Indian Institute of Engineering Science & Technology, Shibpur
M.E (ETC) Final Examination, 2014
Sub: Radar Signal Processing & Imaging (ETC-1036)

Full Marks – 70. Answer any **FIVE** questions (The questions are of equal value)
Time – 3 Hrs.

1. (a) Define Radar Cross Section . Prove that the following relation: Polarization efficiency

$$\rho_{pol} = \frac{|1 - Q_3 Q_2|^2}{\left(1 + |Q_3|^2\right)\left(1 + |Q_2|^2\right)}$$

(b) A target has a scattering cross section of 3 $m^2$ when its scattered wave is right circularly polarized. A receiving antenna is polarized in the $\theta_3$ direction only. What cross section should be used in the radar equation?

[8+6]

2. (a) What are the RCS components?
(b) Explain RCS fluctuation mechanism.
(c) What do you mean by Target Fluctuation model? Define glint and scintillation.

[4+4+6]

3. (a) What do you mean by Synthetic Aperture Radar(SAR)?
(b) What are the different modes in SAR operation ?
(c) Find the length of the synthetic antenna necessary to produce cross range resolution of 1 m at a range of 5 km, find also maximum length of the real antenna and distance to the far field of the synthetic antenna. The RADAR frequency is 10 GHz.

[4+4+6]

4. (a) For SAR prove that range resolution is equal to $\lambda R/ 2L\sin\theta$.
(b) With proper figure explain Range and Cross range resolution.
(c) A RADAR has a PRF of 1250 pps. What is the maximum range which target s can have if they are to be in the first range zone?

[6+4+4]

5. (a) What are the differences between Pyramidal and Tapered loading Absorbers?
(b) With proper diagram explain Dallenbach layer , Salisbury screen, Jaumann Absorbing material.
(c) What do you mean by A scope B scope and C scope in Radar display?

[4+6+4]

6. (a) What are the PRF classes? Define Blind Speed.
(b) A target at range 5km reflects power such that -58dBm appears at the output of an antenna with an effective area of 10 $m^2$. The illumination power density at the target is 20 mW/ $m^2$ . Find the RCS of the target.
(c) Estimate the peak RCS of a Luneburg lens of 8 inch diameter to an X band(10 GHz) Radar.

[4+6+4]

7. (a) Why Pulse compression techniques is important in Radar Signal Processing.
(b) Explain one Digital Pulse compression technique.

[4+10]

8. Write short notes on: any two
(a) PPI (b) Reflector antenna (c) RCS Prediction technique.

[7+7]