CBCS SCHEME

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15EE46

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Operational Amplifiers and Linear IC's

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Analyze the given circuit in [Fig Q1(a)] and derive expressions for closed loop voltage gain (A_f), Inpt Resistance (R_{if}) and Output Resistance (R_{of}) of the circuit, with required diagrams.

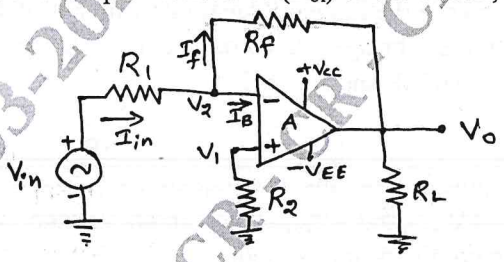

Fig Q1(a) **(10 Marks)**

b. Define the terms slew rate, common-mode rejection ratio and supply voltage rejection rate. **(06 Marks)**

OR

2 a. Explain how a transducer bridge can be connected to an instrumentation amplifier. With required diagram, derive an expression for output voltage of the circuit. What are the applications of instrumentation amplifier? **(08 Marks)**

b. Derive an expression for output voltage (V_o) in the given summing amplifier circuit (Fig Q2(b).

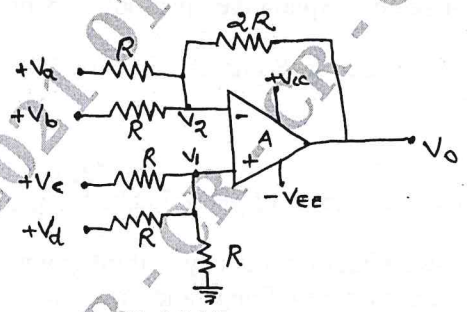

Fig Q2(b) **(08 Marks)**

Module-2

3 a. Derive equations for gain magnitude and phase angle of a First Order Low Pass Filter with required diagrams. Also show how the gain magnitude varies for different input frequencies. **(10 Marks)**

b. Design a wide Band Pass Filter with f_L = 200Hz f_H = 1KHz and a passband gain = 4. Given that capacitance for High pass section = 0.05μF and that of Low Pass section = 0.01μF. Also find quality factor (Q). **(06 Marks)**

OR

4 a. Design a precision Voltage Regulator circuit to provide a 12V output with 50mA maximum load current. Find the value of supply voltage (Vs) required and power dissipation of the circuit. [Use op-amp 741, $I_{B(max)}$ = 500nA and Zener diode 1N757, V_z = 9.1V] **(10 Marks)**

b. With a neat circuit diagram, explain the positive voltage regulator circuit using LM317 IC. Show the output voltage (V_o) equation of the circuit. **(06 Marks)**

Module-3

5 a. Explain the working of a Triangular wave generator circuit with Duty Cycle and Frequency controls. Write the required equations with a neat circuit diagram. **(10 Marks)**

b. Design a Wein bridge oscillator circuit using op-amp to produce a 1KHz and ± 9V output. [Use C_1 = 0.01μF and A_{CL} = 3]. **(06 Marks)**

OR

6 a. With required diagrams and equations, explain how an op-amp circuit output switches between $+V_{osat}$ and $-V_{osat}$ when input voltage, Vin arrives at UTP and LTP, when non-inverting configuration is used. **(08 Marks)**

b. Write short notes on Inverting Zero Crossing Detector, Non-inverting zero crossing Detector and current amplifier. **(08 Marks)**

Module-4

7 a. Sketch an op-amp precision clamping circuit, draw the input and output waveforms and explain the circuit operation. **(08 Marks)**

b. Draw the diagram of op-amp sample and Hold circuit. Sketch the waveforms and explain the circuit operation. **(08 Marks)**

OR

8 a. With a neat sketch, explain the operation of 8-bit Digital to Analog converter using IC 1408. **(08 Marks)**

b. Briefly explain Linear Ramp Analog to Digital converter with the circuit diagram and waveforms. **(08 Marks)**

Module-5

9 a. Draw the block diagrams of phase Locked loop and explain its components briefly. **(08 Marks)**

b. Discuss the working of frequency multiplier with a block diagram. **(04 Marks)**

c. Define the terms Capture Range and Tracking Range. **(04 Marks)**

OR

10 a. Draw the internal block diagram of IC 555 and explain its operation. **(08 Marks)**

b. With required diagrams, waveforms and equations, explain the Astable operation of IC 555 timer. **(08 Marks)**

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