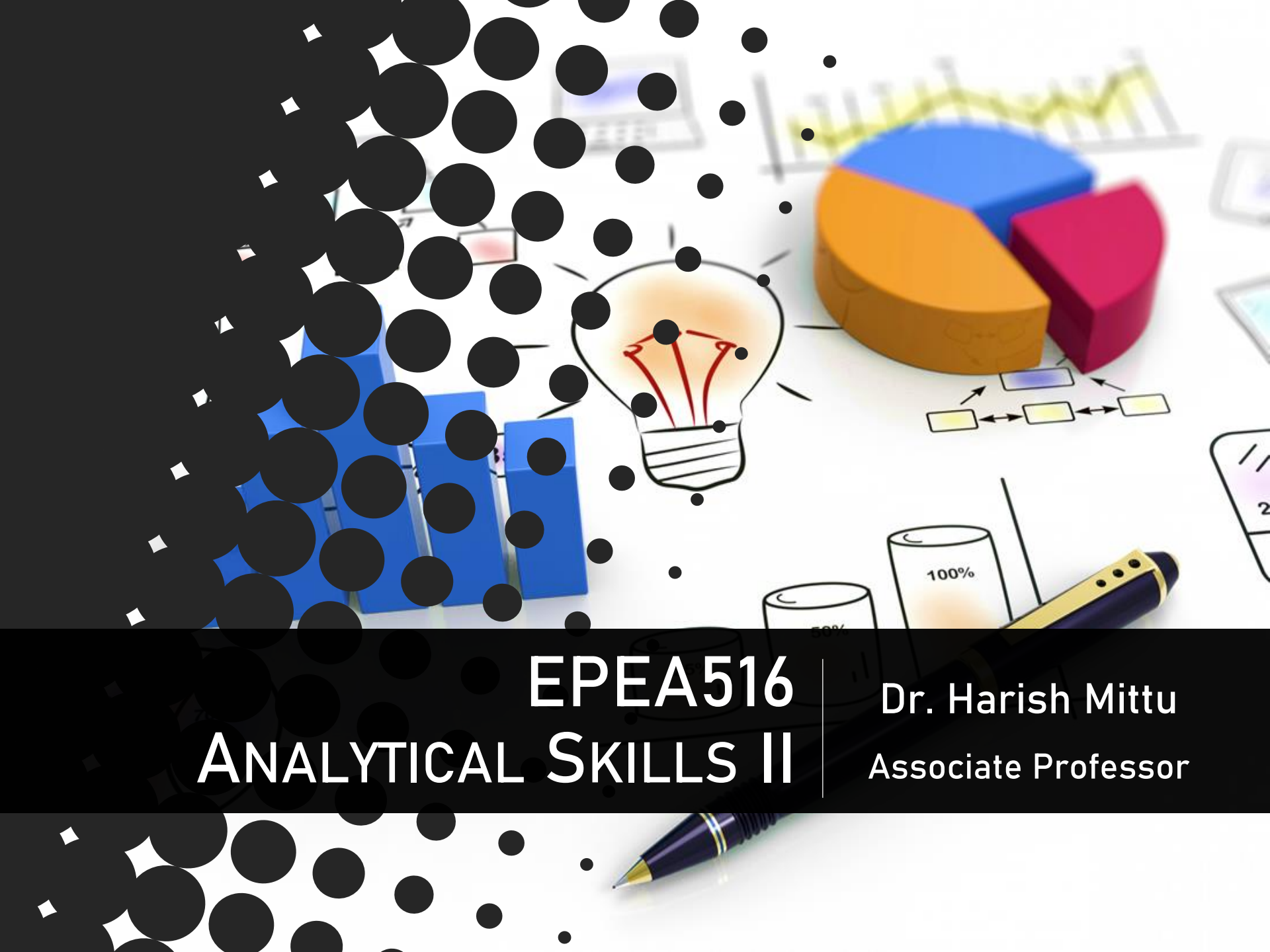

EPEA516
Analytical Skills II

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Learning Outcomes

After this lecture, you will be able to

- understand the concept of alternate day work,
- solve various problems relating to alternate day work.

Alternate Day Work

- A & B
- Working Alone
- Work – A Day Alternately
- Starting/Beginning - A
- Starting/Beginning - B

Example 1

- A & B working alone can do a work in 9 and 12 days respectively. If they work for a day alternately, A beginning, in how many days the work will be completed?

