Q1) $d^{(4)} = 8\%$

a) $\delta = ?$

$$d = 1 - \left(1 - \frac{d^{(p)}}{p}\right)^p$$

$$= 1 - \left(1 - \frac{0.08}{4}\right)^4 = 0.07763184$$

$$\delta = \ln\left(\frac{1}{1-d}\right) = 0.0808108$$
$$= 8.08108\%$$

b) $i = ?$

$$i = \frac{d}{1-d} = 0.08416578$$
$$= 8.416578\%$$

c) $d^{(12)} = ?$

$$= p\left(1 - (1-d)^{1/p}\right)$$

$$= 12\left(1 - (1 - 0.07763184)^{1/12}\right)$$
$$= 0.08053933$$
$$= 8.053933\%$$

Q2) $\delta(t) = 0.004t + 0.0002t^2$

a) x at 0 ———————— 1000 at 10

let the present value $= x$

$\therefore \quad 1000 = x \, e^{\int_0 \ldots}$

$$1000 = x \, e^{\left[\frac{0.004}{2}t^2 + \frac{0.0002t^3}{3}\right]_0^{10}}$$

$\therefore x = 765.93 \text{ Rs}$

ii) $i = ?$

$1000 = 765.93 \, (1+i)^{10}$

$\therefore i = 2.702518 \text{ \% pa}$

Q3) i) $d = iv$ have an interesting relationship as d is the interest paid at beginning and ~~which~~ when i which is interest paid at end of term is discounted by factor v we obtain d.

ii) a) $d^{(2)} = ?$ $\qquad \frac{d^{(4)}}{4} = 2.25$

$d = 1 - \left(1 - \frac{0.025}{4}\right)^4 = \cancel{0.0247666}$ 0.0223108

$\therefore d^{(2)} = 2\left(1 - (1 - 0.0223608)^{\frac{1}{2}}\right)$

$= 0.0224367$

$= 2.24367\%$

$d = 1 - (1 - 0.0225)^4$

$d = 8.700780621\%$

b) $d^{(2)} = ?$ $\qquad d^{(1/2)} = 5\%$

$$d = 1 - \left(1 - \underline{0.05(2)}\right)^{1/2} = 0.0513167$$

$$d^{(2)} = 2\left(1 - (1 - 0.0513167)^{\frac{1}{2}}\right) = 0.0519925$$
$$= 5.19925\%$$

iii) $i^{(365)} = 5\%$

$$\therefore i = \left(1 + \frac{0.05}{365}\right)^{365} - 1 = 0.0512675$$

$$d = \frac{i}{1+i} = 0.04876732$$
$$= 4.876732\%$$

Q4) i) $d = iv$ ~~hold tru~~ have an interesting relationship as d is the interest paid at beggining and ~~which~~ when i which is interest paid at end of term is discounted by factor v we obtain d.

