**Problem-01:**

**Given a bezier curve with 4 control points-**

**B0[1 0] , B1[3 3] , B2[6 3] , B3[8 1]**

**Determine any 5 points lying on the curve. Also, draw a rough sketch of the curve.**

**Solution-**

**We have-**

**The given curve is defined by 4 control points.**

**So, the given curve is a cubic bezier curve.**

**The parametric equation for a cubic bezier curve is-**

**P(t) = B0(1-t)3 + B13t(1-t)2 + B23t2(1-t) + B3t3**

**Substituting the control points B0, B1, B2 and B3, we get-**

**P(t) = [1 0](1-t)3 + [3 3]3t(1-t)2 + [6 3]3t2(1-t) + [8 1]t3 ……..(1)**

**Now,**

**To get 5 points lying on the curve, assume any 5 values of t lying in the range 0 <= t <= 1.**

**Let 5 values of t are 0, 0.2, 0.5, 0.7, 1**

**For t = 0:**

**Substituting t=0 in (1), we get-**

**P(0) = [1 0](1-0)3 + [3 3]3(0)(1-t)2 + [6 3]3(0)2(1-0) + [8 1](0)3**

**P(0) = [1 0] + 0 + 0 + 0**

**P(0) = [1 0]**

**For t = 0.2:**

**Substituting t=0.2 in (1), we get-**

**P(0.2) = [1 0](1-0.2)3 + [3 3]3(0.2)(1-0.2)2 + [6 3]3(0.2)2(1-0.2) + [8 1](0.2)3**

**P(0.2) = [1 0](0.8)3 + [3 3]3(0.2)(0.8)2 + [6 3]3(0.2)2(0.8) + [8 1](0.2)3**

**P(0.2) = [1 0] x 0.512 + [3 3] x 3 x 0.2 x 0.64 + [6 3] x 3 x 0.04 x 0.8 + [8 1] x 0.008**

**P(0.2) = [1 0] x 0.512 + [3 3] x 0.384 + [6 3] x 0.096 + [8 1] x 0.008**

**P(0.2) = [0.512 0] + [1.152 1.152] + [0.576 0.288] + [0.064 0.008]**

**P(0.2) = [2.304 1.448]**

**For t = 0.5:**

**Substituting t=0.5 in (1), we get-**

**P(0.5) = [1 0](1-0.5)3 + [3 3]3(0.5)(1-0.5)2 + [6 3]3(0.5)2(1-0.5) + [8 1](0.5)3**

**P(0.5) = [1 0](0.5)3 + [3 3]3(0.5)(0.5)2 + [6 3]3(0.5)2(0.5) + [8 1](0.5)3**

**P(0.5) = [1 0] x 0.125 + [3 3] x 3 x 0.5 x 0.25 + [6 3] x 3 x 0.25 x 0.5 + [8 1] x 0.125**

**P(0.5) = [1 0] x 0.125 + [3 3] x 0.375 + [6 3] x 0.375 + [8 1] x 0.125**

**P(0.5) = [0.125 0] + [1.125 1.125] + [2.25 1.125] + [1 0.125]**

**P(0.5) = [4.5 2.375]**

**For t = 0.7:**

**Substituting t=0.7 in (1), we get-**

**P(t) = [1 0](1-t)3 + [3 3]3t(1-t)2 + [6 3]3t2(1-t) + [8 1]t3**

**P(0.7) = [1 0](1-0.7)3 + [3 3]3(0.7)(1-0.7)2 + [6 3]3(0.7)2(1-0.7) + [8 1](0.7)3**

**P(0.7) = [1 0](0.3)3 + [3 3]3(0.7)(0.3)2 + [6 3]3(0.7)2(0.3) + [8 1](0.7)3**

**P(0.7) = [1 0] x 0.027 + [3 3] x 3 x 0.7 x 0.09 + [6 3] x 3 x 0.49 x 0.3 + [8 1] x 0.343**

**P(0.7) = [1 0] x 0.027 + [3 3] x 0.189 + [6 3] x 0.441 + [8 1] x 0.343**

**P(0.7) = [0.027 0] + [0.567 0.567] + [2.646 1.323] + [2.744 0.343]**

**P(0.7) = [5.984 2.233]**

**For t = 1:**

**Substituting t=1 in (1), we get-**

**P(1) = [1 0](1-1)3 + [3 3]3(1)(1-1)2 + [6 3]3(1)2(1-1) + [8 1](1)3**

**P(1) = [1 0] x 0 + [3 3] x 3 x 1 x 0 + [6 3] x 3 x 1 x 0 + [8 1] x 1**

**P(1) = 0 + 0 + 0 + [8 1]**

**P(1) = [8 1]**

**Following is the required rough sketch of the curve-**

