Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE UP EXAMINATIONS, DEC 2015 / JAN 2016

SUBJECT: LINEAR CONTROL THEORY [ELE 301]

REVISED CREDIT SYSTEM

Time: 3 Hours | 29 December 2015 | MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.
- Semilog graph sheets may be used

1A. A signal flow graph for the system is shown in Fig. 1.A; determine the overall gain using the Mason's Gain formula.

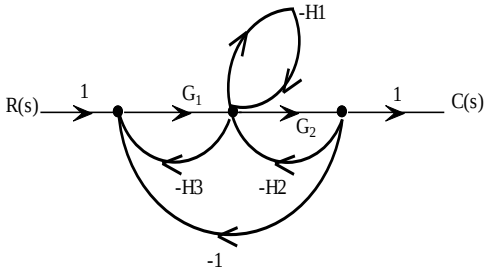

Fig. 1.A **(05)**

1B. For the rotational mechanial system with gear shown in Fig.1.B., the transfer function $G(s) = \dfrac{\theta_1(s)}{T(s)}$.

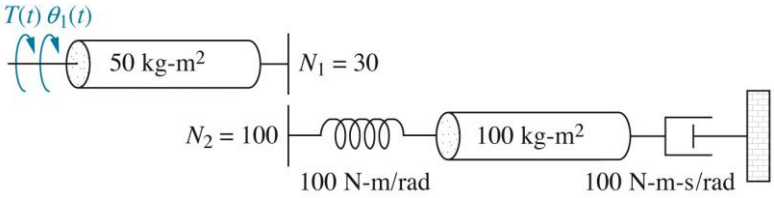

Fig.1.B **(05)**

2A. For the block diagram shown in Fig.2.A find the overall transfer function $\frac{C(s)}{R(s)}$ using block diagram reduction technique.

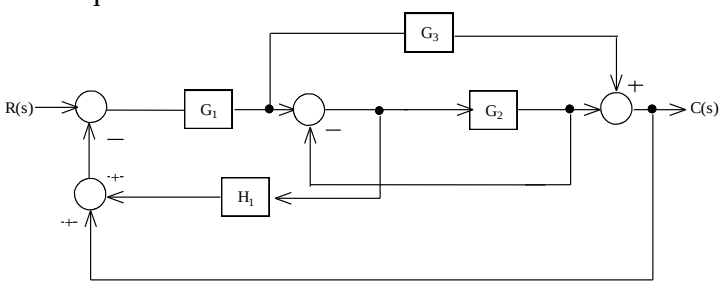

Fig.2.A **(05)**

2B. The open loop transfer function $G(s)=\dfrac{K}{s(s^2+4as+5)}$, find the region of stability on $a-K$ plane , 'a' and 'K' are adjustable positive parameters. **(05)**

3A. The phase margin of a second order system is 60° and the natural frequency is 11.31 rad/sec. Determine the gain cross over frequency. **(04)**

3B. A negative unity feedback system has open loop transfer function $G(s)H(s)=\dfrac{K}{s(2s-1)}$, investigate the stability of the system by applying Nyquist stability criterion. **(06)**

4A. Sketch the root locus for a unity feedback system with open loop transfer function $G(s)H(s)=\dfrac{K(s+3)}{s(s+2)}$. Find values of K for breakaway & break in point. **(07)**

4B. For the unity feedback system with $G(s)=\dfrac{K(s+0.5)}{s^2(s+4)(s+2)}$, if the input is $0.05t^2u(t)$ and the desired steady state error is 0.08 for this input. For a stable system find the value of K to meet the specification. **(03)**

5A. Sketch the Bode plot for a unity feedback system with open loop transfer function $G(s)H(s)=\dfrac{K}{(s+1)(s+3)(s+10)}$, i) find the value of K for the gain margin to be 12dB ii) find the value of K for the phase margin to be 60^o. **(07)**

5B. A unity negative feedback control system has the plant $G(s)=\dfrac{K}{s(s+\sqrt{2K})}$ i) determine the percentage overshoot and settling time (2 % settling criterion) due to a unit step input ii) For what range of K is the settling time less than 1 second?. **(03)**

6A. For the unity feedback system with $G(s)=\dfrac{K}{s(s+6)(s+4)}$, design a PD controller to yield 16% overshoot with three fold reduction in settling time. 'K' of the uncompensated system is 43.35. **(07)**

6B. Find the state space representation of the electrical network shown in Fig.6.B in physical variable form. The output is $V_C(t)$.

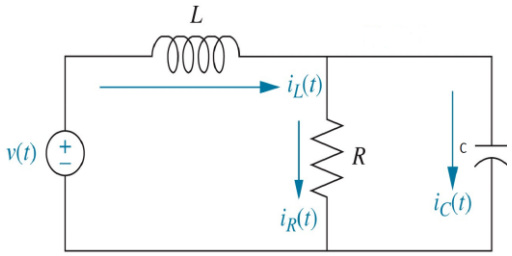

Fig.6B **(03)**