16. Clocks & Calendars

16.1 Clocks

A clock is a complete circle having 360 degrees. It is divided into 12 equal parts i.e. each part is 360/12 = 30°. As the minute hand takes a complete round in one hour it covers 360° in 60 min. In 1 min. it covers 360/60 = 6°/ minute. Also, as the hour hand

covers just one part out of the given 12 parts in one hour, this implies it covers 30° in 60 min. i.e. ½° per minute. This implies that the relative speed of the minute hand is 6 – ½ = 5 ½ degrees.

- Every hour, both the hands coincide once. In 12 hours, they will coincide 11 times. It happens due to only one such incident between 12 and 1'o clock.

- The hands are in the same straight line when they are coincident or opposite to each other.

- When the two hands are at a right angle, they are fifteen-minute spaces

apart. In one hour, they will form two right angles and in twelve hours there are only twenty-two right angles. It happens due to right angles formed by the minute and hour hand at 3'o clock and 9'o clock.

- When the hands are in opposite directions, they are 30-minute spaces apart.

- If a clock indicates 8.15, when the correct time is 8, it is said to be fifteen minutes too fast. On the other hand, if it indicates 7.45, when the correct time is 8, it is said to be fifteen minutes too slow.

NOTE: If both the hour hand and minute hand move at their normal speeds, then both the hands meet after $65\frac{5}{11}$ minutes.

16.2 Calendars

In an ordinary year there are 365 days, which means 52 × 7 + 1, or 52 weeks and one day. This additional day, is called an odd day. Further, every 100^{th}year starting from 1st AD, is a non–leap year, but every 4^{th} century year is a leap year. So any year divisible by 400 will be a leap year e.g.: 1200, 1600 and 2000. And the years 1800, 1900 will be non leap years as they are divisible by 100, but not 400.

The concept of odd days is very important in calendars. In a century i.e. 100 years, there

will be 24 leap years and 76 non–leap years. This means that there will be 24 × 2 + 76 × 1 = 124 odd days. Since, 7 odd days make a week, to find out the net odd days, divide 124 by 7. The remainder is 5. This is the number of odd days in a century. You may memorise the following points related to the concepts of calendars to save time during the paper.

100 years give us 5 odd days as calculated above.

200 years give us $5 \times 2 = 10 - 7$ (one week) – 3 odd days.

300 years give us $5 \times 3 = 15 - 14$ (two weeks) – 1 odd day.

400 years give us $\{5 \times 4 + 1$ (leap century)$\} - 21\} - 0$ odd days.

Month of January gives us 31 – 28 = 3 odd days.

Month of February gives us 28 – 28 = 0 odd day in a normal year and 1 odd day in a leap year and so on for all the other months.

In total first six months i.e. January to June give us 6 odd days in a normal year and 7 – 7 = 0 odd days in a leap year. This is going to help, when you want to find a day, which is after 30^{th} June.

In total first nine months i.e. January to September give us 0 odd day in a normal year and 1 odd day in a leap year.

Now, if we start from 1st January 0001 AD;

for 0 odd day, the day will be Sunday; for 1 odd day, the day will be Monday; for 2 odd days, it will be Tuesday; for 3 odd days, it will be Wednesday and so on.

There are two types of questions, one in which a reference day is given and in the other variety, no reference day is given.