



MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

COURSE PLAN

Department

:

Instrumentation and Control Engineering

Course Name & code

:

Process Instrumentation & Control. & ICE 3154

Semester & branch

:

V SEM & ICE

Name of the faculty

:

Dr.Bhagya R Navada & Nevin Augustine

No of contact hours/week:

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

ASSESSMENT PLAN

Course Outcomes (COs)

At the end of this course, the student should be able to:

| | | No. of Contact Hours | Marks |
|-------|--|----------------------------|-------|
| CO1: | Understand the basic of process modelling and control | 8 | 23 |
| CO2: | Analyse the philosophy of different controller modes | 12 | 34 |
| CO3: | Design of analog and pneumatic controllers | 4 | 11 |
| CO4: | Analyse the performance and tuning of controllers | 6 | 16 |
| CO5: | Describe the principles of advanced control strategies | 6 | 16 |
| Total | | 36 | 100 |

| Components | Quizzes | Sessional Tests | End Semester/ Make-up Examination |
|-----------------------|---|---|---|
| Duration | 20 to 30 minutes | 60 minutes | 180 minutes |
| Weightage | 20 % (4 X 5 marks) | 30 % (2 X 15 Marks) | 50 % (1 X 50 Marks) |
| Typology of Questions | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation | Knowledge/ Recall; Understanding/ Comprehension; Application | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation |
| Pattern | Answer one randomly selected question from the problem sheet (Students can refer their class notes) | MCQ: 10 questions (0.5 marks) Short Answers: 5 questions (2 marks) | Answer all 5 full questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks |
| Schedule | 4, 7, 10, and 13 th week of academic calendar | Calendared activity | Calendared activity |
| Topics Covered | Quiz 1 (L 1-10 & T 0) (CO1,CO2) | Test 1 (L 1-15 & T 0) (CO1,2) | Comprehensive examination covering full syllabus. Students are expected to answer all questions (CO1-5) |
| | Quiz 2 (L 11-20 & T 0) (CO2,CO3) | | |
| | Quiz 3 (L 21-28 & T 0) (CO3,CO4) | Test 2 (L 16-30 & T 0) (CO2,3,4) | |
| | Quiz 4 (L 29-34 & T 0) (CO4,CO5) | | |

Course Plan

| L. No./ T. No. | Topics | Course Outcome Addressed |
|-------------------|--|--------------------------|
| L0 | Introduction to course | CO1 |
| L1 | Need for process control | CO1 |
| L2 | Process control terminology | CO1 |
| L3 | Mathematical model of first order level systems | CO1 |
| L4 | Mathematical model of thermal and pressure systems | CO1 |
| L5 | Mathematical model of higher order process | CO1 |
| L6 | Interacting and noninteracting systems | CO1 |
| L7 | Continuous and batch process | CO1 |
| L8 | Self-regulation,servo and regulator operation. | CO1 |
| L9 | Basic control actions | CO2 |
| L10 | Characteristics of on-off and single floating controllers. | CO2 |
| L11 | Characteristics of proportional controllers. | CO2 |
| L12 | Numericals on proportional controller action | CO2,CO3 |

| | | |
|------------|---|---------|
| L13 | Characteristics of integral control modes | CO2 |
| L14 | Effects of integral control action. | CO2 |
| L15 | Numericals on integral control action. | CO2,CO3 |
| L16 | Characteristics of derivative control modes | CO3 |
| L17 | Characteristics of P+I and P+D control modes | CO3 |
| L18 | Characteristics of P+I+D control modes | CO3 |
| L19 | Two Degrees of Freedom PID controllers | CO3 |
| L20 | Anti-Reset windup issues and its solution. | CO2 |
| L21 | Realization of analog controllers | CO3 |
| L22 | Realization of analog controllers | CO3 |
| L23 | Realization of pneumatic controllers | CO3 |
| L24 | Realization of pneumatic controllers | CO3 |
| L25 | Evaluation criteria – IAE, ISE,ITAE, ¼ decay ratio | CO4 |
| L26 | Determination of optimum settings for processes using time and frequency response | CO4 |
| L27 | Controller tuning-process reaction curve method | CO4 |
| L28 | Controller tuning-Ziegler Nichols method | CO4 |
| L29 | Controller tuning-damped oscillation method | CO4 |
| L30 | Controller tuning-Two point method. | CO4 |
| L31 | Multiloop Control:Feed forward control | CO5 |
| L32 | Ratio control and cascade control | CO5 |
| L33 | Inferential and split range control actions | CO5 |
| L34 | Introduction to multi-variable control, RG Analysis | CO5 |
| L35 | Internal Model Controller | CO5 |
| L36 | Introduction to Model Predictive Control. | CO5 |
| | | |
| | | |
| | | |
| | | |

References:

1. Stephanopoulos, G, Chemical Process Control,(3e), PHI, 2008.
2. Donald R Coughanower, Process Systems Analysis and Control, MGH, (3e), 2017.
3. Curtis D. Johnson, Process Control Instrumentation Technology, PHI, (8e), 2009.
4. Click or tap here to enter text.
5. Click or tap here to enter text.
6. Click or tap here to enter text.
7. Click or tap here to enter text.

Submitted by: NEVIN AUGUSTINE

(Signature of the faculty)

Date: 26-07-2022

Approved by: Click or tap here to enter text.

(Signature of HOD)

Date: Click or tap to enter a date.

FACULTY MEMBERS TEACHING THE COURSE (IF MULTIPLE SECTIONS EXIST):

| FACULTY | SECTION | FACULTY | SECTION |
|-----------------|---------|---------------------|---------|
| NEVIN AUGUSTINE | B | Dr. BHAGYA R NAVADA | A |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |