# Government Polytechnic, Pune

**'180OB' – Scheme**

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|---|---|
| Programme | **Diploma in Computer Engineering** |
| Programme code | 01/02/03/04/05/**06**/07/08/15/16/17/18/19/21/22/23/24/**26** |
| Name of Course | **Principles of Digital Techniques and Microprocessor Programming** |
| Course Code | **CM3105** |
| Prerequisite course code and name | **NA** |
| Class Declaration | **No** |

## 1. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme (In Hours) | | | Total Credits (L+T+P) | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory | | Practical | | Total Marks |
| L | T | P | C | | ESE | PA | *ESE | PA | |
| 04 | 00 | 02 | 06 | **Marks** | 80 | 20 | 25 | 25 | 150 |
| | | | | **Exam Duration** | 3 Hrs | 1 Hr | | | |

***Legends: L- Lecture, P- Practical, T- Tutorial, C- Credit, ESE-End Semester Examination, PA- Progressive Assessment (Test I, II/Term Work), *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;***

## 2. RATIONALE

As computer engineering student, it is essential to know fundamentals of digital electronics to understand the concept of microprocessor and its application. Microprocessor is challenging, to meet challenges of growing advanced microprocessor technology. The student should be conversant with microprocessor programming.

## 3. COMPETENCY

The aim of the course is to attend following industry identified competency through various teaching learning experiences:

- **Simplify logic circuit using Boolean algebra.**
- **Develop assembly language code**

## 4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

1. Perform arithmetic operations with various number systems.
2. Differentiate various logic gates and apply the logic using Boolean algebra.
3. Test combinational logic circuits of Multiplexer and De-Multiplexer.
4. Construct K-MAP using logic functions and vice versa.
5. Describe Microprocessor architecture.
6. Write, debug and execute 8086 programs

## 5. SUGGESTED PRACTICALS/ EXERCISES

| Sr. No. | Unit No | Practical Exercises (Outcomes in Psychomotor Domain) | Relevant CO | Approx. Hrs. Required |
|---|---|---|---|---|
| 1. | 1 | Know the Digital Lab:<br>1.IC Tester<br>2.Multimeter<br>3.Bread Board<br>4.Trainer Kit | -- | 02 |
| 2. | 1 | Study of Basic Gates ICs (7400, 7404, 7408, 7486, 7432) and verification of Truth tables by monitoring the output of ICs on Bread Board. | 2 | 02 |
| 3. | 1 | To derive AND, OR, NOT gates using universal gates by forming circuits on Bread Board. | 2 | 02 |
| 4. | 1 | Verify De-Morgan's Theorem by forming the circuit on Bread Board. | 2 | 04 |
| 5. | 2 | Minimization and realization of function using K-maps and its implementation by constructing the circuit on bread board. | 4 | 02 |
| 6. | 2 | Verify of Multiplexer & De-multiplexer. | 3 | 02 |
| 7. | 4 | Introduction to Assembler, its interface, and steps to write, debug and execute assembly language programs using IDE | 6 | 02 |
| 8. | 5,6 | Arithmetic operations on 16-bit numbers (Addition, Subtraction, Multiplication, Division) | 6 | 04 |
| 9. | | Sum of given series of numbers (8-bit / 16-bit) | 6 | 02 |
| 10. | | Find the smallest and greatest number from the given series. | 6 | 02 |
| 11. | | Arrange the given numbers in ascending and descending order. | 6 | 02 |
| 12. | | String related programs (any 5) | 6 | 02 |
| 13. | | Programs using Procedure, Macros – 2 of each | 6 | 02 |
| 14. | All | Micro-project<br>(Refer point 11 for micro project list) | All | 02 |
| **Total Hours** | | | | **32** |

| Sr.No. | Performance Indicators | Weightage in % |
|---|---|---|
| a. | Correctness of algorithm | 40 |
| b. | Debugging ability | 20 |
| c. | Quality of input and output (messaging and formatting) | 10 |
| d. | Preparing assignments (write-ups, program and output). | 20 |
| e. | Assignment submission (on-time) | 10 |
| **Total** | | **100** |

