Chhatrapati Shahu Ji Maharaj
University, Kanpur

Answer Script Details
Barcode 11562011

Roll No. 24062000472
Total Mark 54/75.00

Exam M.SC-III_ODD_EXAM_NOV_2025
Subject B040902T - Plant Biotechnological and Molecular Techni

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	3/5	8	0/15				
1B	4/5	9A	0/7				
1C	4/5	9B	0/7				
1D	3/5	9C	0/7				
1E	3/5	9D	0/7				
1F	3/5						
1G	3/5						
1H	3/5						
1I	2/5						
2	0/15						
3	0/15						
4	13/15						
5	0/15						
6A	0/7						
6B	0/7						
6C	0/7						
7	13/15						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-II

MARKS OBTAINED											
Q.	1	2	3	4	5	6	7	8	9	10	
(a)											
(b)											
(c)											
(d)											
(e)											
(f)											
(g)											
(h)											
(i)											
(j)											
Total											
Total Marks in Figures										Max. Marks	
Total Marks in Words											

Paper Code: B 0 4 0 5 0 2 T

Signature of Evaluator

PART-I

Date of Exam: 5/12/25 Shift: II Room No.: 25

Paper Code: B040502T Subject: NANCY RATHI Year/Sem.: III

Name of Candidate:

Roll No.: 2 4 0 6 2 0 0 0 4 7 2

Signature of Candidate

Signature of Invigilator

COE Facsimile

PART-III

Course: Master of Science (Botany)

Session: 2025-26 Year/Semester: III

Subject: Plant Biotechnological & Molecular Techniques

Paper Code: B 0 4 0 5 0 2 T

Exam Date: 0 5 / 1 2 / 2 0 2 5

Name of Candidate: NANCY RATHI

Father's Name: GAYA PRASAD RAJ HI

महाविद्यालय का कोड College Code: K N O 4

परीक्षा केन्द्र का कोड Exam Centre Code: K N O 4

परीक्षा का प्रकार Type of Exam: Regular / Ex. Student; Private / Back paper Exam

ANSWER BOOKLET NO.: 11562011

Paper Code: B 0 4 0 5 0 2 T

PART-IV

नामांकन संख्या Enrollment Number: C S J M A 2 4 0 0 0 1 3 1 6 5 8

परीक्षार्थी अनुक्रमांक संख्या Candidate's Roll Number: 2 4 0 6 2 0 0 0 4 7 2

पेपर कोड Paper Code: B 0 4 0 5 0 2 T

Signature of Candidate

Signature of Invigilator

C S Facsimile

COE Facsimile

नोट : 1. परीक्षार्थी को निर्देशित किया जाता है कि आवरण पत्र के पृष्ठ भाग पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. बॉक्स में भरी जाने वाली प्रविष्टियाँ काली स्याही से भरी जायें। 3. गोलों को काले या नीले बॉलपेन से भरा जायें।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-III

1. Use blue or black ball point pen for writing alphabets & numerals in ☐ Boxes.
2. Carefully study the example before you start marking.
3. As shown in the example below blacken the circles completely.

Correct method	Incorrect method
① ● ③ ④	✓ ✗ ◉ ⊙

4. Make no Stray marks on this sheet.
5. **DO NOT WRITE OR MARK ON THE BAR CODE.**

परीक्षार्थी के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र कोड सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1–24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. B कोपी या अतिरिक्त ग्राफ नहीं दिया जायेगा।

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/ electronic watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

INSTRUCTIONS TO THE CANDIDATE

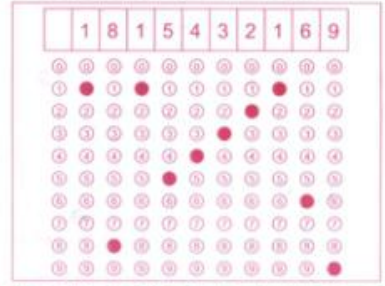
1. Read the instructions carefully given on the Question Paper Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-32) or any other kind of damage in your answer script, if found than change the answer script immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g. Subject Code. Subject Name and Question of the Question Paper during first THIRTY MINUTES of the commencement of the exam, so that it can be corrected in TIME. After that no corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over papers should fill in status as Carry Over. Those appearing as Ex Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided.

