DEPARTMENT OF BIOTECHNOLOGY

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

AUTUMN MID SEMESTER EXAMINATION — 22-09-2022 (FN)

BIOPROCESS TECHNOLOGY (BT30201 AND BT40009) — B.TECH / DUAL

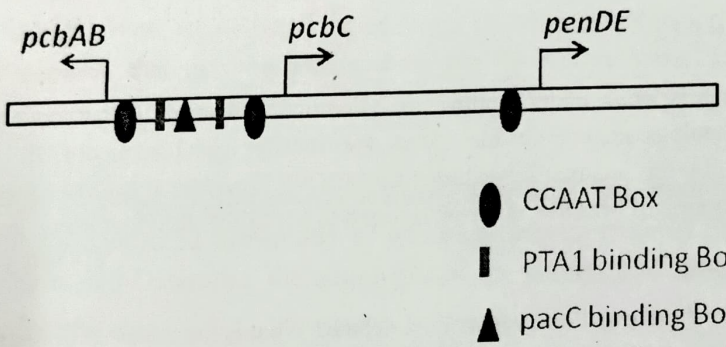
TIME: 2 HOURS — FULL MARKS: 30

NO. OF STUDENTS: 100 — No. of question paper pages: 02

Answer All Questions.

PART-A

1. Given below is the penicillin gene cluster in *P. chrysogenum*. The intergenic regions are marked and important control elements are labelled.



Discuss with proper explanation, how the penicillin biosynthesis will be affected in each of the following hypothetical cases: (1x4=4)

A) CCAAT box present upsteam of penDE is deleted.

B) Isolated pacC N-terminal domain is overexpressed in the given strain of *P.chrysogenum* and the cells were grown at a pH 8.

C) CCAAT box present upsteam of pcbAB is mutated to CACAT and and an extra copy of penDE gene is added downstream of existing penDE gene.

D) PTA1 box is deleted and glucose concentration is reduced in the growth medium.

2. A) Using a flow diagram, discuss the stages in Cephalosporin C production and recovery and its conversion to 7-ACA.

B) How is penicillin recovered from the fermentation broth? Why is it essential to control the glucose concentration in penicillin fermentation process?

C) Which step of the cephalosporin biosynthesis will be affected if the cefG gene is deleted from the cephalosporin gene cluster? What is the modification successfully made in cephalosporin gene cluster for efficient production of 7-ADCA?

(2x3=6)

PART-B

3. Differentiate between early and final stages of chromatographic CVV purification? How does gel filtration help in increasing purity of CVV? What are the advantages and disadvantages of tangential flow filtration? What are aptamers and how do they recognize cognate CVV candidates? [1.5+1+1.5+1]

4. State two ways through which reverse genetics can be applied in vaccine design to provide genetic stability? Given sedimentation coefficient (s) and rotational speed (RPM) and relative centrifugal field (rcf), friction coefficient (f) and mass (m) of a particle. Find the buoyant force on the particle, distance from axis of rotation and given density (r), what should be the partial specific volume (g=9.8). Consider the terminal velocity to be constant. What is meant by conjugate vaccine? [2+2+1]

PART-C:

5. What is your understanding of Microbial Enhanced Oil Recovery (MEOR) technology and its relevance? How does it differ from Chemical EOR? Which type of oil reservoirs is suitable target for MEOR? Elucidate at least two mechanisms of operation of MEOR? What are referred to as 'OOIP' & 'Thief Zone' in a reservoir? [1+1+0.5+1.5+1 = 5]

6. Why there was Food versus Fuel debate? What is the essential difference between First and Second Generation Biofuels? Schematically represent three distinct steps in producing lignocellulosic bioethanol. Name the enzymes that are involved in converting cellulose and hemicellulose into C6 and C5 sugars respectively. Can bioethanol be a true renewable alternative to petrol/gasoline? [1+1+1.5+1+0.5 = 5]

$a.b\,rcf = \frac{\omega^2 r}{g}$

THE END