Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
(Manipal University) Manipal – 576 104

FOURTH SEMESTER B.Tech (BME) DEGREE END SEM EXAMINATIONS MAY 2016

SUBJECT: ANALOG ELECTRONIC CIRCUITS (BME 202)
(REVISED CREDIT SYSTEM)
May 7th 2016 : 2.00 p.m.- 5.00 p.m.

TIME: 3 HOURS MAX. MARKS: 100

Instructions to Candidates:
1. Answer any FIVE full questions.
2. Draw labeled diagram wherever necessary

1. (A) In a full wave rectifier circuit the load resistance is 0.5KΩ and the transformer rating is 230v, 50Hz primary with 30-0-30 volts secondary. Given $R_f = 50\Omega$. Calculate peak, average and rms values of current, average value of dc voltage, dc power output, efficiency and ripple factor. 6
   (B) Explain the working of a shunt voltage regulator circuit and indicate the three coefficients that stabilize the output leading to better regulation. 6
   (C) Derive the expression for the peak current in the diode of a full wave rectifier circuit with capacitor filter. Also, elaborate on the design of a regulated power supply. 8
2. (A) An amplifier without feedback gives a fundamental output of 36 volts with 7% second harmonic distortion, when the input is 0.028 volts.
   a) If 1.2% of the output is fed back into the input in a negative voltage series feedback circuit, what is the output voltage?
   b) For an output of 36 volts with 15 second harmonic distortion, what is the input voltage? 6
   (B) Illustrate the feedback amplifier topologies and derive an expression to find the gain of the amplifier with feedback. 6
   (C) In the process of analysis of a current series feedback amplifier with FET as the active device, evaluate the gain, feedback factor, input impedance and output impedance. 8
3. (A) Design a FET phase shift oscillator having $g_m = 5000\mu S, r_d = 40K$ & *feedback* circuit value of $R = 10K$. The circuit needs to oscillate at a frequency of 1KHz. To ensure oscillatory action, assume suitable value of A and calculate R_D. 6

(B) Describe the crystal oscillator with an equivalent electrical circuit. Draw its symbol, and explain the principle behind oscillator. Draw the typical impedance response of the crystal and illustrate the circuit of crystal controlled oscillator operating in the series resonance mode. 6

(C) For a typical FET RC phase shift oscillator, derive an expression for each of the following: frequency of oscillations, phase of the loop gain and minimum value of h_{fe}. 8

4. (A) A two stage FET RC coupled amplifier has $g_m = 10mA/V$, $r_d = 5.5K$, $R_D = 10K$, $R_g = 0.5M\Omega$ for each stage. C_s is large and $C_b = 0.006\mu F$. Find overall mid band voltage gain in dBs' Also determine lower 3-dB frequency of each stage and the overall lower 3-dB frequency. 6

(B) Arrive at the expression for the overall upper 3-dB frequency and overall lower 3-dB frequency taking into consideration non-interacting stages. 6

(C) How does the direct coupled transistor amplifier operate? Draw its circuit diagram and the low frequency model. Also, discuss the biasing conditions involved. 8

5. (A) For a class B amplifier providing a 20-V peak signal to a 16-Ω load (speaker) and a power supply of V_{CC} = 30 V, determine the input power, output power, and circuit efficiency. 6

(B) Derive an expression for the conversion efficiency of a class B push pull power amplifier circuit. Also obtain the relation between the maximum collector dissipation and the maximum power delivered to the load. 6

(C) With a circuit diagram of class B push pull power amplifier circuit, explain its working. Mention the advantages of a push pull system. 8

6. (A) a. Prove that the ratio of parallel to series resonant frequency is given by $\left(1+\frac{1}{2}\frac{C}{C^1}\right)$ 6

b. The ac equivalent circuit of a crystal has these values: L = 1H, C = 0.01 pF,
R = 1000 Ω and C' = 20 pF. Calculate f_s and f_p of the crystal.

(B) Derive an expression for the frequency of oscillation of the Hartley oscillator circuit. 6

(C) For a single-tuned capacitance coupled amplifier, obtain an expression for the normalized voltage gain and draw its frequency response. 8