BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE **SEMESTER: III**
BRANCH: EEE **SESSION : MO/2018**

SUBJECT : EE3201 INTRODUCTION TO SYSTEM THEORY

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Define the following (i) periodic and aperiodic signals (ii) continuous time and discrete time signals. Also give one example of each. [2]

(b) Check whether the system given by $\frac{d^3y(t)}{dt^3}+4\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+2y^2(t)=x(t)$ is linear or nonlinear. [3]

Q2 (a) Sketch the following signals: [2]

$(i)\ x_1(t)=u\left(\frac{t-1}{4}\right)\quad (ii)\ x_2(t)=e^{-2t}u(-2+t)$

(b) Determine which of the following signals are energy signals, power signals, neither energy nor power signals. [3]

$(i)\ x_1(t)=e^{-3t}u(t)\quad (ii)\ x_2(t)=Cos\,t$

Q3 (a) Establish the analogy between electrical and mechanical systems. [2]

(b) Write the equilibrium equation and obtain the equivalent analog electrical system using force-voltage and force-current analogy for the system given in Fig-1. [3]

Q4 (a) Establish the analogy between friction wheels and transformer. [2]

(b) Obtain the transfer function of the mechanical system shown in Fig-2 considering x_i as input and x_o as the output. [3]

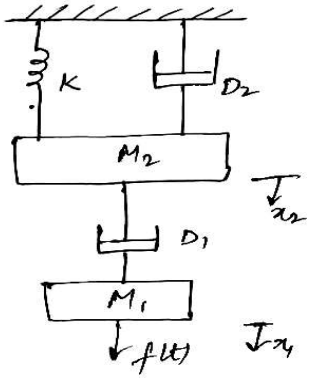

Fig-1.

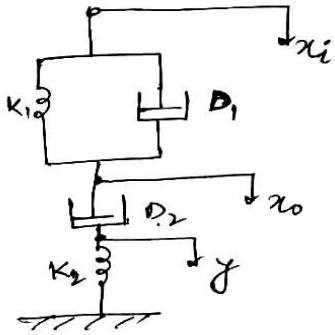

Fig-2

Q5 (a) Evaluate the initial and final value of function f(t), if [2]

$$F(s)=\frac{s^2+3s+5}{s^2+2s+2}$$

(b) Solve for the Laplace transform of [3]

(i) $x(t)=t^2e^{-3t}u(t)$ (ii) $x(t)=5e^{-2t}Sin\,5t\,\mathrm{u(t)}$

Q6 (a) State and prove the convolution theorem. [2]

(b) Solve for the inverse Laplace transform of [3]

(i) $X(s)=\frac{s+3}{(s+2)(s^2+2s+1)}$ (ii) $X(s)=\frac{2se^{-2s}}{(s^2+4s+3)}$

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