	End Somester Essans
	End Semester Essam AA 674 (474: Radio abstranomy
	7.11 6717 (7.1
	Sulemitted ley:
	Sulemitted <u>ley:</u> Schini Dutter
	2003121011
<i>.</i> 0.1.	(c)
Q.(. =	
Q.2·	(a)
1	
Q.3·	(a)
g.4.	(e)
-	
g.s.	$(\boldsymbol{\iota})$
Q.6	(h)
7	
9.7.	(e)
Q.9 ⁻	(L)
*	

9.9.	(a)
9.10.	(a)
	SECTION B:
Q.1.0) Given that dy nodic period of mars S = 780 days.
	Hors is a suguer or planet I nee know in that case,
	1 = 1-1 => 1 = 687 days.
	S P wind of body 1 2
	Using Keelin law P. = /a, > Celital
	Hard is a superior planet & nex know in that case, \[\frac{1}{5} = 1 - \frac{1}{5} = \frac{1}{5} \] Using Kepler's law, \[\frac{1}{12} = \frac{1}{12} \] \[\frac{1}{12} = \frac{1}{12} = \frac{1}{12} \] \[\frac{1}{12} = \frac
	Let Esseth be body 1. Is paid of body?
	Then, P, = 365 days body 2
	and on = Au.
	given that for Mass, l2 = 697 days.
	Urise these, 3
	(365) = (1
	(687) (a)
	$=$ $a_{1}^{3} = 1$
	0.531
	=) 02 = 1.52 Au
	,

(b) aligned resolution of an interferometer type consay:

; given by:

0= 1.022

leman :- the manimum Resolution will be achieved by the shockest wardingth. So, 0= <u>102x3 x10-6</u> = 3.06×10 gadians = 0.0063117" The diameter of the earth is: 12,742 km = 1.2942×10 m. elt or distance of 10 pe, this will outlind on angle of: = 4.129×10-11 radians 0= 1.2742×107 10× 3.096×1016 = 8.52 ×10 -6 order This is much much amaller that the best resolution delaivalele ley TPF. The distance beliveen beath & Sun is 1AU At 10 pc, this endetends an angle of:

$G = \underbrace{(.49 \times 10^{11})}_{(0003.036 \times 10^{16})} = 4.89 \times 10^{-3} + \text{ordions}$ $[0003.036 \times 10^{16}] = 0.10036$ Whis distance can be tested by the TPF eince the angular eize is larger tan the resolution. (C) Given that the S+B count is: S+6: n. Be count is: $B = n_B$ Wine direction: the same for beth cores. Then, dignal count can be given as: $S = (S+B) - B = n_1 - n_2 = 0$ wow considering the two observations to be independent, $Ts^2 = Ts + Ts^2$ Both $(S+B)$ and B observations are Poissonian: $Ts + a = \sqrt{S+B} = \sqrt{n_1}$ and $Ts = \sqrt{B} = \sqrt{n_2}$ $Ts^2 = n_1 + n_2 = 0$ Signal to notice ratio is given by $\frac{S}{Ts}$		
This distance can be resolved by the TPF eince the angular eize is begin term the resolution. (c) Given that the S+B count is: S+6: n . Be count is: $B = n_B$ Zime direction is the same for both cores. Then, dignal count can be given as: $S = (S+B) - B = n_1 - n_2 - D$ word considering the two observations to be independent, $T_S^2 = T_{S+B} + T_B^2$ Both $(S+B)$ and B observations are looksonian. $T_{S+B} = \sqrt{S+B} = \sqrt{n_1}$ $T_{S+B} = \sqrt{n_2}$ $T_{S+B} = \sqrt{n_1} + n_2$ $T_{S+B} = \sqrt{n_2}$		0= 1.49 ×10" = 4.89 ×10 + andions
This distance can be tended by the TPF eince the angular eize is begin than the sendition. (c) Given that the S+B count is: S+B: n. B count is: B: n. Line direction is the same for beth cores. Then, dignal count can be given as: $S = (S+B) - B = n_1 - n_2 - D$ word considering the two observations to be independent, $T_S^2 = T_{S+B} + T_B^2$ Both $(S+B)$ and B observations are lossonian. $T_{S+B} = \sqrt{S+B} = \sqrt{n_1}$ and $T_B = \sqrt{n_2}$ $T_S^2 = n_1 + n_2 - T_B$		10x3.08e × 101e = 0-1008e
(c) Given that the S+B count is: $S+B=n$. B court is: $b=n$. Lime disaction: $b=n$ the same for letter cores. Then, dignal count can be given as: $S=(S+B)-B=n_1-n_2 - 0$ now considering the two descentions to be independent, $T_S^2=T_{S+B}^2+T_{R}^2$ Both $(S+B)$ and B eleverations are Poissonian. $T_{S+B}=\sqrt{S+B}=\sqrt{n_1}$ $T_{S+B}=\sqrt{n_2}$ $T_{S+B}=\sqrt{n_1}+n_2$ $T_{S+B}=\sqrt{n_2}$		This distance can be resolved by the TPF
2'm disation: $b = na$ S= (S+B) - $b = na$ $a = na$ $a = na$ S= (S+B) - $b = na$ $a = na$ $a = na$ $a = na$ S= (S+B) - $a = na$ $a = n$		eince the angular eize is læger tran the resolution.
2'm disation: $b = na$ S= (S+B) - $b = na$ $a = na$ $a = na$ S= (S+B) - $b = na$ $a = na$ $a = na$ $a = na$ S= (S+B) - $a = na$ $a = n$	(c)	Given that the STB count is: STB= n.
Zine deation is the same for lath cones. Yhen, signal count can be given as: $S = (S+B) - B = n_1 - n_2 \qquad - 0$ now considering the two descentions to be independent, $T_S^2 = S_{S+B}^2 + T_B^2$ Both $(S+B)$ and B descentions are lossonian. $T_{S+B} = \sqrt{S+B} = \sqrt{n_1} \text{and} \sigma_B = \sqrt{B} = \sqrt{n_2}$ $T_S^2 = n_1 + n_2 \qquad 2$		B court is: B = na
S= $(S+B)-B=n_1-n_2$ Now considering the two descentions to be independent, $Ts^2 = Ssta^2 + Ta^2$ Both $(S+B)$ and B descentions are Poissonian. $Sta^2 = \sqrt{S+B} = \sqrt{n_1} \text{and} \sigma_B = \sqrt{B} = \sqrt{n_2}$ $\Rightarrow Ts^2 = n_1 + n_2$		L'ine duration : - the same for lett cares.
S= $(S+B)-B=n_1-n_2$ now considering the two descentions to be independent, $Ts^2 = Ssta^2 + Ta^2$ Both $(S+B)$ and B descentions are Poissonian. $Sta^2 = \sqrt{S+B} = \sqrt{n_1} \text{and} \sigma_B = \sqrt{B} = \sqrt{n_2}$ $\Rightarrow Ts^2 = n_1 + n_2$		Then, Signal count can be given as:
now considering the two obscurations to be independent,		
Both (S+B) and B eleverations are Poissonian. $ \vdots \nabla_{S+B} = \sqrt{S+B} = \sqrt{n}, \text{and} \nabla_{B} = \sqrt{B} = \sqrt{n}, $ $ \Rightarrow \nabla_{S}^{2} = n_{1} + n_{2} \qquad \qquad$		S= (S+B) -B = n,-n2 -0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		now considering the two descurations to be independent,
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		
		Both (S+B) and B descriptions are Poissonian.
		$\therefore \nabla_{S+R} = \sqrt{S+B} = \sqrt{n}, \text{and} \nabla_{R} = \sqrt{B} = \sqrt{n},$
		$= n_1 + n_2 \qquad = n_2$
Signal to rota ratio is given ley S		
Ts		Single to better series less S
		TE TE
: from 1 and 2,		: from 1 and 2,

$$\frac{S}{T_2} = \frac{n_1 - n_2}{\sqrt{n_1 p_{12}}}$$

(d)
$$\mu_{av} = \int_{0}^{\infty} x^{N} \exp\left(-\sigma nx\right) dn$$

$$= \left(\frac{1}{\sqrt{n^{2}}}\right) \left[\exp\left(-\sigma nx\right)\right]_{0}^{\infty}$$

$$\left(\frac{1}{\sqrt{n^{2}}}\right) \left[\exp\left(-\sigma nx\right)\right]_{0}^{\infty}$$

B. 2. (a) Gorom the given equation, $R = f_{\nu} \cos \left(\frac{\partial}{\partial x} \frac{\partial}{\partial x} \sin \left(\frac{\partial e}{\partial x} + \frac{\partial}{\partial x} \right) \right)$ The information we can get from this interferenter does not some from this single measurement. We need to delet the output for a large of times to detect the oscillation in feinges. (le) The answer to this question can not be inferred from this eight measurement. But from the set up of the question, we know that the amplitude is 3.00 Ty. and the phase difference can be measured by $\Delta \phi = 2\pi \frac{le}{\Delta}$ sin with (c) For the completion of the full cycle, we need to find the t for which the place difference is 211. : we need: Sp = 2π Freson part (b), $\Delta \phi = 2\pi b$ sin wt

Lo, equating the two, we find: 211 = 211 h sin wt =) = ainwt $\frac{1}{\omega} = \frac{1}{\omega} \left(\frac{\lambda}{\omega} \right) = t$ given that w= 7.29 × 10 -5 radions/s \Rightarrow $t=1.372\times10^4$ sin $\frac{1}{b}$ seconds (d) Given that 0= 0.71 = 2.0653 × 10 gadians The angelor audution of an interferenter eystem is given by:

0= (.027 bonan -> Baseline That my system to be able to resolve the Radio galany, the augular ausolution O of my 2ystem < 0.71.

