

Toughture 19600 books of Ring-) Let R be a non-empty set with two binary composition addition (+) & multiplication() then R is Called Ring 191 Lt Lates fres the following:

I) R is an abelian group under + 1.c. R is closed under addition.

(soir) forta, b, CER! odtoo soldto a+(b+c) = (a+b) +c (1.1.

associativity under addition holds in R.

in) for Each ack, I der st ato=a±0+a 11. R has additive identity.

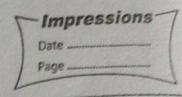
11) for each aER J-aER s.t

at (-a) = 0, i.e. R has additive influye

for Each aber

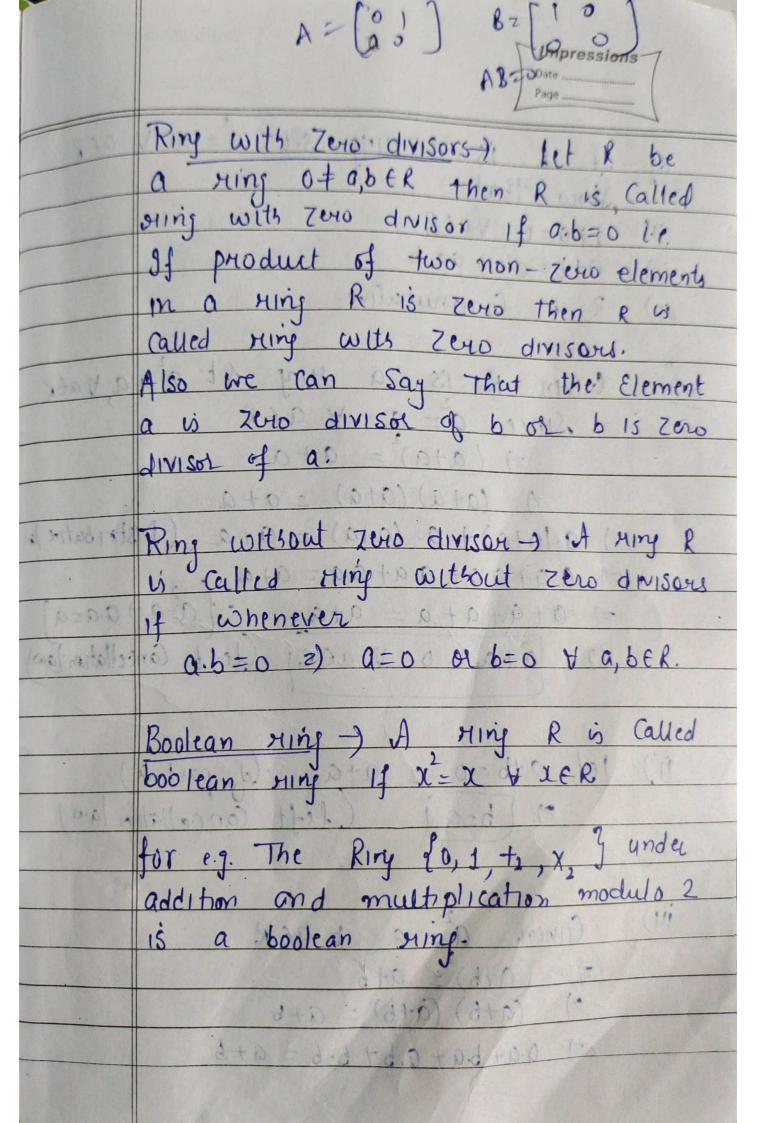
at6=15ta LP. R is Commutative

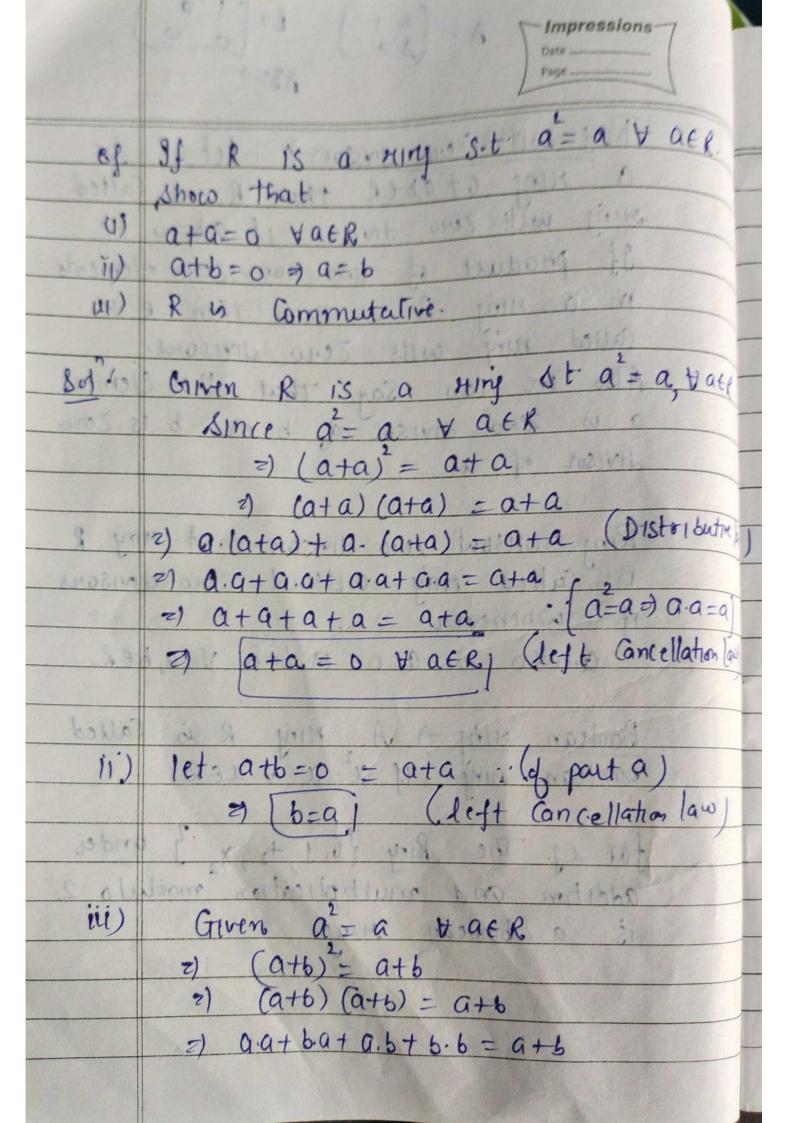
under addition.