अनुचित साधन से बचने हेतु:

1. उत्तर पुस्तिका के निर्दैशित स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखे तथा कोई भी चिन्ह न बनाये क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में निम्न वस्तुएं साथ न लाये, जैसे लिखे हुए कागज के टुकड़े, मोबाईल, डिजिटल डायरी, कोपी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल समंवित प्रश्नपत्र में ही मेमोरी लैस साइटफिक केल्कुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रूपये न रखें न ही उत्तर पुस्तिका में चिपकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-IV

1. Use blue or black ball point pen for writing alphabets & numberals in ☐ Boxes.
2. Use blue or black ball point pen for filling the circles.



Note - If your Roll No. is of 10 digits. Please leave first three columns

Paper Code

01

Section → B

Answer → 4

Southern Blotting → for DNA
Northern Blotting → for RNA
Western Blotting → for Proteins

Below I am going to explain Blotting techniques to understand for Blotting clearly.

* Southern Blotting

Southern Blotting is used to identify the particular / specific DNA sequence from the DNA.

Steps involved in Southern Blotting

the Southern Blotting consists of following steps :-

① Isolation of DNA
the DNA is isolated, breaked down into fragmed fragments by Restriction enzyme.

② Gel Electroporation

the DNA fragments are now sent to Gel electrophoresis of the DNA

fragments is done so that the DNA is is seperated according to the ~~ca~~ size.

Alkaline treatment → Alkaline treatment is given to it now so that the DNA become single stranded.

③ Blotting

Now Blotting of DNA gel is is done on the transfer Buffer. ~~Now~~ By the capillary action beig of the transfer Buffer DNA moves up in the membrane.

Gel moves up by the capillary action into membrane.

④ Membrane fixation & Hybridisation

Now the membrane in which gel is there because of capillary action it is now fixed by Baking / Heat

Now, the Radioactive probe is used

(8/) so that the DNA ~~sequence~~ sequence we want we can get. the probe used is complementary to the DNA (desired). Now, ones the probe is it used and we get sequence sa we do Autoradiography/ screening.

Isolation of DNA

Isolation of DNA → fragments cut by RE → Alkali treatment → Gel electrophoresis → Blotting → Heat for membrane fixation & Hybridisation → Autoradiography

Southern Blotting

PTO

* Northern Blotting → for RNA

Isolation of RNA → formaldehyde treatment → Gel electrophoresis → membrane Gel → Blotting → membrane fixation and hybridisation → use of Radiolabelled probe → Screening

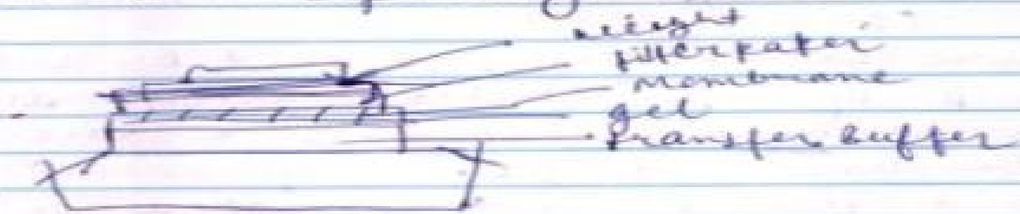
Northern blotting is used to get the desired mRNA/RNA sequences.

① Isolation of RNA
the RNA is isolated and RE's are used to cut it into fragments

formaldehyde treatment is given to RNA so that there is no loop formed in the RNA.

(2) Gel electrophoresis
the RNA fragments are seperated from each other on the basis of ~~gelselect~~ size.

(3) Blotting
the Gel moves into the membrane due to the capillary action.



(4) Membrane fixation & hybridization
the ~~RNA~~ Membrane is now heated or baked to be fixed and it is hybridised. Radiolabelled complementary sequence probe is used.
And after that their ~~are~~ cis screening ~~data~~ and we can get our desired RNA sequence.

+ Scurlar.

PTO

* Southern Blotting → for protein

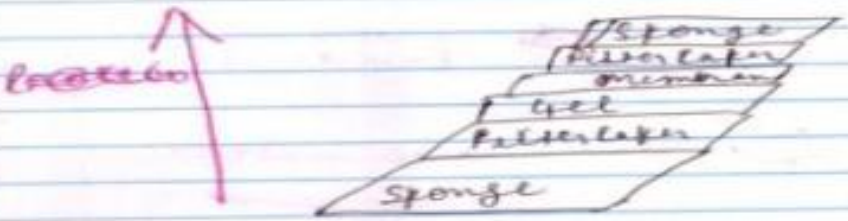
Southern blotting is done to get our desired protein structure from the mixture of protein.

(1) Isolation of protein
protein is isolated by the 6 process of centrifugation.

(2) ~~SDS PAGE etc~~
(2) Electroporation (SDS PAGE)
(agarose)
the protein is seperated by the help of gel electroporation, there is a negative charge on the protein because of SDS.
and protein is seperated on the basis of size.

(3) New electric blotting

there electric blotting is used so that the negatively charge protein travels to positively charge and it gets blotted into membrane.



④ Now membrane is fixed and primary antibody is added to it. It is kept like that for few hours and then it is washed to get rid of excess.

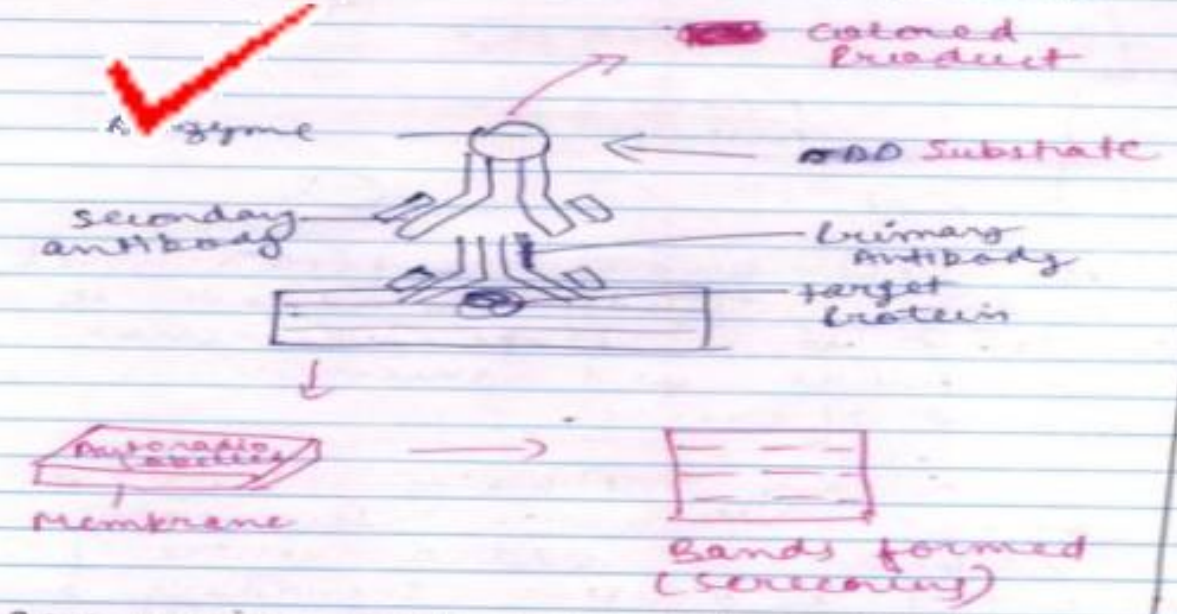
⑤ Secondary Antibody is added to the membrane secondary antibody is added where primary antibody is there. Secondary antibody is coupled with the enzyme.

⑥ Now to the secondary antibody as substrate is added which produces colour when product is formed. as it has enzyme.

⑦ and NOW to the membrane Autoradiographic film is added for screening and NOW we can see our extract our desired protein.

If the Bands are formed then

the desired protein sequence is there and if not it is not there.



