Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2015 (REGULAR)

SUBJECT: ADVANCED BIOPROCESS ENGINEERING (BIO 425)

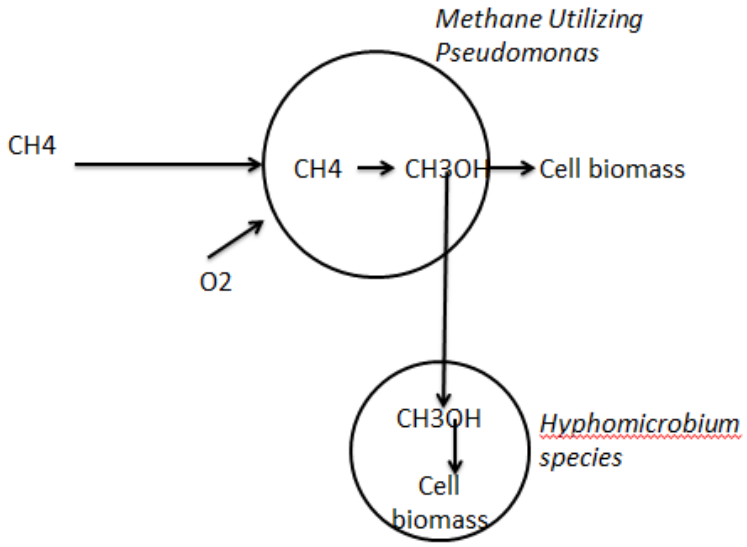
REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A.	Explain how scale-up is done for surface cultures and suspension animal cultures	**03**
1B.	Why scale-up of animal cells is much more difficult compared bacterial cells-explain?	**02**
1C.	Write on the scheme of the most relevant metabolic pathways for the metabolism of sugar compounds and glutamine in Chinese hamster ovary (CHO) cell lines during the synthesis of tissue plasminogen activator (t-PA). Also explain on influence of carbon sources on the formation of Lactate and ammonium.	**05**
2A.	Write on the: Air-lift bioreactor & Fluidized bed bioreactors that are used in animal cell cultivation	**04**
2B.	Explain with suitable examples how cellular productivity is increased via choice of medium composition.	**04**
2C	Write on the various elements that contribute the total production cost of a particular product during its transformation from Raw material to final finished product.	**02**
3A.	Explain with example: Mutualism, Commensalism	**03**
3B.	Lactic acid is produced using Lacto bacillus in a Chemostat under sterile environment with glucose as the substrate, S_0=4 g/l at dilution rate of D=0.491 h^{-1}. Steady state substrate and biomass concentrations are 1.5 and 1.0 g/l respectively. Assume that growth follows the Monod's kinetics with, μ_m=0.53 h^{-1}, K_s=0.12 g/l and Y=0.4 i. Find the elements of A matrix ii. Find the Eigen values and comment on the stability of the system	**05**
3C	Write the Vito Volterra model equations for two competing species n_1 and n_2 in a batch system. If effective yield coefficient for both the species on limiting nutrient are 0.58 and 0.48 and maximum specific growth rate of species n_1 is 1.56 h^{-1} then find the specific growth rate for species n_2 at the coexistence.	**02**
4A.	Write material balances on Biomass and substrate in a Chemostat with two competing species. Using the operating diagram explain the coexistence of two species in a Chemostat.	**05**

4B.	Develop the model equations for biomass, product and oxygen in the following Bioprocessing system (Fig. 1) of methane utilizing pseudomonas species and methanol utilizing Hyphomicrobium species in a Chemostat.  Fig.1	**05**
5A.	Using the relevant equations explain the two stage Nitrification and denitrification process in biological treatment of waste water. Write any two drawbacks of combined BOD & Nitrification processes in a single unit.	**05**
5B.	For the activated- sludge unit the specific growth rate of cells is given by $\mu_{net} = \frac{\mu_m S}{K_s + S} - K_d$ The following parameter values are known: v_0 = 500 l/h, α = 0.4, γ = 0.1, X_e = 0, V = 1500 liters, K_s = 10 mg/l, μ_m = l h^{-1} , k_d = 0.05 h^{-1} , S_0 = 1000 mg/l, $Y_{X/S}$ = 0.5 g dw/g substrate. a. Calculate the substrate concentration (S) in the reactor at the steady state. b. Calculate the cell concentration in the reactor. c. Calculate X_r and S_r in recycle stream.	**05**
6A.	Explain how insulin is obtained in purified crystallized form from pancreas of pigs.	**03**
6B.	Write any two clinical applications of Monoclonal Antibodies (MAbs). Write on various culturing techniques used for the production of MAbs.	**03**
6C.	i. Name the various stages need to be considered in designing of the new bioprocessing plant ii. What are the Economic factors that must be considered during the production of various Recombinant DNA products	**04**