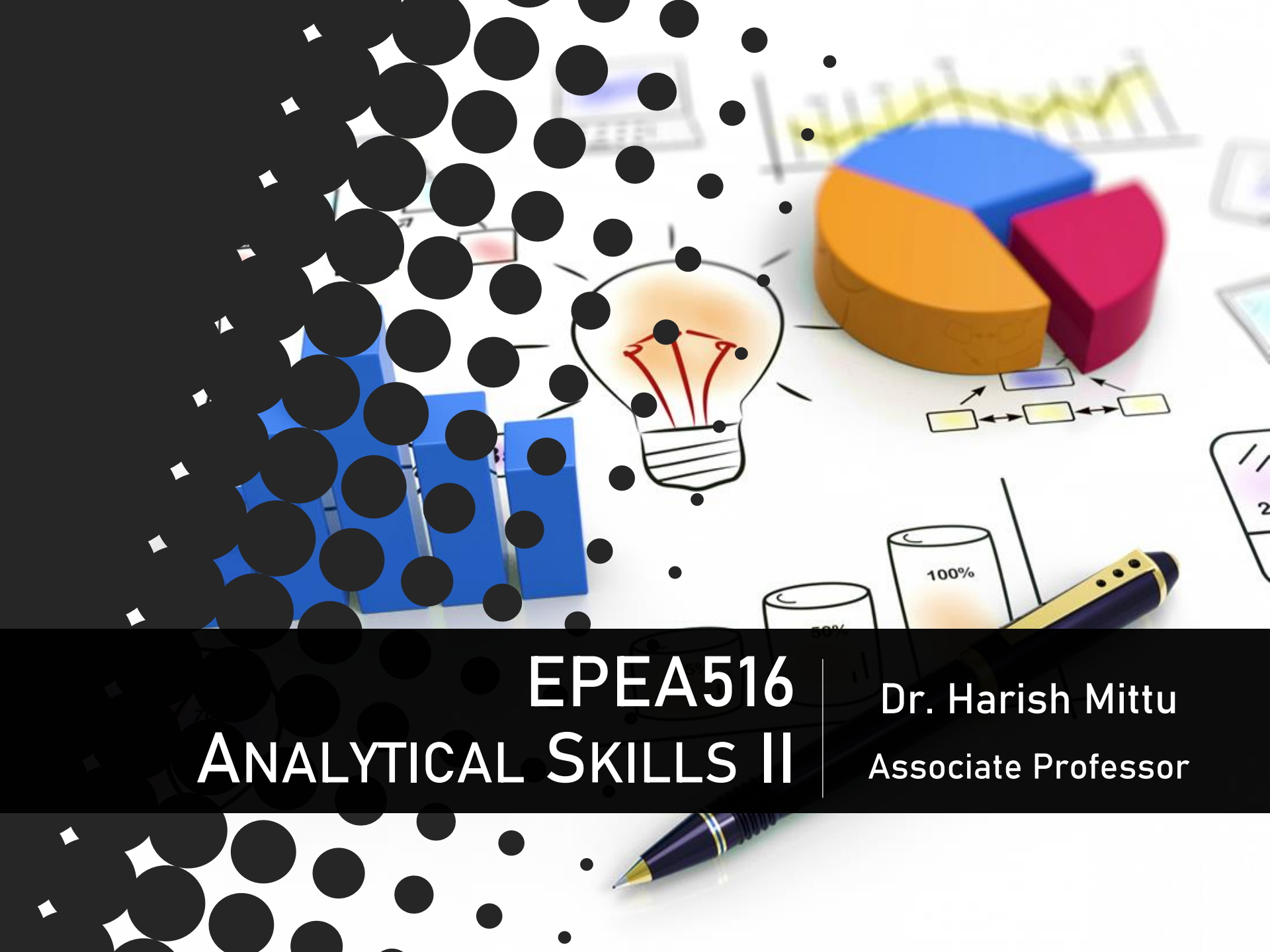

EPEA516
Analytical Skills II

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Learning Outcomes

After this lecture, you will be able to

- develop understanding about basics of races,
- derive important facts and formulae relating to various problems on races,
- solve various problems relating to races.