## 6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practical, as well as aid to procure equipment by authorities concerned.

| Sr.no. | Major Equipment/ Instruments required | Experiment Sr. No. |
|---|---|---|
| 1. | Computer system with any assembler and debugger | All |

## 7. THEORY COMPONENTS:

| Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|
| **Units I - Number System, Codes & Logic Gates and Boolean Algebra** (Weightage - 15, Hours - 12) | |
| 1a. Convert codes from one number system to another.<br>1b. Perform arithmetic operations with different number systems.<br>1c. Differentiate various logic gates and apply the logic on Boolean algebra.<br>1d. Explain theorems for Boolean algebra.<br>1e. Create simplified logic circuits. | 1.1 Introduction to Number systems: Decimal, Binary, Octal, Hexadecimal<br>1.2 Binary arithmetic: Addition, subtraction, multiplication, Division<br>1.3 One's complement, Two's Complement, Signed Numbers, Codes, Error code.<br>1.4 Logic Gates: Introduction, Working principals and Truth of AND, OR, NOT, NOR, NAND, EX-OR, EX-NOR Gates, Universal Gates<br>1.5 Boolean Algebra: Basic Boolean Operations, Basic Laws of Boolean Algebra, Duality Theorem, De-Morgan's Theorems |
| **Unit II - Standard representation for logic function & Sequential Logic Design** (Weightage-12, Hours - 10) | |
| 2a. Construct K-MAP using logic functions and vice versa.<br>2b. Simplify equations in the minterms/maxterms. | 2.1 KARNAUGH map representation, Simplification of logic function using K-MAP<br>2.2 Minimization of logical function specified in minterms/maxterms or truth table<br>2.3 Don't care conditions |
| **Unit III: Combinational logic design using MSI circuit** (Weightage-13, Hours - 10) | |
| 3a. Design Multiplexer and De-Multiplexer.<br>3b. Implement combinational logic design with multiplexers.<br>3c. Implement combinational logic design with demultiplexers. | 3.1 Multiplexer and their use in combinational, logic design<br>3.2 De-multiplexer/decoders and their use in combinational logic design<br>3.3 De-multiplexer: 4 to 16-line DEMUX. Demux design using sop method. 1:4, 1:8, 1:16 DEMUX. |

| Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|
| **Unit IV: Microprocessor, Microprocessor Architecture & Microcomputer Systems** (Weightage-14, Hours - 12) | |
| 4a. Describe Microprocessor architecture.<br>4b. Understand 8086 registers and instruction format.<br>4c. Draw timing diagram for read/write memory cycle. | 4.1 Microprocessor – Introduction, Features, and its operations<br>4.2 Memory & I/O Devices<br>4.3 8086 Microprocessor - Introduction, Architecture, and Working, Pin configuration<br>4.4 Memory segmentation in 8086<br>4.5 Minimum mode and Maximum mode configuration of 8086<br>4.6 Instruction timing |
| **Unit V: 8086 Assembly Language Programming** (Weightage-15, Hours - 10) | |
| 5a. Write and execute 8086 programs for addition, subtraction.<br>5b. Write programs implementing branching. | 5.1 Instruction format and Addressing modes in 8086<br>5.2 8086 Instructions set and classification of instructions - Arithmetic, Logical, Data transfer, String, Bit manipulation, Flag manipulation, Branching, Machine Control |
| **Unit VI: Procedure and Macro in Assembly Language Program, and Interrupts** (Weightage-11, Hours - 10) | |
| 6a. Write and execute assembly language program using procedures<br>6b. Write and execute assembly language program using macros | 6.1 Procedures - Defining Procedure, Directives used, FAR and NEAR, CALL and RET instructions, Reentrant and Recursive procedures, Assembly Language Programs using Procedure.<br>6.2 Macros - Defining Macros, Assembly Language Programs using Macros, Directives used.<br>6.3 8086 interrupts – Introduction, Interrupt Service Routines (ISR) |

