

# BME5108: HUMAN MACHINE INTERFACE

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## Effective Term

Semester B 2024/25

## Part I Course Overview

### Course Title

Human Machine Interface

### Subject Code

BME - Biomedical Engineering

### Course Number

5108

### Academic Unit

Biomedical Engineering (BME)

### College/School

College of Biomedicine (BD)

### Course Duration

One Semester

### Credit Units

3

### Level

P5, P6 - Postgraduate Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

Nil

### Precursors

Nil

### Equivalent Courses

MBE5108/BME8121 Human Machine Interface

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

A human machine interface gives a user a visual display of what's going on in the controller and a way to interact with the system. The course aims to develop an understanding of the history and state-of-the-art of human machine interface

technologies and the communication between machines and humans to let students identify the appropriate concepts required in given control problems and apply them to formulate the suitable engineering solutions.

Upon completing the course, students should be able to:

- Understand the human machine interface technological integration of applying the principles and techniques to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities;
- manage and apply scientific methods for the design, implementation of user friendly user interface through hypermedia on automatic control system, mobile devices, the web, and desktop platforms; and
- evaluate the performance of the human machine interface with standard methods during an iterative design process to shorten the project schedules and decrease the budgets.

#### Course Intended Learning Outcomes (CILOs)

| CILOs |   | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|-------|---|---------------------|--------|--------|--------|
| 1     | Explain the basic concepts and design mechanism of the human machine interface  |                     | x      | x      |        |
| 2     | Understand the scientific methods and design principles to different control objects and customize those generic concepts in meeting the needs of particular requirements |                     |        | x      |        |
| 3     | Identify the strategies and evaluation standards in satisfying a set of given requirements to user interface design   |                     |        | x      |        |
| 4     | Design a user friendly user interface through hypermedia on automatic control system, mobile devices, the web, or desktop platforms                                       |                     |        | x      | x      |

#### A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

#### A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

#### A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

#### Learning and Teaching Activities (LTAs)

| LTAs |         | Brief Description                              | CILO No.   | Hours/week (if applicable) |
|------|---------|--|------------|----------------------------|
| 1    | Lecture | Lectures on the topics of the keyword syllabus | 1, 2, 3, 4 | 2 hours/week               |

|   |              |  |            |                |
|---|--------------|--|------------|----------------|
| 2 | Tutorial     | Group work activities<br>Group projects are given to students for the investigation in relation to the CILOs. Students will discuss the projects during the tutorial period. The group assessment is based on the group presentation and the peer assessment.  | 1, 2, 3, 4 | 1 hour/week    |
| 3 | (Self Study) | Individual work activities<br>Students are required to carry out self study on webs and search appropriate information/ data in conjunction with the lecturing materials to accomplish a set of given requirements. The work of the self study will be presented as an individual report for assessment. | 1, 2, 3, 4 | (20 hrs total) |

**Assessment Tasks / Activities (ATs)**

| ATs | CILO No.                             | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |  |
|-----|--------------------------------------|---------------|--|--|
| 1   | Group presentation & peer assessment | 1, 2, 3, 4    | 25                                     | 20% of the marks is based on the presentation, and 5% is based on the peer assessment.   |
| 2   | Individual report                    | 1, 2, 3, 4    | 25                                     | 20% of the marks is based on the accomplishment of satisfying the given requirements, and 5% is based on the self study of webs. |

**Continuous Assessment (%)**

50

**Examination (%)**

50

**Examination Duration (Hours)**

2

**Additional Information for ATs**

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

**Assessment Rubrics (AR)****Assessment Task**

Group presentation & peer assessment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Identify the needs for developing appropriate human-machine interfaces, and select one case towards developing a feasible solution through group effort.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

Individual report (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Critical literature search related to contemporary issues, strategies, design and technological developments in the area of human-machine interfaces.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Ability to describe the concepts involved for identifying the needs for developing human-machine interfaces and the strategies and standards that could be adopted while designing them.

Application of relevant scientific techniques for interface designs suitable for various devices.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

Group presentation & peer assessment (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Identify the needs for developing appropriate human-machine interfaces, and select one case towards developing a feasible solution through group effort.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B) Significant

**Marginal**

(B-, C+, C) Basic

**Failure**

(F) Not even reaching marginal levels

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**Part III Other Information****Keyword Syllabus**

- Introduction to human machine interface; Programmable logic controller; Networked control systems
- User friendly user interface; Hypermedia domains; User model; Knowledge management; Frameworks
- Evaluating Interface Designs; Managing Design Processes; Command and Natural Languages; Interaction Devices; Information Visualization; Societal and Individual Impact of User Interfaces

**Reading List****Compulsory Readings**

| Title |   |
|-------|---|
| 1     | Tyson Macaulay, Bryan L. Singer “Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS” . CRC Press, 2012.                                |
| 2     | Dix, Alan, et. al. “Human-Computer interaction” . Pearson Education 2003  |
| 3     | Shneiderman, Ben; and Plaisant, Catherine “Designing the User Interface: Strategies for Effective Human-Computer Interaction” . Fourth ed. Addison Wesley 2004. |

**Additional Readings**

| Title |   |
|-------|---|
| 1     | Newman, W M & Lamming, M G “Interactive System Design” . Addison-Wesley 1995. |
| 2     | Pearrow, Mark “Web site usability handbook” . Charles River Media 2000.       |