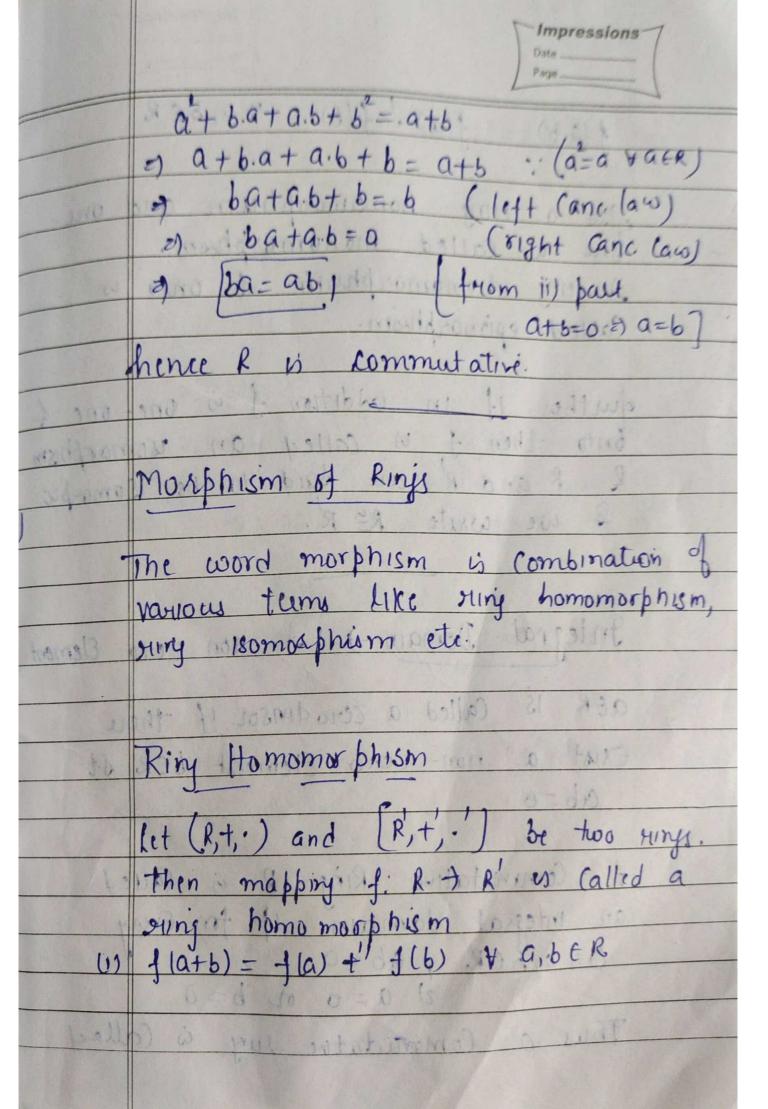


for Each 0,5 ER, a.bER 11. R is closed under multiplication property of the couper of el for a, b, CER, a.(b.c) = (a.b) . c . l. associativity under multiplication holds is an appliant storb under + 10 10) for a, b, cer, add a sada set or ased ander addition: (i) a. (b+c) = a.b+a.c (left distributive law) (a+b)·c = actbc [Right distributive law) tor eg. Set of interest z, +.) is a ring. 9 in which notables return thirtee of 100 commutative Ring & A ring R is called a commutative ring If a.b=ba & a,ber. 11) for each aft 3 - aft diff SHOW ME Ring with Unity) A ming & is called sting with unity if for Each TER 3 IER S.t 1.2= x= z.i. The Element is called multiplicative identity of

west also so go







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to his to de Dor.

1(a.5) = f(a) . f(b) 4 a, b & R.

Also a tiny homomorphum and one one is called monomorphum.

A tiny homomorphum 4 onto is called epimorphism.

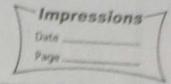
durther if in addition of is one-one onto then of us called an usmorph 2 R and R' are daid to be isomorph 2 we write R= R'.

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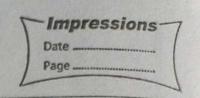
Integral Domain -) A non zero Elemant of there exust a non-zero Element ber st.

A Commutative Ring R is Called an integral domain if for Every $0 \neq a, b \in R$, ab = 021 a = 0 or b = 0

Thus a Commutative ruy is Called



	Paga
	an integral domain if R has no
	Zero divisor.
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N.	Est and She Brosseth and
Ø.	find all Zero divisors of Zis,
y	
301	$Z_{15} = \{0, 1, 2 14, +_{15}, \times_{15}\}$
	kle know that an Element m in
31111	(In the Xon) is a Term divisor if
	en les not relative prime ton.
	Here n= 15. The only no which are
	not relatively prime to: 15 are
	3, 5, 6, 9, 10, 12,
	home 3,5,6,9,10,12 au Zero divisars
	Tild of Commutation Right
	Also 3x15 = 0 9x10 =0.
	& 5x;6=0 10xs12 = 0 etc.
	17 Very 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	ad = 1 = da va Called field.
	the deviated left from



ii) $Z_6 = \{0, 1, 2, 3, 4, 5, t_6, x_6\}$ The only Element which are not selatively prime to 6 are 2, 3, 4

: Zero divisors of Z_6 are 2, 3, 4

Also $2 \times 3 = 0$, $3 \times 64 = 0$ etc

 $\frac{100}{20} = \frac{10}{10}, \frac{1}{20}, \frac{3}{100}, \frac{3}{100}$

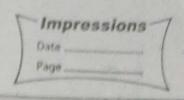
Elements which one not . Helative prime to 20 one 2,4,6,8,10,12, 14, 6, 18

hence Zero divisor of Zo are 2, 4, 6, 8, 10, 12, 14, 16, 18.

field: A Commutative Ring F
with unity sit reach non-zero
element has a multiplicative
inverse i.e. Fa EF s.t

aa' = 1 = a'a us Called field.

It is denoted by F.



Alternatively F is a field if its non zero Elements form a group under multiplication.

es. [a, +, ·], [R, +, ·] au fidds.

The Every field is an integral domain

sport let F be a field.

domain.