## 8. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Number System, Codes & Logic Gates and Boolean Algebra | 12 | 05 | 04 | 06 | 15 |
| II | Standard representation for logic function & Sequential Logic Design | 10 | 03 | 03 | 06 | 12 |
| III | Combinational logic design using MSI circuit | 10 | 03 | 03 | 07 | 13 |
| IV | Microprocessor, Microprocessor Architecture & Microcomputer Systems | 12 | 04 | 04 | 06 | 14 |
| V | 8086 Assembly Language Programming | 10 | 03 | 04 | 08 | 15 |
| VI | Procedure and Macro in Assembly Language Program, and Interrupts | 10 | 03 | 04 | 04 | 11 |
| **Total** | | **64** | **21** | **22** | **37** | **80** |

## 9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal based on practical performed in laboratory.
b. Follow Coding Standards.

## 10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations.
c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
d. Use different Audio-Visual media for Concept understanding.
e. Guide student(s) in undertaking micro-projects.
f. Demonstrate students thoroughly before they start doing the practice.
g. Observe continuously and monitor the performance of students in Lab.

## 11. SUGGESTED MICRO-PROJECTS

***Only one micro-project*** is planned to be undertaken by a student that needs to be assigned to him/her. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.*** The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. (Affective Domain Outcomes). Each student will have to maintain activity chart consisting of individual contribution in the project work and give a seminar presentation of it before submission. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Design and implement adder circuit using universal gate
b. Design and implement 4 – bit counter
c. Develop assembly language application to perform number system conversions (such as BCD – to – Binary, Binary to hexadecimal etc.)
d. Develop menu- based assembly language application to perform all string related functions – String reverse, length of given string, concatenation of two strings, Copying string etc.)
e. Develop menu- based assembly language application to perform validation for given user id and password and then proceeding to next given activity.

## 12. SUGGESTED LEARNING RESOURCES

| S. No. | Title | Author | Publisher, Edition, and Year of publication, ISBN Number |
|---|---|---|---|
| 1 | Modern Digital Electronics | R P Jain | McGraw Hill Education; 4th edition (27 July 2009), ISBN-10:0070669112, ISBN-13:978-0070669116 |
| 2 | Microprocessors and Interfacing: Programming and Hardware, Intel Version | Douglas Hall | McGraw-Hill Education; 2nd edition (30 December - 1991), ISBN-10: 0070257426, ISBN-13: 978-0070257429 |

## 13. SOFTWARE/LEARNING WEBSITES

1. http://www.nptel.ac.in
2.https://www.tutorialspoint.com/
3. http://www.logic.ly

## 14. PO - COMPETENCY- CO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | - | 1 | 3 | 2 | - | 1 | - |
| **CO2** | - | 2 | 1 | 2 | - | - | 1 |
| **CO3** | 1 | 2 | 3 | 3 | - | 1 | 1 |
| **CO4** | - | 1 | 2 | 3 | - | 1 | 1 |
| **CO5** | - | 3 | 3 | 3 | 1 | 1 | 2 |
| **CO6** | - | 3 | 3 | 3 | - | - | 1 |

| | PSO1 | PSO2 |
|---|---|---|
| **CO1** | 3 | - |
| **CO2** | 3 | - |
| **CO3** | 3 | - |
| **CO4** | 3 | - |
| **CO5** | 3 | - |
| **CO6** | 1 | 3 |

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| Sign:<br><br>Name:<br>1. Smt. M.G. Yawalkar<br>2. Smt. A. S. Paike<br>(Course Expert /s) | Sign:<br><br>Name: Mr. U.V. Kokate<br>Dr. S.B. Nikam<br>(Head of Department)<br>(Department of Computer Engineering) |
| Sign:<br><br>Name:<br>Mr. U.V. Kokate<br>Dr. S.B. Nikam<br>(Programme Head)<br>(Department of Computer Engineering) | Sign:<br><br>Name:<br>Shri A.S. Zanpure<br>(CDC In-charge) |