# UNIT-1 Lecture-7

Small Signal Analysis of input stage, the second stage, the output stage; Gain, Frequency Response of 741; a Simplified Model, Slew Rate, Relationship Between ft and SR

#### Small signal Analysis of OP-AMP



- The differential signal  $v_I$  applied between the input terminals.
- The four transistors shown in figure are connected in series.
- Input differential resistance is given by,

$$R_{id} = 4(\beta_N + 1)r_e = 2.11M\Omega$$

### SECOND STAGE



- This is used to determine the values of the parameters of the equivalent circuit.
- Input Resistance: The resistance  $R_{i2}$  is given by  $R_{i2} \square (\square_{16} \square 1)[r_{e16} \square R_9 \quad (\square_{17} \square 1)(r_{e17} \square R_8)]$

So,  $R_{i2} = 4M\Omega$ .



# OUTPUT STAGE





# SLEW RATE

Consider the unity-gain follower shown on previous slide

- •10 volt step is applied at the input.
- •The entire value of the step signal will appear as a differential signal between the two input terminals.

Relationship between and SR can found by:  

$$=\frac{G_{m1}}{SR} = \frac{2I}{I}$$
As we know that=  
So,  $G_{m1} = \frac{I}{2V_T}$   
So,  $=\frac{I}{2C_CV_T}$ 

And we get,

Finally get, 
$$=\frac{SR}{8\pi V_{-}}$$