ii) $i = 0.08$

a) $d^{(12)} = ?$

$$d = \frac{i}{1+i} = 0.0740741$$

$$d^{(12)} = 12\left(1 - (1 - 0.0740741)^{1/12}\right) = 0.07671478$$

$$= 7.671478\%$$

b) $i^{(365)} = ?$

$i^{(365)} = 365\left((1+0.08)^{1/365} - 1\right) = 0.0769615$

$= 7.696915\%$

c) $\delta = ?$

$\delta = \ln(1+i) = 0.07696104$

$= 7.696104\%$

d) $i^{(0.5)} = ?$

$i^{(0.5)} = 0.5\left((1+0.08)^{1/0.5} - 1\right) = \cancel{8.3}\ 0.0832$

8.32%

Q5) i) $d^{(4)} = 6\%$

a) $i^{(2)} = ?$

$d = 1 - \left(1 - \frac{d^{(p)}}{p}\right)^p = 0.05866345$

$\therefore i = \frac{d}{1-d} = \cancel{0.02}\ 0.0623193$

$i^{(2)} = p\left((1+i)^{1/p} - 1\right) = 0.0613775$

$= 6.13775\%$

b) $d^{(12)} = ?$

$d^{(12)} = p\left(1 - (1-d)^{1/p}\right) = 0.0603025$

$= 6.03025\%$

ii) 200000 ? 220000

15th Ap 2005 — 17th July 2005 — 15th Apr 2006

93 days

a) Amount paid by Amit on 17th July to terminate the contract $= x$

Let the interest $= i$

$$\therefore \quad 220000 = 200000(1+i)$$

$$i = 10\%$$

$$x = 200000(1+0.1)^{93/365.25}$$

$$\boxed{x = 204806.04 \text{ Rs}} \rightarrow \text{Paid By Amit}$$

Q6) Price of toy $= x$

Cost price when amount paid on spot $= 70\%$ of x $= 0.7x$

CP when amount paid 6 months after purchase $= 75\%$ of x $= 0.75x$

Time $= \frac{1}{2}$ year

$$\therefore \quad PV = AV(1-d)^n$$

$$0.7x = 0.75x(1-d)^{0.5}$$

$$d = 12.8888889\%$$

ii) $d^{(12)} = ?$

$$d^{(12)} = \cancel{1-\left(1-\frac{d^{(p)}}{p}\right)^p} \quad p\left[1-(1-d)^{1/p}\right] = 13.7195447\%$$

b) $i = \frac{d}{1-d} = 14.7957838$

$i^{(2)} = p\left((1+i)^{1/p} - 1\right) = 14.2857002\%$

$\delta = \ln(1+i) = 13.79857032\%$

Q7) $20000 \xrightarrow{\text{17 Months}} 26000$

$$26000 = 20000\left(1 + \frac{17}{12} i_s\right)$$

iii) $i_s = 21.17647059\%$ (SI)

$$26000 = 20000(1+i)^{\frac{17}{12}}$$

$$i = 20.34570672\%$$

i) $i^{(4)} = 4\left((1+0.2034570672)^{1/4} - 1\right)$
$= 18.95525556\%$

ii) $d = \frac{i}{1+i} = 16.90605714\%$

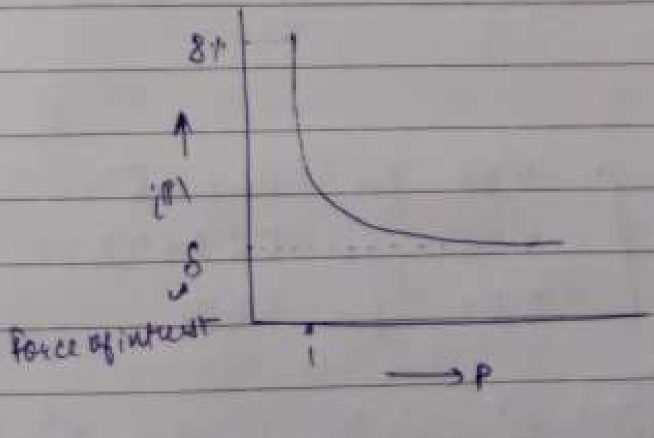
$d^{(2)} = 2\left(1 - (1-d)^{1/2}\right)$
$= 17.688235\%$

iv) Here numerically SI(i_s) got the highest value as compare to i and d as to accumulate the same value in same time it would require higher value as in i, compounding takes place.

Q8) $i = 8\%$. $\quad i^{(p)} - 1$

$i^{(p)} = p\left((1+i)^{1/p} - 1\right)$

p	$i^{(p)}$
1	8%
2	7.846096908%
3	7.795670402%
4	7.770618763%
365	7.696915541%
1000	7.696400271%



- More is the compounding less is the interest. ~~to accumulate same.~~
- When compounding take place at per unit time ~~the va~~ or $p \to \infty$ then i is also reffered as force of interest.

Q9) i) FOI is the nominal rate of interest compound for unit interval of time.

ii) $i^{(2)} = 0.0775$

$$i = \left(1 + \frac{i^{(p)}}{p}\right)^{p} - 1 = 7.90015625\%$$

$$d = \frac{i}{1+i} = 7.321728\%$$

$$\therefore d^{(12)} = p\left(1 - (1-d)^{1/p}\right) = 7.5795748\%$$

$$i^{(12)} = p\left((1+i)^{1/p} - 1\right) = 8.212218594\%$$

Q10)

$$\delta(t) \begin{cases} 0.08 & \text{for } 0 \le t \le 5 \\ 0.06 & \text{for } 5 \le t < 10 \\ 0.04 & \text{for } t \ge 10 \end{cases}$$