Basics, Important Facts & Formulae

- Race
  - A contest of Speed
  - Running/Driving/Riding/Sailing/Rowing
  - Specified Distance
- Racecourse
  - Ground/Path
  - Contests - Arranged

Basics, Important Facts & Formulae

- Starting Point
  - Race – Begins/Start
- Winning Post/Goal
  - Race – Finishes/Ends
- Winner
  - First Reaches - Finishing Point

Basics, Important Facts & Formulae

- Dead-heat Race
  - All the persons contesting a race
  - Reach finishing point – Same time (exactly)

Basics, Important Facts & Formulae

- A & B – Two Contestants
- A beats B by ‘t’ seconds.
  - A finishes the race ‘t’ seconds before B finishes.
- A gives B a start of ‘t’ seconds.
  - A starts ‘t’ seconds after B starts from the same point.

Basics, Important Facts & Formulae

- A & B – Two Contestants
- A gives B a start of ‘d’ m.
  - While A starts at the starting point, B starts ‘d’ m ahead from the starting point at the same time.

Basics, Important Facts & Formulae

- A & B – Two Contestants
- Game of 100
  - A game in which the participant scoring 100 points first is the winner.
- In a game of 100, 'A can give B 20 points'
  - While A scores 100 points, B scores only (100–20) or 80 points.

Basics, Important Facts & Formulae

- If A is ‘n’ times as fast as B and A gives B a start of ‘d’ m. If both A and B reach the winning post at the same time, then the length of the race course is given by

$$\left(\frac{nd}{n-1}\right) m$$

Problem 1

- A is 3 times as fast as B. If A gives B a start of 50 m. How long should the race course be so that both of them reach at the same time?

- Length of Race Course = $\left(\frac{nd}{n-1}\right)$ m

- n = 3 and d = 50 m

- Length of Race Course = $\left(\frac{3 \times 50}{3-1}\right)$ m = $\left(\frac{3 \times \overset{10}{\cancel{50}}}{\cancel{2}}\right)$ m

  = 30 m

Problem 2

- A runs 4 times as fast as B. If A gives B a start of 60 m, how far the winning post be so that A and B might reach it at the same time?

- Length of Race Course = $\left(\frac{nd}{n-1}\right)$ m

- n = 4 and d = 60 m

- Distance of Winning Post = $\left(\frac{4 \times 60}{4-1}\right)$ m = $\left(\frac{4 \times \overset{20}{\cancel{60}}}{\cancel{3}}\right)$ m

  = 80 m

Basics, Important Facts & Formulae

- If A can run 'd' m race in t_1 seconds and B in t_2 seconds (where $t_1 < t_2$), then A beats B by a distance of

$$\frac{(d)(t_2 - t_1)}{(t_2)} \text{ m}$$

Problem 3

- A can run 80 m in 20 seconds and B in 25 seconds. By what distance A beats B?

- A beats B by a distance = $\frac{(d)(t_2 - t_1)}{(t_2)}$ m, where $t_1 < t_2$

- d = 80 m, t_1 = 20 seconds, and t_2 = 25 seconds

- A beats B by a distance = $\frac{(80)(25 - 20)}{(25)}$ m = $\frac{(80)(5)}{(25)_5}$ m (16)

= 16 m

Problem 4

- A can run 1000 m in 7 min and B can cover the same distance in 10 min. By what distance can A beat B?

- A beats B by a distance = $\frac{(d)(t_2 - t_1)}{(t_2)}$ m, where $t_1 < t_2$

- d = 1000 m, t_1 = 7 seconds, and t_2 = 10 seconds

- A beats B by a distance = $\frac{(1000)(10 - 7)}{(10)}$ m = $\frac{(1000)(3)}{(10)}$ m

= 300 m

Problem 5

- In a 1200 m race, A beats B by 20 m in 5 seconds. Find A's time over the course.
- B covers 20 m in 5 seconds.
- B's time over the course $= \frac{5 \times \cancel{1200}^{60}}{\cancel{20}}$

  $= 300$ sec
- A's time over the course $= (300 - 5)$ sec $= 295$ sec

  $= 4$ min 55 sec

Problem 6

- In a 200 m race, A beats B by 40 m and B beats C by 50 m.

  In the same race, find the distance by which A beats C.