- The major difference b/w Southern Northern & Western blotting is :—

Southern Blotting	Northern Blotting	Western Blotting
for DNA	for RNA	for protein
Not use Antibody	Not use Antibody	use Antibody
uses formaldehyde & does not use secondary antibody	does not use formaldehyde & does not use secondary antibody	does not use formaldehyde & does not use secondary antibody

Paper Code

09

Section C

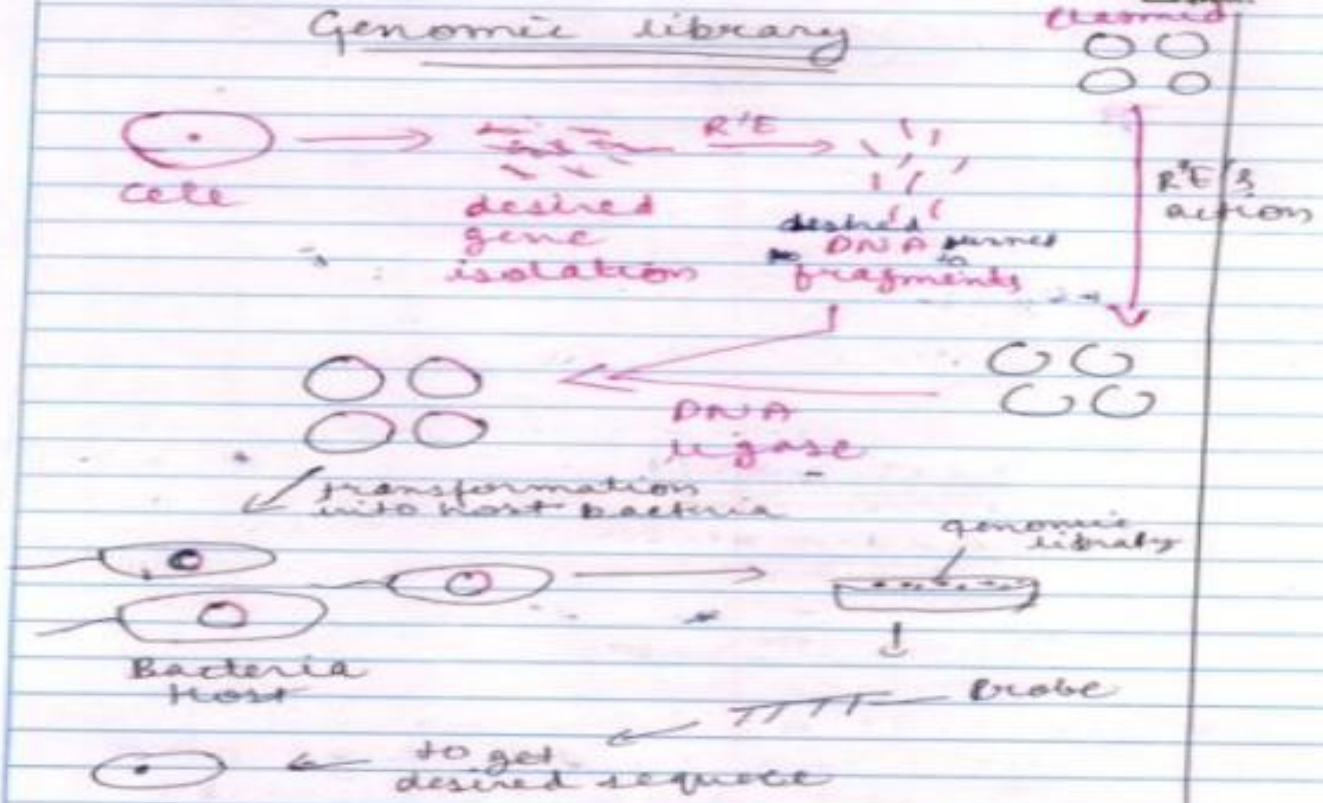
Ans → 7

DNA libraby

DNA libraries are the libraries from where you can get desired DNA sequence for study, research, experiment purposes. there are 2 types of DNA libraby :-