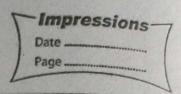
Since F 1s field, F must be!

commutative. Izle show F 1s without

Zero divisoris.

let a, 6 EF S.t. a. 6=0 10

each non zero Element of F has multiplicative inverse i-e for at F there Exists af F St aa'=1=a'a



from 0 a.b=0 a (a.6) = a . 00 000 0000 2) (da) · b = 0 | a0 = 0 bate Hence if ato then b=0 lly if b\$0 then a=0 at from tield is an integul don Hence F is with out Zero divisor abiotic por de de lot da consequently F is an integral domain The Converse is however not the for eg. Zus an integral domain but for 2EZ there is no a EZ s.t 2.a=1 = a.2 ce. 2 has no muet p treative in beise. . Zolannot be a field each against Element of F ha musiciplication to the to de de



Quotient Ring! -) Let. R. is a King and I is an ideal of R. Detine

R/I. by

R/I = {xtI, xer}

then RI is also ring under addition & multiplication defined by

(M+IIS+I) = M+S+I, Y MISER

SHII) (SHI) = MS+I. Y MISER

The ring defined by R/I is known as quotient ring.

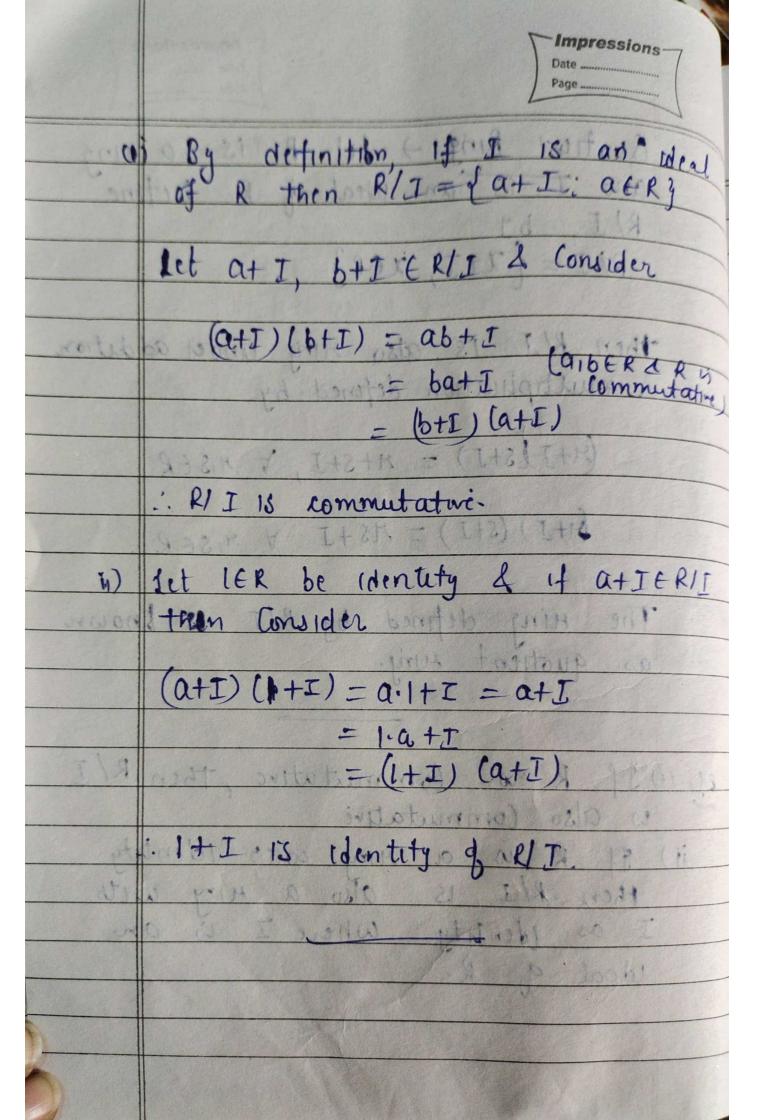
es. (1) If R w Commutative, then R/I is also Commutative.

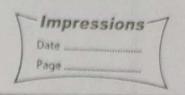
ii) gf R us a ring with Identity

then R/I is also a ring with

I as identity when I is an

ideal g R.





The	mteger	modulo	m	(m>	1)	
	1					

The Integer modulo m denoted by Zm is set given by

Zm = {0,1,2,3--- m-1; to, xm y

where the operation to (read as

addition modulo m) & xm (read

as multiplication modulo m) are

defined as

atmb = Hemainder after atb is divided by m.

axmb = remaindu after ab is divided by m.

order of a group. The order of Elements in the group in. It is denoted by O(Gr) or [Gr].