- $\frac{A}{B} = \frac{200}{200 - 40} = \frac{200}{160}$ and $\frac{B}{C} = \frac{200}{200 - 50} = \frac{200}{150}$

- $\frac{A}{C} = \frac{A}{B} \times \frac{B}{C} = \frac{\overset{4}{\cancel{200}}}{\underset{4}{\cancel{160}}} \times \frac{\overset{5}{\cancel{200}}}{\underset{3}{\cancel{150}}}$

- $\frac{A}{C} = \frac{4 \times 5 \times 10}{4 \times 3 \times 10} = \frac{200}{120}$

- A beats C = (200 – 120) m = 80 m

Problem 7

- In a game of 100 points, A can give B 10 points and C 25 points. How many points B can give C in a game of 180?
- $\frac{A}{B} = \frac{100}{100 - 10} = \frac{100}{90}$ and $\frac{A}{C} = \frac{100}{100 - 25} = \frac{100}{75}$
- $\frac{B}{C} = \frac{B}{A} \times \frac{A}{C} = \frac{\cancel{90}^{18}}{\cancel{100}} \times \frac{\cancel{100}}{\cancel{75}_{15}}$ $\left\{ \frac{A}{B} = \frac{100}{90} \text{ or } \frac{B}{A} = \frac{90}{100} \right\}$
- $\frac{B}{C} = \frac{18}{15}$
- $\frac{B}{C} = \frac{18 \times 10}{15 \times 10} = \frac{180}{150}$

Problem 7

- $\frac{B}{C} = \frac{180}{150}$
- B can give C (180 – 150 = 30) points in a game of 180.

Problem 8

- A, B and C are three contestants in a 1000 m race. If A can give B a start of 200 m and A can give C a start of 500 m, how many metres start can B give C?

- $\frac{A}{B} = \frac{1000}{1000 - 200} = \frac{1000}{800}$

- $\frac{A}{C} = \frac{1000}{1000 - 500} = \frac{1000}{500}$

- $\frac{B}{C} = \frac{B}{A} \times \frac{A}{C} = \frac{\cancel{800}^{8}}{\cancel{1000}} \times \frac{\cancel{1000}}{\cancel{500}_{5}}$ $\left\{ \frac{A}{B} = \frac{1000}{800} \text{ or } \frac{B}{A} = \frac{800}{1000} \right\}$

Problem 8

- $\frac{B}{C} = \frac{8}{5}$
- $\frac{B}{C} = \frac{8 \times 125}{5 \times 125} = \frac{1000}{625}$
- B can give C a start of (1000 – 625) m = 375 m

Problem 9

- In a 300 m race, A runs at $\frac{10}{3}$ m/s. If A gives B a start of 20 m and still beats him by 50 seconds, what is B's speed?

- Speed of A $= \frac{10}{3}$ m/s, Distance = 300 m, and Time = ?

- Time $= \frac{\text{Distance}}{\text{Speed}} = \frac{300}{\frac{10}{3}}$ $= 30$

- Time = 90 seconds

Problem 9

- Distance covered by B = (300 – 20)m = 280 m
- Time taken by B = (90 + 50) = 140 seconds
- Speed of B $= \frac{\text{Distance}}{\text{Time}}$

$$= \frac{\cancel{280}^{2}}{\cancel{140}} \text{ m/s}$$

$$= 2 \text{ m/s}$$

Conclusion

- Race (A contest of Speed)
- Racecourse (Ground/Path)
- Starting Point (Begins/Start)
- Winning Post/Goal (Finishes/Ends)
- Winner (First Reaches - Finishing Point)
- Dead-heat Race (Reach finishing point - Same time)

Conclusion

- A beats B by ‘t’ seconds.
- A gives B a start of ‘t’ seconds.
- A gives B a start of ‘d’ m.
- Game of 100.
- In a game of 100, A can give B 20 points.

Conclusion

- If A is n times as fast as B and A gives B a start of ‘d’ m. If both A and B reach the winning post at the same time, then the length of the race course

$$\left(\frac{nd}{n-1}\right) m$$

- If A can run ‘d’ m race in t_1 seconds and B in t_2 seconds (where $t_1 < t_2$), then A beats B by a distance

$$\frac{(d)(t_2 - t_1)}{(t_2)} m$$

Summary

- Race
  - Basics
  - Important Facts
  - Formulae
  - Problems

That’s all for now…