- genomic library
- C-DNA library

Genomic library



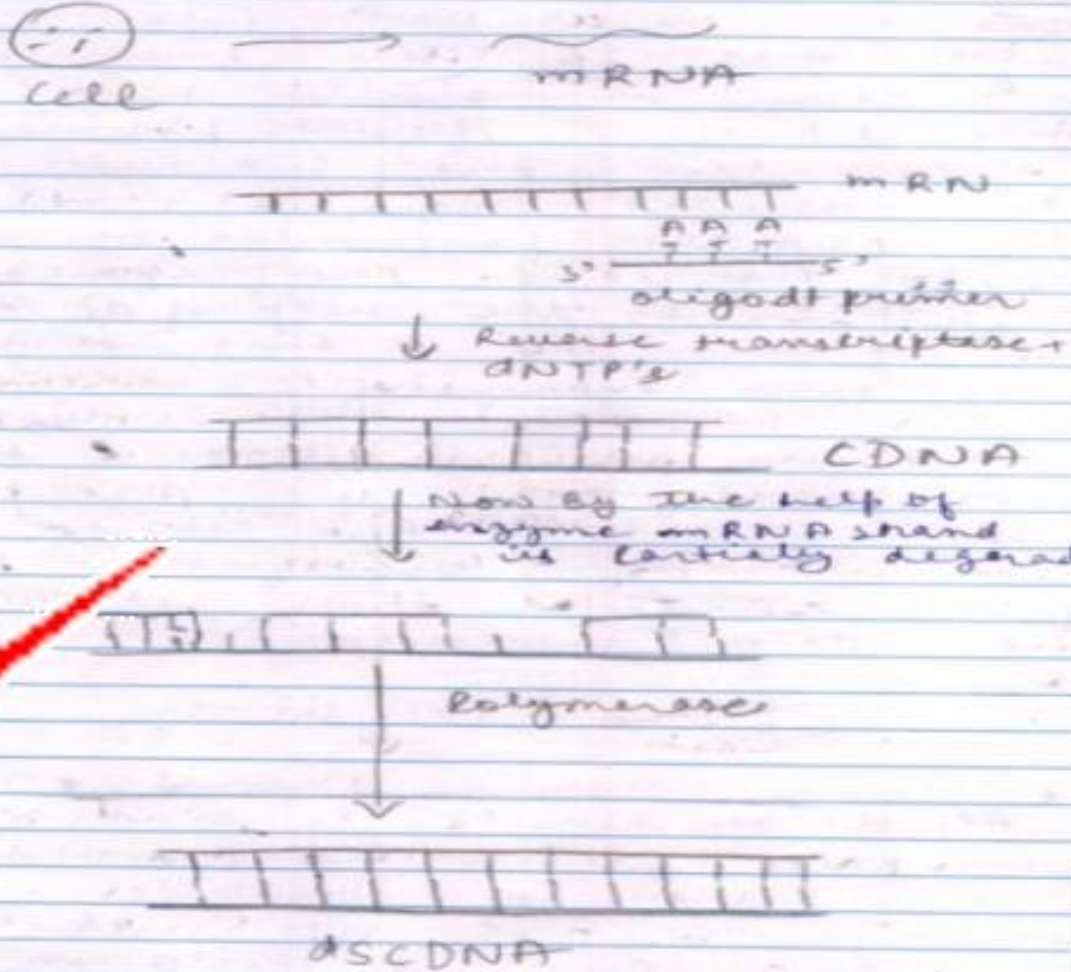
genome is the total genetic content present in either cell
DNA in genomic library genomic is a ~~part~~ its library for the first step is to isolate the desired gene R'E fragment and Now the restricted endonuclease

is used to break DNA into fragments and of these fragments can also be stored as genomic library. further plasmid is there which is also cut with the same restricted enzyme (RE's) by which DNA was fragmented. Now this plasmid & DNA fragment are joined by the help of DNA ligase. & then it this is transformed into host (here the host is bacteria). it is then cultured in petridish pellate & use. from here now we use probe (mostly radiolabelled) which is complementary to the desired DNA sequence and we then get our desired DNA sequence.

