# SNS COLLEGE OF TECHNOLOGY

**(An Autonomous Institution)**

**COIMBATORE-35**

**Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade**
**Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai**

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**COURSE NAME: 19EEB301/ CONTROL SYSTEMS**

III YEAR / V SEMESTER

Unit I – SYSTEMS AND THEIR REPRESENTATIONS

Topic : Analogous systems

# Electrical Analogies of Mechanical Systems

- Two systems are said to be analogous to each other if the following two conditions are satisfied.
  - The two systems are physically different
  - Differential equation modelling of these two systems are same
- Electrical analogies of translational mechanical systems.
  - Force voltage analogy
  - Force current analogy
- Electrical analogies of rotational mechanical systems.
  - Torque voltage analogy
  - Torque current analogy

# Force - Voltage Analogy

| Translational Mechanical System | Electrical System |
|---|---|
| Force(F) | Voltage(V) |
| Mass(M) | Inductance(L) |
| Frictional Coefficient(B) | Resistance(R) |
| Spring Constant(K) | Reciprocal of Capacitance $\left(\frac{1}{c}\right)$ |
| Displacement(x) | Charge(q) |
| Velocity(v) | Current(i) |

# Force - Current Analogy

| Translational Mechanical System | Electrical System |
|---|---|
| Force(F) | Current(i) |
| Mass(M) | Capacitance(C) |
| Frictional coefficient(B) | Reciprocal of Resistance$\left(\frac{1}{R}\right)$ |
| Spring constant(K) | Reciprocal of Inductance$\left(\frac{1}{L}\right)$ |
| Displacement(x) | Magnetic Flux(ψ) |
| Velocity(v) | Voltage(V) |

# Torque - Voltage Analogy

| Rotational Mechanical System | Electrical System |
|---|---|
| Torque(T) | Voltage(V) |
| Moment of Inertia(J) | Inductance(L) |
| Rotational friction coefficient(B) | Resistance(R) |
| Torsional spring constant(K) | Reciprocal of Capacitance $\left(\frac{1}{c}\right)$ |
| Angular Displacement(θ) | Charge(q) |
| Angular Velocity(ω) | Current(i) |

# Torque – Current Analogy

| Rotational Mechanical System | Electrical System |
|---|---|
| Torque(T) | Current(i) |
| Moment of inertia(J) | Capacitance(C) |
| Rotational friction coefficient(B) | Reciprocal of Resistance$\left(\frac{1}{R}\right)$ |
| Torsional spring constant(K) | Reciprocal of Inductance$\left(\frac{1}{L}\right)$ |
| Angular displacement(θ) | Magnetic flux(ψ) |
| Angular velocity(ω) | Voltage(V) |


# Thank You