- A's one day work = $\frac{1}{9}$

- B's one day work = $\frac{1}{12}$

- Total amount of work = LCM of 9 and 12 = 36

- Amount of work done by A and B in 2 days = $\frac{1}{9} + \frac{1}{12}$

Example 1

- Amount of work done by A and B in 2 days $= \frac{1}{9} + \frac{1}{12}$

$= \frac{4 + 3}{36}$

$= \frac{7}{36}$

- Amount of work done by A and B in 10 days i.e. 5 x 2 days

$= 5 \times \frac{7}{36}$

$= \frac{35}{36}$

Example 1

- Amount of work done by A and B in 10 days i.e. 5 x 2 days

$$= \frac{35}{36}$$

- In 10 days work done is $\frac{35}{36}$.
- Since it's A's turn next, he can complete 1 item in $\frac{1}{4}$ day or the remaining $\frac{1}{36}$ will be handled by A and he can finish this off in $\frac{1}{4}$ of a day. Hence, the work will be completed in 10 $\frac{1}{4}$ days or $\frac{41}{4}$ days.

Example 1 – Alternative Method

- A & B working alone can do a work in 9 and 12 days respectively. If they work for a day alternately, A beginning, in how many days the work will be completed?
- Rate for A = $\frac{w}{t}$ = $\frac{36}{9}$ = 4 units per day
- Rate for B = $\frac{w}{t}$ = $\frac{36}{12}$ = 3 units per day
- When A and B alternate, the amount of work produced every 2 days = 4+3 = 7 units

Example 1 – Alternative Method

- When A and B alternate, the amount of work produced every 2 days = 4+3 = 7 units
- Number of 2 days periods (2 x 5 = 10 days) required to produce 35 units $= \frac{35}{7} = 5$ and Rate for A (r) = 4
- Time for A to produce the remaining 1 unit on the last day

$$= \frac{w}{r} = \frac{1}{4}$$

$$\text{Total Time} = 10\,\frac{1}{4} \text{ days or } \frac{41}{4} \text{ days}$$

Example 2

- A and B work on alternate days to complete a work with B beginning the work on the first day. A can finish the work alone in 48 days. If the work gets completed in $11\frac{1}{3}$ days, then in how many days B alone can finish 4 times the same work?
- A alone can finish the work in 48 days.
- A's one day work = $\frac{1}{48}$

Example 2

- Both A and B completed the work in $11\frac{1}{3}$ days = $\frac{34}{3}$
- As A and B works on alternate days, beginning with B.
- B will work only 6 days.
- A will work only for $(\frac{34}{3} - 6)$ $= \frac{34 - 18}{3}$

$= \frac{16}{3}$ or $5\frac{1}{3}$ days

Example 2

- A will work only for $\frac{16}{3}$ or $5\frac{1}{3}$ days
- A's $\frac{16}{3}$ or $5\frac{1}{3}$ days work = $\frac{16}{3} \times \frac{1}{48} = \frac{1}{9}$ (3)
- Remaining work $= 1 - \frac{1}{9} = \frac{8}{9}$
- B complete $\frac{8}{9}$ work in 6 days.
- B complete whole work in = $\overset{3}{6} \times \frac{9}{8}$ days (4) $= \frac{27}{4}$ days

Example 2

- B complete whole work in $\frac{27}{4}$ days.
- B alone can finish 4 times the same work in

$$= \cancel{4} \times \frac{27}{\cancel{4}}$$

$$= 27 \text{ days}$$

Example 3

- A and B can do a piece of work in 8 and 18 days respectively. In how many days the work will be completed if they both work on alternate days starting with B?
- Total work = LCM of 8 and 18 = 72
- A's one day work = $\frac{1}{8}$ and Efficiency of A = $\frac{\overset{9}{\cancel{72}}}{\cancel{8}}$ = 9
- B's one day work = $\frac{1}{18}$ and Efficiency of B = $\frac{\overset{4}{\cancel{72}}}{\cancel{18}}$ = 4

Example 3

- Two days work of A and B = 9 + 4 = 13
- 5 x 2 (i.e., 10) days work of A and B = 5 x 13 = 65
- On 11^{th} day, there is B's turn.
- So, B complete remaining work = 72 – 65 = 7

  in $7x \frac{1}{4} = \frac{7}{4}$ days

- The work will be completed in $10 \frac{7}{4}$ days.

Example 4

- A alone can complete a work in 16 days and B alone in 12 days. Starting with A, they work on alternate days. In how many days the total work will be completed?

