Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: RADAR Technology **Semester: VIII**
Program: ASE+AVE **Time : 03 hrs.**
Course Code: AVEG 4009 **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define the various RADAR Bands	**4**	**CO1**
Q 2	Differentiate Mono-static and Bi-static RADAR system	**4**	**CO2**
Q 3	List out ten factors affecting the RADAR operations	**4**	**CO3**
Q 4	Discuss the principle of operation of SAR	**4**	**CO4**
Q 5	Discuss the fundamentals of Ground Controlled Approach RADAR and Its operation	**4**	**CO4**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	How the Minimum Detectable Signals could be calculated? Derive the relationship for Range equation with the consideration of Noise Figure/factors.	**10**	**CO2**
Q 7	Discuss the basic principle of Doppler's effect. Write down the various cases for the Electromagnetic/speech signal transmissions from the source to observer. Derive the relative velocity for the moving target under radial manner. Develop the algorithms for the same under the various categories.	**10**	**CO3**
Q 8	If the power transmitted from a transmitter is 10kW and gains of transmitting and receiving antennas are 30dB and 20dB respectively then calculate the maximum power received at a distance of 10km over free space for 2GHz transmission frequency.	**10**	**CO 4**
Q 9	What are the various types of RADAR displays? Discuss five important displays for the obtained data receptions	**10**	**CO4**
SECTION-C **(2Qx20M=40 Marks)**			

Q 10	The radar parameters for the biostatic radar system is as shown in Table 1. The range parameters are defined in Table 2. Calculate SNR for the RADAR receiver.	**20**	**CO1**

Table 1 – Radar Parameters

RADAR PARAMETER	VALUE
Peak Transmit Power @ Power Tube, P_T	1 Mw
Transmit Losses, L_t	2 dB
Pulse Width, τ_p	0.4 μs
Antenna Gain, G_T, G_R	38 dB
Operating Frequency, f_c	8 GHz
Receive Losses, L_R	3 dB
Noise Figure F_n	8 dB
Other Losses, L_{other}	2 dB

Table 2 – Radar Range Equation Parameters

DAR RANGE EQUATION PARAMETER	VALUE (MKS)	VALUE (
P_T	10^6 w	60 dBw
G_T	6309.6 w/w	38 dB
G_R	6309.6 w/w	38 dB
$\lambda = c/f_c$	0.0375 m	-14.26 dB
σ	3.98 m^2	6 dBsm
R	60×10^3 m	47.78 dB
kT_0	4×10^{-21} w-s	-204 dB(

		$B = 1/\tau_p$	2.5×10^6 Hz	64 dB(Hz)		
		F_n	6.31 w/w	8 dB		
		$L = L_t L_r L_{other}$	5.01 w/w	7 dB		
Q 11	A CW radar is illuminating at 10 GHz frequency towards the automobiles and a car is found to move towards the radar with a speed of 200km/hr. Find the Doppler shift and the frequency of received echo signal. Also, find the frequency of the echo signal if the car moves away from the radar with the same speed. Describe what principle its operates, Also derive the system equation for target velocity measurement				**20**	**CO 3**