we know $\quad d = \dfrac{e^{\delta} - 1}{e^{\delta}}$

$$d = 1 - v$$

$$1 - v = \frac{e^{\delta} - 1}{e^{\delta}}$$

$$\therefore v = e^{-\delta}$$

→ ~~When $0 < t \le 5$~~

~~$V(t) = e^{-\delta} = e^{-0.08} = 9.231163464\%$.~~

→ ~~When $5 \le t \le 10$~~

~~$V(t) = e^{-\delta} = e^{-0.06} = 9.4176$~~

→ When $0 \le t \le 5$

$$v(t_1) = e^{-\int_0^5 0.08\,dt} = \cancel{e^{-0.08t}}\, e^{-0.4}$$

When $5 \le t \le 10$

$$V(t_2) = e^{-\int_5^{10} 0.06\,dt} = e^{-(0.06 \cdot 10 - 0.3)}$$

When $t \ge 10$

$$V(t_3) = e^{-\int_{10}^{t} 0.04\,dt} = e^{-(0.04t - 0.4)}$$

Hence when ~~Ca~~ $t > 0$

$$V(t) = V(t_1)\, V(t_2)\, V(t_3)$$

$$= e^{-0.4 - 0.06(10) + 0.3 - 0.04t + 0.4}$$

$$= e^{-0.04t + 0.3 - 0.6} = \boxed{e^{-0.04t - 0.3}}$$

Q1) a)

$CD = 18\%$ pa

$0 \qquad\qquad\qquad\qquad\qquad \frac{9}{12}$: 50000

$$PV = AD\,(v)^n$$
$$= 50000\,(1 - 0.18)^{9/12}$$
$$= 43085.43$$

b) i) $\delta = 6\% \qquad d^{(12)} = ?$

$$d = \frac{e^{\delta} - 1}{e^{\delta}} = 5.823546642$$

$$d^{(12)} = p\left(1 - (1-d)^{1/p}\right) = 5.98502495$$

ii) $d^{(4)} = 6\%$

$$d = 1 - \left(1 - \frac{d^{(p)}}{p}\right)^4 = 5.86634493\%$$

$$\therefore i = \frac{d}{1-d} = 6.231931538\%$$

$$i^{(4)} = 4\left((1+i)^{1/4} - 1\right) = 6.09137055\%$$

$$i^{(12)} = 12\left((1+i)^{1/12} - 1\right) = 6.06070886\%$$

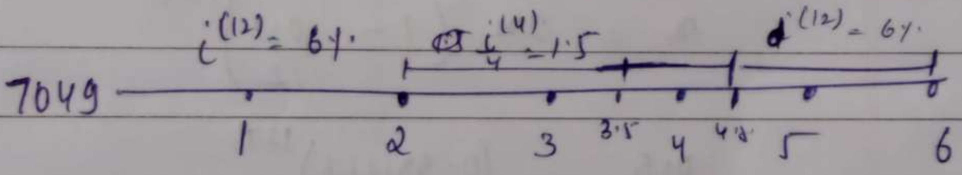
c) $d < \delta < i^{(4)} < i$

d is minimum among the given values as it changed in the beginning of the term so ~~for~~ to get same effective value of i which is changed at the end of term it is less.

$i^{(4)}$ denotes that the interest is compounded quarterly so you get an ~~et~~ extra interest on already earned interest.

d) $d = iv$ ~~two~~ always holds true because d is the interest paid at beginning and when i is discounted by v factor it automatically gives d.

Q12)



$$AV = 7049\ (A_1)(A_2)(A_3)$$

$$A_1 = \left(1 + \frac{0.06}{12}\right)^{12\times 2} = 1.127159776$$

$$A_2 = \left(1 + 10\times 0.015\right) = 1.15$$

$$A_3 = \frac{1}{v_3} = \frac{1}{\left(1 - \frac{0.06}{12}\right)^{1.5\times 12}} = 1.094421325$$

$$AV = \cancel{10091.55}\quad 9999.89$$

Q13) i) $i = 10\%$ pA let $PV = x$

$\therefore AV = 2x$

$\therefore 2x = x(1 + 0.1)^t$

~~r = 0.1 t~~ ~~t = 1.1 t~~ $2 = 1.1^t$

$t = 7.2725$ years

ii) $d^{(12)} = 10\%$ pa let $PV = x$

$\therefore AV = 2x$

$$x = 2x\left(1 - \frac{0.1}{12}\right)^{12t}$$

$$0.5 = (0.991666)^{12t}$$

$t = 6.901995$ yrs