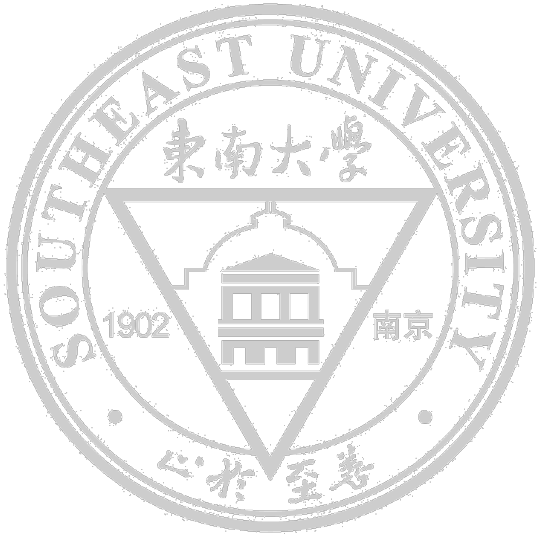


*An Undergrad Course of Southeast University*

# Lecture 13
# Final Review

Course ID: B3060221

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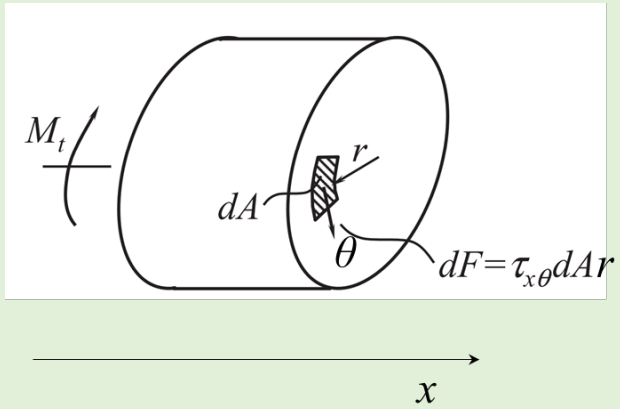
# Format

- Total 40 pts;
- Fill-the-blanks: 10 questions, 2 pts each, 20 pts total.
- Short answers: 4 questions, 5 pts each, 20 pts total.

# Example Questions

- Question: What is the full name of MEMS?
  Answer: micro-electromechanical system
- Question: List a process for adding a layer of film in vacuum?____
  Answer: sputter, evaporation (either one is correct)
- Question: Calculate the polar moment of inertia of the circular cross section on the right, where the radius is $r_0$.
  Answer:

$$J = \int r^2 dA = \int_0^{2\pi} \int_o^{r_0} r^2 \cdot r \mathrm{d}r\mathrm{d}\theta = \int_0^{2\pi} \int_o^{r_0} r^3 \mathrm{d}r\mathrm{d}\theta = \frac{\pi r_0^4}{2}$$



# L01

| Concept |
| --- |
| Dimensional Analysis |

| Equations |
| --- |
| Express dimensions of physical quantities using FLT units (PPT, P37) |

# L02

| Concept | | | |
|---|---|---|---|
| Crystalline orientation, graphic representation | Anisotropy | Single and poly crystal | Photolithography |
| Steps of photolithography | Positive/negative resist | Additive and subtractive processes | Etch anisotropy |
| Mean free path | Sputter vs. plasma etch | Anisotropic wet etch | Isotropic wet etch |

| Equations | | |
|---|---|---|
| Spin-coating thickness | Photoresist contrast | Photolithography resolution |

# L03

| Concept | | | |
|---|---|---|---|
| Evaporation | Shadowing effect | Sputter Deposition | CVD |
| Si oxidation methods | CVD reaction rate | Deposition uniformity | LPCVD |
| PECVD | ALD | Step coverage | |

| Equations | | |
|---|---|---|
| Arrhenius Law | | |

# L04

| Concept | | | |
|---|---|---|---|
| Moment | Free body diagram | Normal force | Shear force |
| Tensile force | Compressive force | Yield | Neutral line |
| Radius of curvature | | | |

| Equations | | |
|---|---|---|
| Force equilibrium | Stress | Strain |
| Moment of inertia | Moment-curvature relationship | Neutral surface location |
| Euler-Bernoulli equation (P47) | Deflection of Cantilever beam (P52) | Castigliano's theorem (P62) |
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| Concept | | | |
|---|---|---|---|
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| Equations | | |
|---|---|---|
| Effective stiffness of springs with parallel and series connections | Stiffness of a straight beam (P8) | |
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| Concept | | | |
|---|---|---|---|
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| Equations | | |
|---|---|---|
| Coriolis acceleration (P12) | Centrifugal force (P15) | Free vibration of undamped system (P21) |
| Free vibration of undamped system (P25) | Forced vibration of undamped system (P26) | Quality factor (P29) |
| | | |
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| Concept | | | |
|---|---|---|---|
| Piezoelectric | Piezoresistance | | |
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| Equations | | |
|---|---|---|
| Capacitance | Inductance | Kirchhoff's laws |
| Coulomb's law | Electrostatic force on vertically moving parallel plates (P16) | Electrostatic force on laterally moving parallel plates (P17, 18) |
| Lorentz force (P23) | | |
| | | |

| Concept | | | |
|---|---|---|---|
| Effective flexural rigidity (P5) | | | |
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| Equations | | |
|---|---|---|
| Neutral line position of composite beam(P7) | | |
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| Concept | | | |
|---|---|---|---|
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| Equations | | |
|---|---|---|
| Deflection of a strip under uniform pressure (P5) | Governing Equation for accelerometer (P10) | |
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| Concept | | | |
|---|---|---|---|
| Conduction | Convection | Radiation | Thermoresistor |
| Seebeck's Effect | Peltier Effect | | |
| | | | |

| Equations | | |
|---|---|---|
| Temperature distribution across uniformly heated beam (P6) | | |
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| Concept | | | |
|---|---|---|---|
| Compressibility | | | |
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| Equations | | |
|---|---|---|
| Shear stress between moving plate and viscous fluid (P6) | Fick's first law | Velocity distribution of flow in a pipe (P19) |
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| Concept | | | |
|---|---|---|---|
| Transverse wave | Phase | frequency | wavenumber |
| Specular reflection | Diffuse reflection | | |
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| Equations | | |
|---|---|---|
| Law of reflection | Law of refraction | |
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