- Two days work of A and B $= \frac{1}{16} + \frac{1}{12}$

$= \frac{3 + 4}{48}$

$= \frac{7}{48}$

Example 4

- Two days work of A and B $= \frac{7}{48}$
- 6 x 2 (i.e., 12) days work of A and B = $\cancel{6} \times \frac{7}{\cancel{48}_{8}} = \frac{7}{8}$
- Remaining work $= 1 - \frac{7}{8} = \frac{8-7}{8} = \frac{1}{8}$
- On 13^{th} day, there is A's turn, Work done by A = $\frac{1}{16}$
- So, A complete remaining work $= \frac{1}{8} - \frac{1}{16}$

Example 4

- So, A complete remaining work = $\frac{1}{8} - \frac{1}{16} = \frac{2-1}{16} = \frac{1}{16}$

On 14th day, it is B's turn.

- $\frac{1}{12}$ work is done by B in 1 day.
- $\frac{1}{16}$ work is done by B in $\cancel{12}^{3} \times \frac{1}{\cancel{16}_{4}} = \frac{3}{4}$ days
- Total Time taken = $13\frac{3}{4}$ days

Example 5

- A and B can do a work in 20 and 16 days respectively. If they work on alternative days beginning with A, then, in how many days the work will be completed?

- Two days work of A and B $= \frac{1}{20} + \frac{1}{16}$

$= \frac{4 + 5}{80}$

$= \frac{9}{80}$

Example 5

- Two days work of A and B $= \frac{9}{80}$
- 8 x 2 (i.e., 16) days work of A and B = $\cancel{8} \times \frac{9}{\cancel{80}_{10}} = \frac{9}{10}$
- Remaining work $= 1 - \frac{9}{10} = \frac{10 - 9}{10} = \frac{1}{10}$
- On 17^{th} day, there is A's turn, Work done by A = $\frac{1}{20}$
- So, A complete remaining work $= \frac{1}{10} - \frac{1}{20}$

Example 5

- So, A complete remaining work = $\frac{1}{10} - \frac{1}{20} = \frac{2-1}{20} = \frac{1}{20}$

On 18th day, it is B's turn.

- $\frac{1}{12}$ work is done by B in 1 day.
- $\frac{1}{20}$ work is done by B in $\cancel{12}^{3} \times \frac{1}{\cancel{20}_{5}} = \frac{3}{5}$ days
- Total Time taken = $17\frac{3}{5}$ days

Example 6

- A and B can do a work in 12 and 36 days respectively. If they work on alternative days beginning with B, then, in how many days the work will be completed?
- Total work = LCM of 12 and 36 = 36
- A's one day work = $\frac{1}{12}$ and Efficiency of A = $\frac{\overset{3}{\cancel{36}}}{\cancel{12}}$ = 3
- B's one day work = $\frac{1}{36}$ and Efficiency of B = $\frac{\overset{4}{\cancel{36}}}{\cancel{36}}$ = 1

Example 6

- Two days work of A and B = 3 + 1 = 4
- 9 x 2 (i.e., 18) days work of A and B = 9 x 4 = 36
- Remaining work = 36 – 36 = 0
- The work will be completed in 18 days.

Example 7

- A and B can do a work in 8 and 12 days respectively. If they work on alternative days beginning with A, then, in how many days the work will be completed?

- Two days work of A and B $= \frac{1}{8} + \frac{1}{12}$

$= \frac{3 + 2}{24}$

$= \frac{5}{24}$

Example 7

- Two days work of A and B $= \frac{5}{24}$
- 4 x 2 (i.e., 8) days work of A and B = $\cancel{4} \times \frac{5}{\cancel{24}_{6}} = \frac{5}{6}$
- Remaining work $= 1 - \frac{5}{6} = \frac{6-5}{6} = \frac{1}{6}$
- On 9^{th} day, there is A's turn, Work done by A = $\frac{1}{8}$
- So, A complete remaining work $= \frac{1}{6} - \frac{1}{8}$

Example 7

- So, A complete remaining work = $\frac{1}{6} - \frac{1}{8} = \frac{4-3}{24} = \frac{1}{24}$

On 10th day, it is B's turn.

- $\frac{1}{12}$ work is done by B in 1 day.
- $\frac{1}{24}$ work is done by B in $\cancel{12}^{1} \times \frac{1}{\cancel{24}_{2}} = \frac{1}{2}$ days
- Total Time taken = $9\frac{1}{2}$ days

Conclusion

- Alternate Day Work
  - A & B working alone.
  - A beginning or B beginning.
  - Calculate number of days to complete the work.
  - If the work gets completed in ‘X’ days, then in how many days B alone can finish ‘Y’ times the same work?

Summary

- Time and Work
    - Alternate Day Work

That’s all for now…