c-DNA library

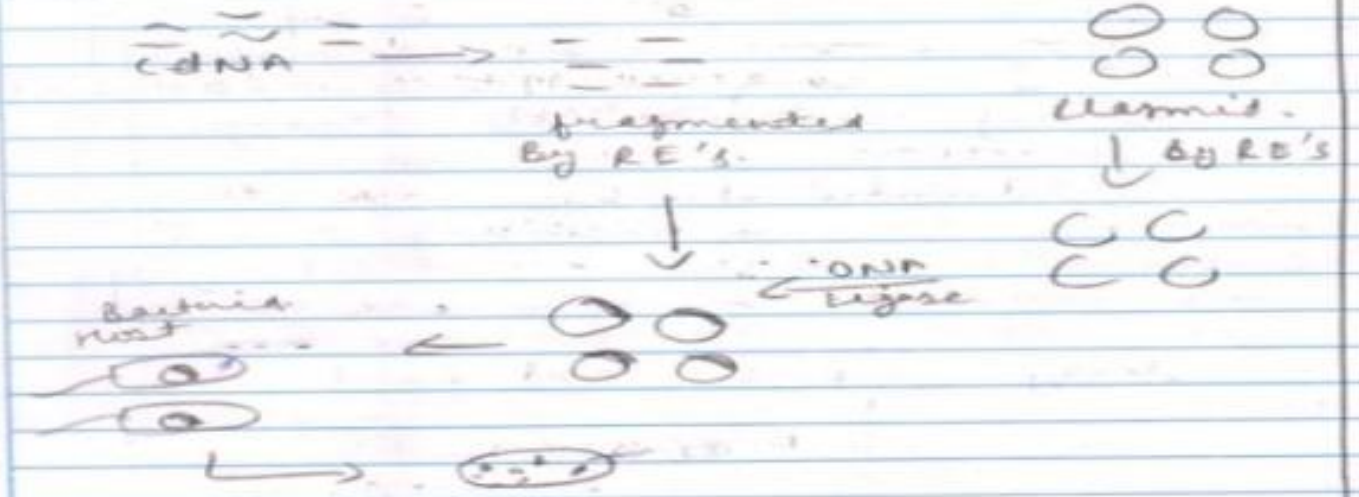
In c DNA library the d.s DNA is stored bye which is made by the mRNA which was formed by the action of reverse transcriptase. and after that this is ds cDNA is stored and further steps of storation are like genomic library only.

P.t.O



Now, this DNA is stored in the form of library.. and further

procedure is like that of genomic library only where the cDNA is broken by RE's and plasmid is is also cut by same RE and then it is transformed to the host and library is formed, after multiplication it is cultured.



cDNA library is used to get when specific gene need to study or work on specific character. A genomic library is used when you need to work or study on whole genome.

Section → A

(1.)
(A.)

Enzymes are ~~are~~ made up from protein. enzymes are used to catalyse the reaction. Enzyme is the used to catalyse the reaction. the reduce the activation energy and they increase the probability of the ~~product~~ and ~~exp~~ formation of the product. ~~Enzymes are do not take part in the rea~~ as they are not part of the product. Enzymes do not mix with product. After the reaction is done. Enzymes are set free. Enzyme work on the mechanism of lock and key hypothesis and induced fit model. to increase the ~~ac~~ efficiency enzyme temperature can be increased upto optimal temperature and after that if temperature is increased enzyme is denatured.

Paper Code

15

(B)

Reporter gene are the type of Genetic markers. that are mostly present in the plasmid so that when the process of Genetic engineering takes place we can select Rec Recombinants from the non Recombinants. Normally in plasmid there are two types of markers Selectable Markers and Screenable markers.

Reporter genes are Screening Markers By these Markers the formation of Color or by the fluorescence it is able to know that if it is Recombinant or not. there are many examples of Reporter gene. and every plasmid does not have reporter gene ; only the plasmid which has certain combination

eg. - Luciferase → it forms the fluorescent / colored enzyme

GFP → when exposed to air they turn green

GUS → they turn it colored due to this.

Ans C

RAPD

Random Amplification Polymorphic DNA.

↳ it is Dominant Molecular Marker which means it does not distinguish between Hetero & Homo.

↳ In RAPD PCR is used.

↳ RAPD → DNA is amplified randomly.

↳ We do not need to the sequence of the DNA (desired) before.

↳ the Random Primers are used in RAPD.

↳ RAPD is helpful in the finding out the relative species. it is used in Gene mapping.

↳ RAPD is low in cost

↳ the only problem with RAPD is that it does not have high reproducibility As other enzymes.

