
(d). Phase constant and wavelength at a frequency of 25MHz neglecting dissipation

1C. In an experiment it is found that voltage minima occur at 0.358λ away from the load and VSWR = 3.5. With the help of Smith chart, determine R_{max}, R_{min} and reflection coefficient for the unmatched line. Also design a single stub matching network (closest to the load) to match the load with transmission line having $R_o = 100\Omega$.

(3+3+4)

2A. For a rectangular waveguide of cross section dimension 2.3X1.1 cm, determine mode/modes which will propagate at a frequency of 9 GHz. Also find α, β, γ, cut off wavelength, waveguide wavelength, V_{ph}, and Z_{TE}.

2B. What are the wave impedances of TE, TM and TEM for guided waves? and show the variations in graphical representation.

2C. Why TEM waves are not possible in rectangular/circular waveguide?

(4+3+3)

3A. Describe working of two slot directional coupler with all ports perfectly matched. Solve for its S matrix.

3B. A four port circulator with insertion loss = 1dB, VSWR = 1.5 and isolation = 30dB. Determine its S Matrix.

3C. With necessary diagram and S matrix, explain working of gyrator.

(4+3+3)

4A. From the fundamentals, derive the velocity modulation equation for reflex klystron with necessary diagram. Explain the working with the help of applegate diagram.

4B. Explain the bunching process in two cavity klystron amplifier and obtain the expression for bunching centre.

(6+4)

5A. Starting from fundamentals, discuss the generalized voltage and current equations at any point on a two wire transmission line.

5B. With a neat diagram, explain the amplification process in helical TWT.

5C. An X-band pulsed cylindrical magnetron is operated at cyclotron frequency 10GHz ,with average velocity of electrons $0.9*10^8$ m/s has the following parameters, diameter of anode cylinder is 16cm, the cut off magnetic flux density at fixed V_0 is 15mWb/m^2. Calculate,

a) Fixed Magnetic density.
b) The cut-off voltage for fixed B_0
c) Radius of cathode cylinder

(4+3+3)