K. J. SOMAIYA SCHOOL OF ENGINEERING, MUMBAI – 400077
DEPARTMENT OF SCIENCE AND HUMANITIES
F.Y. B. TECH. SEMESTER –I (2024-25)
APPLIED MATHEMATICS-I
IA-II

SEIR Epidemic Model

NAME : RAJAT KUMAR
ROLL NO.: 16014224054
DIV: C5 **BATCH:** C5-3

What are Epidemic Models ?

It is a mathematical model that helps to predict the outcome of any disease epidemic.

How **SEIR** epidemic model works ?

It divides the population into 4 categories based on their status w.r.t the disease & uses **differential equations** to predict the progression of the epidemic.

Susceptible Individuals likely to contract the disease

λ

Exposed Individuals exposed but still not infectious

σ

Infected Individuals that can infect others also

γ

Recovered Individuals that gained immunity OR died

Equations of the SEIR Model

S, E, I, R represents number of susceptible, exposed, infected and recovered (or dead) individuals respectively, also S + E + I + R = N (Total size of population).

- β (Transmission Rate): Rate of contacting the disease from an infected individual.
- λ (Exposure Rate): Rate of being exposed to the disease. It is proportional to β & I.
- σ (Incubation Rate): Rate at which exposed individuals become infected.
- γ (Recovery Rate): Rate at which infected individuals get recovered or succumbed to the disease.
- μ (Birth & Death Rate): Assuming equal birth & death rates in the population.
- R_0 (Reproduction Number): Average number of secondary cases produced by 1 infected individual.

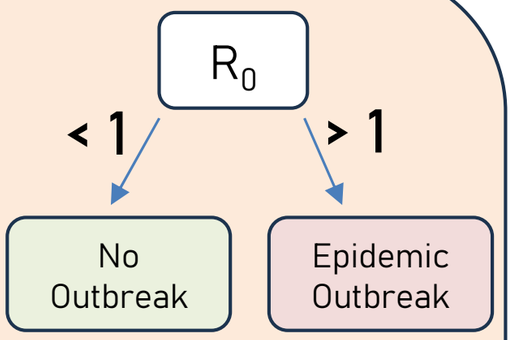
$$\frac{dS}{dt} = \mu N - \mu S - \frac{\beta IS}{N}$$

$$\frac{dE}{dt} = \frac{\beta IS}{N} - (\mu + \sigma)E$$

$$\frac{dI}{dt} = \sigma E - (\gamma + \mu)I$$

$$\frac{dR}{dt} = \gamma I - \mu R$$

$$R_0 = \frac{\sigma\beta}{(\mu+\sigma)(\mu+\gamma)}$$



References

i. https://en.wikipedia.org/wiki/Compartmental_models_in_epidemiology
ii. https://docs.idmod.org/projects/emod-generic/en/latest/model-seir.html
iii. https://web.pdx.edu/~gjay/teaching/mth271_2020/html/09_SEIR_model.html

Date : 15-11-2024