2 primers attached to the

Ans D

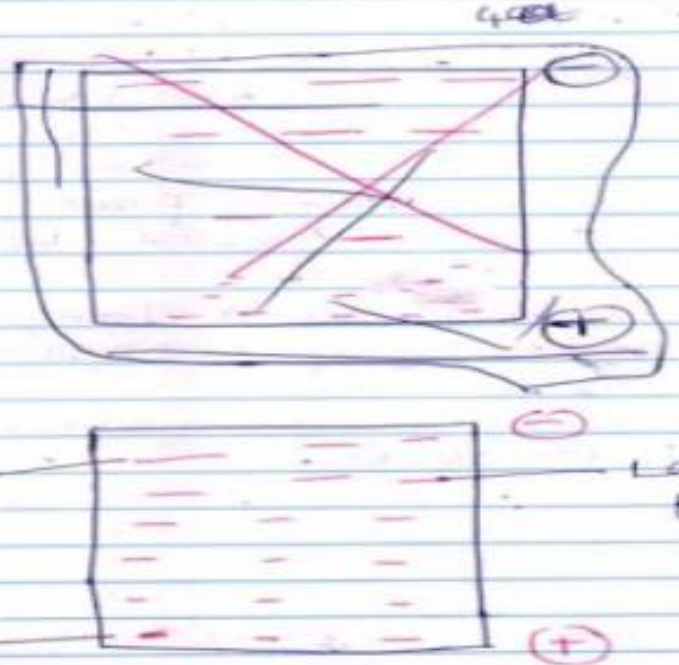
DNA polymerase → it is the enzyme that is used to synthesize the DNA strands mostly. ~~there are~~ ~~mostly~~ ~~the~~ the DNA polymerase is use to during the formation of DNA strand so that other DNA strand is formed which is complementary to the DNA strand ~~there are~~ DNA polymerase I is present in ~~the~~ mostly prokaryotes. It is has ~~to~~ ~~has~~ ~~to~~ ~~has~~ ~~to~~ ~~has~~ ~~to~~ activity 5' to 3' proofreading ability as well as polymerase activity. and it also has 3' — 5' ~~exon~~ proofreading activity. ~~is~~ DNA polymerase II has the

5' → 3' Polymerase activity.

DNA polymerase is also used in process of reverse transcriptase where there is need to form the complementary DNA strand. DNA polymerase can be DNA dependent DNA polymerase which means DNA polymerase will form the complimentary strand when DNA strand is already present there. RNA dependent DNA polymerase is also there which forms the strand when one strand of RNA is present and from it forms DNA.

RNA polymerase is the enzyme which is used to form RNA complementary strand the RNA can be RNA dependendent RNA polymerase which will form the strand when the RNA strand is present prior and DNA dependent RNA polymerase when RNA has to be synthesized from DNA strand present prior.

Ans E



Gel electrophoresis

Gel electrophoresis is the process in which when the DNA (Here I have used in the above diag) so when the DNA fragments are

moved to gel electroporesis the small size DNA fragments comes towards the (+) as DNA is negatively charged and the large sized DNA fragments are behind because small sized DNA fragments travel fast. gel electroporesis is used to

↳ seperate the DNA fragments on the basis of charge.

Mostly agarose gel is used in gel electroposis.

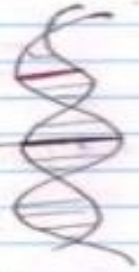
Ans 7

Probe → Single stranded

F → fluorescent
I } insitu
S
H → hybridisation

It is the technique which is used to identify specific sequence of in the

FISH DNA : It is used in this the name FD fluorescent probe is used as its name suggests. It is used to detect different diseases. diseases also.



DNA

Here, F_1 is the probe 1 → which gives pink color

F_2 is the probe 2 which gives → green color.

