**Mehran Univesity o**f **Engineering & Technology, Jamshoro**

**School of Biomedical Engineering**

**Biomedical Control Systems**

**Assignment (5 Marks)**

**Instructions/Guidelines for the Assignment!**

* **Assignment should be hand written.**
* **Each question should starts from new page.**
* **If necessary, neat and clean diagrams/plots should be draw/sketch,**
* **All questions should be solved according to the steps/procedure given in the theory lecture/notes slides.**
* **For answers verification, see the page number of the book given at the end of each question, or answer appendix given at the end of book, or see the solution manual guide.**

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|  | **Nyquist Plot and Nyquist Stability Criterion** |
| **01** | **Sketch the Nyquist Stability Plot for the open-loop transfer function given by**    **Also check whether the system is stable or unstable?**  **[This problem is taken from the book SCHAUM’S OUTLINE FEEDBACK and CONTROL SYSTEMS, Second Edition, problem 11.42. (page 280), and 11.54. (page 287).]** |
| **02** | **Sketch the Nyquist Stability Plot for *G H (s) =* 1/s, also check whether the system is stable or unstable?**  **[This problem is taken from the book SCHAUM’S OUTLINE FEEDBACK and CONTROL SYSTEMS, Second Edition, problem 11.43. (page 280), and 11.55. (page 287).]** |
| **03** | **Sketch the Nyquist Stability Plot for GH(s) = 1/s2(s+p), also determine the stability of the system.**  **[This problem is taken from the book SCHAUM’S OUTLINE FEEDBACK and CONTROL SYSTEMS, Second Edition, problem 11.46. (page 282), and 11.57. (page 288).]** |
|  | **Root Locus Technique** |
| **04** | **Given a unity feedback system that has the forward transfer function;**    **Do the following:**   1. **Calculate the angle of G(s) at the point (3 + j0) by finding the algebraic sum of angles of the vectors drawn from the zeros and poles of G(s) to the given point.** 2. **Determine if the point specified in part (a) is on the root locus.** 3. **If the point specified in part (a) is on the root locus, then find the gain, K, using the lengths of the vectors.**   **[This problem is taken from the book CONTROL SYSTEMS ENGINEERING, Norman S. Nise, Sixth Edition, Skill-Assessment Exercise 8.2, (page 397)]** |
| **05** | **Sketch the root locus and its asymptotes for a unity feedback system that has the forward transfer function;**    **[This problem is taken from the book CONTROL SYSTEMS ENGINEERING, Norman S. Nise, Sixth Edition, Skill-Assessment Exercise 8.3, (page 402)]** |
|  | **Block Diagram Reduction Techniques** |
| **06** | **Simplify the block diagram shown in Figure. Obtain the transfer function relating C(s) and R(s).**    **[This problem is taken from the book Modern Control Engineering, by Katsuhiko Ogata, Fifth Edition, problem A-2-2. (page 46).]** |

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