

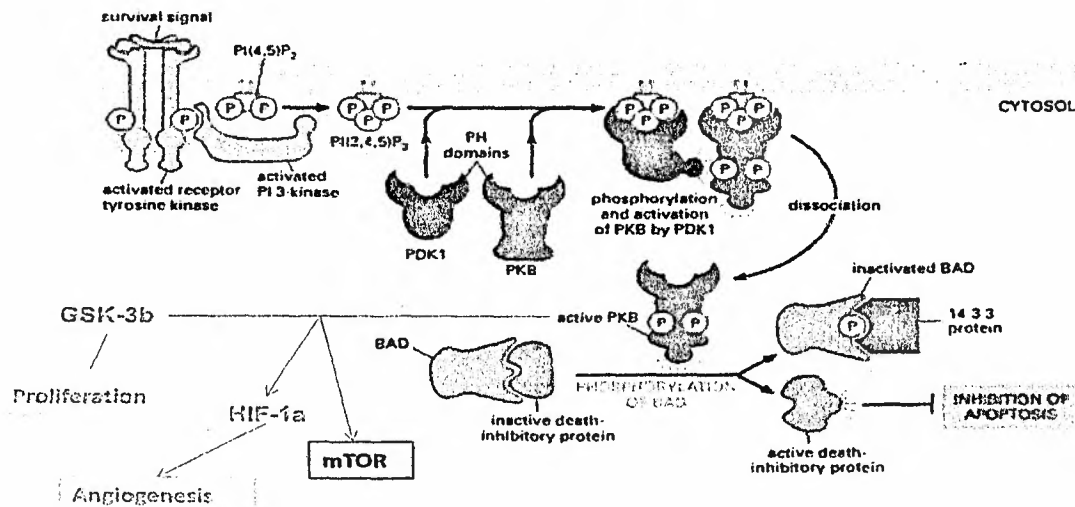
Indian Institute of Science Education and Research (IISER) Kolkata
Mid-semester Examination Year 2019 : Cancer Biology (LS 4204) course

Total Time: 90 min

Total Marks: 20

If you use the question paper to answer the parts of questions numbered 2 and 4 then please write your name and roll number on the question paper and submit it along with the answer script

1. According to Hanahan and Weinberg, there are 10 hallmarks of cancer, of which 2 are called enabling hallmarks. Mention the two enabling hallmarks and justify (in brief) why they are enabling ones. (1+2+2 = 5)
2. What do you mean by 'proto-oncogenes' and 'tumor suppressor genes'? Identify four proto-oncogenes and two tumor suppressor genes from the figure given below (2+2+1 = 5)



3. In the given box below, you will find the components of a signaling pathway. Construct a signaling pathway by using the components given in the box) and briefly describe about the pathway. (2.5+2.5 = 5)

Grb2, Ras, EGF-R, MAP-KK, eIF4E, SOS, Map-K, EGF, Map-KKK, Mink-1

4. What do you mean by cancer stem cells? Fill the given table by putting 'X' in appropriate box(es) (1.5 +3.5=5)

Characteristics of cells	Normal Stem Cells	Cancer Stem Cells
Divide only when new offspring cells are needed to maintain homeostasis.		
Give rise to progenitor cells that divide and differentiate to form specialized cells that carry out body functions.		
Harmed by radiation and current chemotherapy drugs that kill rapidly dividing cells.		
Grow to form a tumor if transplanted into a new location.		
Can self-renew.		
Divide unevenly to form a new stem cell and a progenitor cell.		
Forms cells that are relatively "immature" (unspecialized).		