Steps involved in FISH

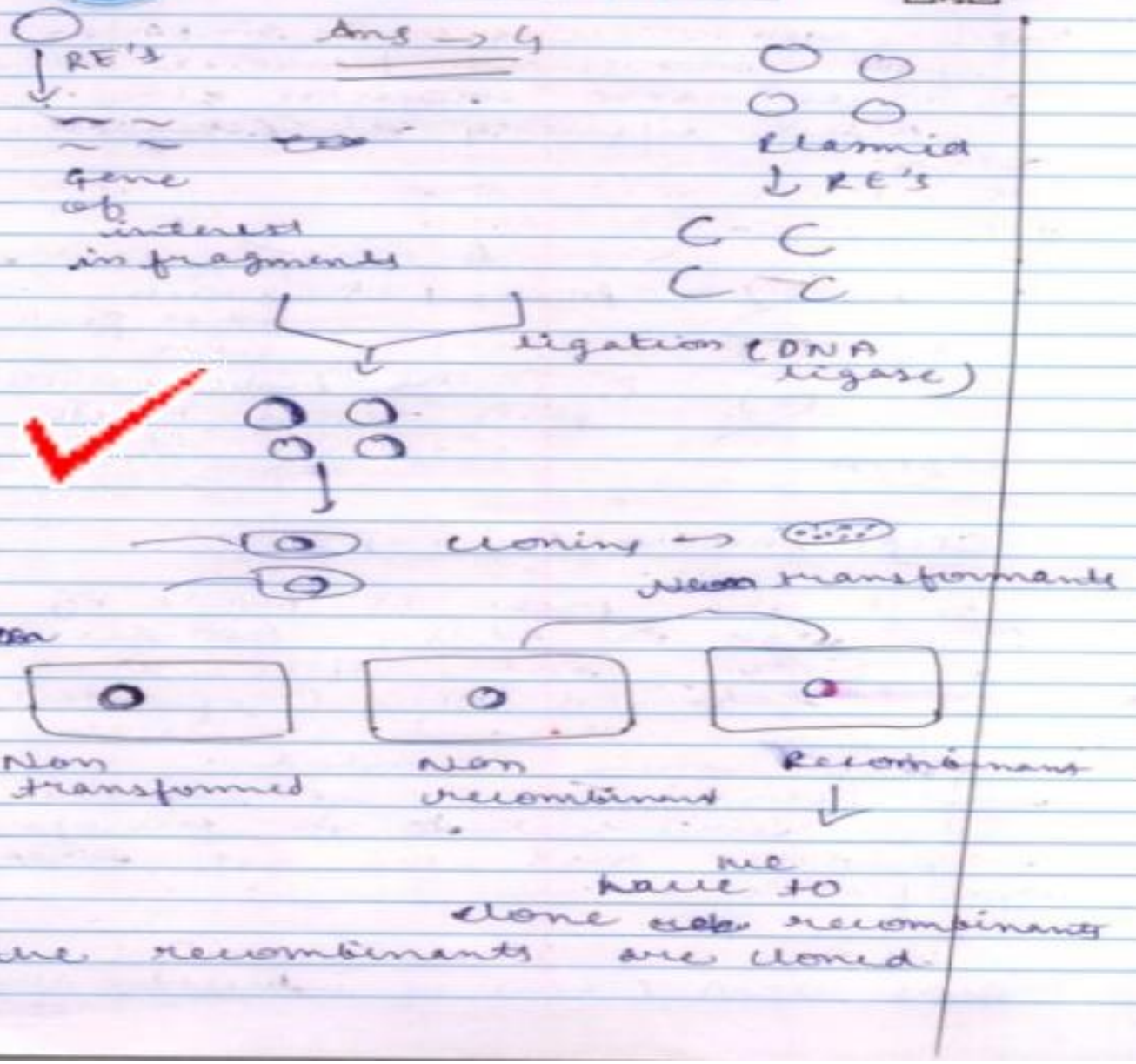
First the probe is made by DNA adding Biotin-dioxygimin and biotin and after that the required gene (of interest) is fixed and it is also made single stranded.

and after that it is ligated and fluorescent fluorophore is added and we get the specific site we want.

Probe → Single stranded

DNA (Gene of interest) → Single stranded

Ans → 4



by the help of the Vector ~~Plasmid~~ in which gene of interest is ligated the cloning is done. ~~After~~ different sites of the ~~two~~ ~~cloning~~ is ~~vector~~ Plasmids are taken only because they have multiple cloning site and when it is transformed with GOI to host it clones rapidly.

Host

cloning of the desired gene ~~in~~ ~~host~~

Ans H

5' ——— G A A T T C ——— 5'

3' ——— C T T A A G ——— 5'

Q) Palindromic sequences

Palindromic sequences are those sequences which are same from forward and Backward

as GAATTC & CTTAAG.
the palindromic sequences are those where the restricted enzyme does its action. palindromic sequences are the sequences which are needed by RE's to perform its activity.

(I)

Bt cottton is the genetically modified cotton which was modified because of the cotton ball worm was the insect which used to harm the cotton plant.

By genetic engineering Cry protein was introduced into cotton and it was named Bt cotton it does not harm humans. it only harms ball worm.