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Total Number of Pages: 2

**B.Tech**  
**PEEI5406**

**8<sup>th</sup> Semester Regular / Back Examination 2016-17**

**ADAPTIVE CONTROL**

**BRANCH(S): AEIE, EIE, ELECTRICAL, IEE**

**Time: 3 Hours**

**Max Marks: 70**

**Q.CODE: Z142**

**Answer Question No.1 which is compulsory and any five from the rest.  
The figures in the right hand margin indicate marks.**

- Q1 Answer the following questions: (2 x 10)**
- a) Give some real examples in which adaptive controllers may be useful? What factors would you consider when judging the need for adaptive control?
  - b) Give the algorithm for self oscillation adaptive tuning scheme?
  - c) What do you mean by the term persistent Excitation in Parameter estimation problem?
  - d) Define the generalized steps to design a Adaptive controller?
  - e) Mathematically explain the projection algorithm?
  - f) Give the overall block diagram of self tuning adaptive controller?
  - g) What is the back stepping algorithm? Give the design steps of the back stepping algorithm?
  - h) How is MIT rule used in MRAC control?
  - i) How adaptive control is used in Flight Control system?
  - j) Why is online parameter estimation is a key element in adaptive control scheme?
- Q2 a) What is a Dual control? Give some real time examples where dual control is used? (5)**
- b) How Least square algorithm is used for estimating parameters in Nonlinear models? (5)**
- Q3 a) Explain the minimum degree pole placement (MDPP)? (5)**
- b) How is the least square method can be interpreted as a geometric problem? Explain using some mathematical formulations? (5)**
- Q4 Show how indirect self tuning algorithm can be designed using RLS and Minimum degree pole-placement algorithm? (10)**

- Q5** a) Show how least square algorithms can be used for estimating parameters for nonlinear models? **(5)**
- b) Design a MRAS (model reference adaptive System) for a first order system? **(5)**
- Q6** How is Lyapunovs function can be used to design a Model reference adaptive controller? **(10)**
- Q7** Consider the process  $G(s) = 1/(s + a)$  where 'a' is unknown parameter. Assume that the desired closed loop system is  $G_m = w^2/(s^2 + 2\zeta s + w^2)$ . Construct continuous and discrete time indirect self tuning algorithm for the system? **(10)**
- Q8** **Write short notes on any two:** **(5 x 2)**
- a) BIBO stability
- b) Relation between MRAS and STR
- c) State feedback linearization control. .