:. 2.0653 ×10⁻⁴ > 1.02 × 1. leman

=> 4938.75 m > 6man > 1.02x1 2.0653x10-4 => leman > 4.94 fcm 3) The leastine of my interferenter must be bager than 4.94 km to olesserve Cygnus A at giren woovelength. Q.3 given that Tens = 2.73 K (a) The Planck's function is: $\frac{Z_{s} = \frac{2he^{2}}{\lambda^{s}} \left(e^{h4AK7} - 1 \right)$ $= 2 \times 6.63 \times 10^{-37} \times 9 \times 10^{16}$ $(10^{-3})^{5} \left[enp \left(\frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{10^{-3} \times 1.33 \times 10^{-23} \times 2.73} \right) \right]$ => In = 6.129 × 10 - 9 H m - 3 sq -1 This is the beight new of CMB at the given

wavelength. In = 2e KT = 6.129 ×10 -4 × (10-3) 2×3×10 ×1.39×10-23 This is very much less than the actual temperature of the CHB. Hence, Rayleigh I can approximation does not hold true in this case. (C) det 2= 90 cm, $T_{2} = 2hc^{2} \times \frac{1}{2}$ $\left[e^{hc/3KT} - 1 \right]$ = 2×6.63 ×10-34 ×9×1016 (90×10-2) x emp (6.63×10-34×37108) = 3.435 ×10-14 Wm-3 sx-1 Using Rayleigh Ieans approximation to find

Temperature (as in pt. b) gives:

$$T = I_3 A^4 = \underbrace{3.435 \times 10^{-14} \times (90 \times 10^{-2})^4}_{2 \times 1.53 \times 10^{-23}}$$

$$= 2.722 \times 10^{3} \times 1.53 \times 10^{-23}$$

$$= 2.722 \times 10^{10} \times 1.53 \times 10^{-23}$$

$$= 2.722 \times 10^{10} \times 1.53 \times 10^{-23} \times 10^{-23}$$

$$= 2.722 \times 10^{10} \times 10^{10} \times 10^{-23} \times 10^{-23} \times 10^{-23}$$

$$= 2.122 \times 10^{-23} \times 10^{-23} \times 10^{-23} \times 10^{-23} \times 10^{-23}$$

$$= 2 \times 10^{-24} \times 10^$$

	= 92.97K
	=> RJ approximation holds good in this case.
B.4.	Power transmitted = 200 mW = P
	Herequency 2 = 900MHz
	Bandwidth DV = 30KHz
(ac)	distance = 5 cm
	Flux: $love = 200 (mw) = 0.6366 mW cm2$ obrea $411 \times (5 cm)^{2}$
	Flux: $lower = 200 (mw) = 0.6366 mW cm2$ obrea $4.0 \times (5 cm)^{2}$
(h)	Liree at a distance of Scm, the flun is
	0.63 m W cm which is much less than the
	limit of 10 mW cm ⁻² , we are not in danger, from
	the cell phone.
(ي	The Felun density will be given beg'.
	fr = <u>Power</u> d= 10 km = 10 m
	wird p DV
	$f_{\nu} = \frac{p_{owee}}{v_{\nu} d^{2} p_{\nu} d^{2}}$ $= \frac{200 \times 10^{-3}}{4 \text{ if } x (10^{4})^{2} \times 30 \times 10^{3}} = 5.3 \times 10^{11} \text{ Jy}$
	477 × (104) 1 × 30×103 = 5.3 ×10 11 In

: flux dessity detained alone is larger than
109 Ty which causes compression in the seceiver,
are accepted to the second sec
Dianeter = 45 m.
Power received = Fo p AREA x DD
Power received = $fv \neq Area \times \Delta v$ = $5.3 \times 10^{-15} \times 11 \times \left(\frac{45}{2}\right)^{2} \times 30 \times 10^{3}$
= 2.53 700 -7 W
Nameer of photon received per second =
Energy exercised in Iscoord
Energy of photos
<i>ad</i> 8 1 -
= 2.53 × 10 -7
6.63×10-34× 900×106
6.63×10 - 34× 900×106 = 4.25×10 17 platons.
V