

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF COMPUTER SCIENCE
COURSE CURRICULUM

| PART- A: Introduction | | | |
|--|---------------------------------------|---|---|
| Program: Bachelor in Science (CS) <i>(Certificate / Diploma / Degree/Honors)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | CSSC-08T | |
| 2 | Course Title | Fundamentals of IoT and Applications | |
| 3 | Course Type | DSC (Discipline Specific Course) | |
| 4 | Prerequisite | <i>As per program</i> | |
| 5 | Course Learning Outcomes (CLO) | At the end of this course, the students will be able to: <ul style="list-style-type: none"> Understand IoT value chain structure (device, data cloud), application areas and technologies involved. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi and Arduino. | |
| 6 | Credit Value | 3 Credits | Credit = 15 Hours - Learning & Observation |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

PART -B: Content of the Course

Total No. of Teaching–Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

| Unit | Topics (Course contents) | No. of Period |
|------------|---|---------------|
| I | Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry. | 13 |
| II | IoT Physical Devices - Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C). Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors. | 11 |
| III | Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor. | 10 |
| IV | Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection. | 11 |

Keywords: Internet of Things, IOT Sensors, IOT Actuators, Arduino, Raspberry Pi.

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
Chairman

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(Swasthacharya)

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF COMPUTER SCIENCE
COURSE CURRICULUM

| PART- A: Introduction | | | |
|--|--|--|--|
| Program: Bachelor in Science (CS) (Certificate / Diploma / Degree) | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | CSSC-08P | |
| 2 | Course Title | Lab 8: Fundamental of IoT and Applications | |
| 3 | Course Type | DSC | |
| 4 | Prerequisite | As per program | |
| 5 | Course Learning Outcomes (CLO) | At the end of this course, the students will be able to: <ul style="list-style-type: none"> • Handle various real world project. • Understand work of IoT. • Handle various IoT sensors. • Understand application of IoT in real world scenario. • Configure Arduino and Raspberry Pi for various real world project. | |
| 6 | Credit Value | 1 Credits | Credit =30 Hours Laboratory or Field Learning/Training |
| 7 | Total Marks | Max. Marks: 50 | Min Passing Marks: 20 |
| PART -B: Content of the Course | | | |
| Total No. of learning-Training/performance Periods: 30 Periods (30 Hours) | | | |
| Module | Topics (Course contents) | | No. of Period |
| List of Practical Experiment | <ol style="list-style-type: none"> 1. Data acquisition using Multimeter and oscillographic recorder 2. Connect an LED to GPIO pin 25 and control it through the command line. 3. Connect an LED to GPIO pin 24 and a Switch to GPIO 25 and control the LED with the switch. 4. The state of LED should toggle with every press of the switch Use DHT11 temperature sensor and print the temperature and humidity of the room with an interval of 15 seconds 5. Use joystick and display the direction on the screen 6. Use Light Dependent Resistor (LDR) and control an LED that should switch-on/off depending on the light. 7. Create a traffic light signal with three colored lights (Red, Orange and Green) with a duty cycle of 5-2-10 seconds. 8. Switch on and switch of a DC motor based on the position of a switch. 9. Convert an analog voltage to digital value and show it on the screen. 10. Create a door lock application using a reed switch and magnet and give a beep when the door is opened. 11. Control a 230V device (Bulb) with Raspberry Pi using a relay. 12. Control a 230V device using a threshold temperature, using a temperature sensor. 13. Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor). 14. Create a web application for the above applications wherever possible with suitable modifications to get input and to send output. <p>Note: Concerned teacher can add additional experiment as per requirement.</p> | | 30 |
| Keywords | Internet of Things, IOT Sensors, IOT Actuators, Arduino, Raspberry Pi. | | |
| Name and Signature of Convener & Members of CBoS: | | | |
| <div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p><i>Dr. H.S. Mahalingam</i> Chairman</p> <p><i>Sudhakar</i></p> </div> <div style="text-align: center;"> <p><i>K. S. Kumar</i></p> <p><i>(Secretary)</i></p> </div> <div style="text-align: center;"> <p><i>Y. S. Kumar</i></p> </div> <div style="text-align: center;"> <p><i>Prabhu</i></p> </div> <div style="text-align: center;"> <p><i>Shankar</i></p> </div> <div style="text-align: center;"> <p><i>Arjun</i></p> </div> <div style="text-align: center;"> <p><i>Arjun</i></p> </div> <div style="text-align: center;"> <p><i>Arjun</i></p> </div> </div> | | | |

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
- Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
- Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

Reference Books Recommended:

- Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
- Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
- N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

Online Resources:

- Swayam/NPTEL: https://www.youtube.com/channel/UC6ZY_csXZc7YZZm2W8HcQ6A
- Javatpoint: <https://www.javatpoint.com/iot-internet-of-things>
- Tutorialspoint: https://www.tutorialspoint.com/internet_of_things/index.htm
- Topics Related to IOT from data-flair: <https://data-flair.training/blogs/iot-tutorial/>
- Topics Related to IOT from edureka: <https://www.edureka.co/blog/iot-tutorial/>
- Lab manuals:
 - https://www.lnmiit.ac.in/Department/ECE/uploaded_files/Internet_of_Things_Lab_manual.pdf
 - https://www.iare.ac.in/sites/default/files/lab1/IARE_IOT%20LAB%20MANUAL.pdf
 - https://www.amirajcollege.in/wp-content/uploads/2020/06/2180709-iot_manual.pdf
 - <https://peer.asee.org/internet-of-things-iot-laboratory.pdf>
 - <https://www.teachmint.com/tfile/studymaterial/class-7th/internetofthingsiot/iotlabmanualpdf/d85015cf-722b-4b50-86e4-0f456f91bfa0>
 - <https://www.slideshare.net/RadheyShyam18/iot-lab-manual-new>
 - <https://www.psgkwc.ac.in/wp-content/uploads/2021/08/IoT-Applications-Lab-Manual-IT.pdf>
 - <https://www.coursehero.com/file/37028140/IoT-Lab-Manualpdf/>
 - <https://www.scribd.com/document/408744059/IoT-Lab-Manual>
 - https://mrcet.com/CSE_downloads.html
 - <http://iotmumbai.bharativedyapeeth.edu/index.php/lab-manuals#computer-technology>

PART -D: Assessment and Evaluation




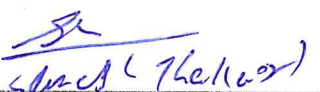
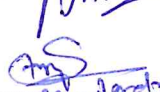




















































Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

| | | |
|--|---|--|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): 10 & 10 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks |
| | Assignment/Seminar +Attendance - 05 Total Marks - 15 | |
| End Semester Exam (ESE): | Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) – 10 Marks | Managed by Course |

| | | |
|---|---|---|
| | C. Viva-voce (based on principle/technology) - 05 Marks | teacher as per lab. status |
| Name and Signature of Convener & Members of CBoS: | | |
| Dr. Mrs. Batya chairman |  |  |
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Dr. Mrs. Batya
 Dr. Mrs. Batya
 Dr. Mrs. Batya

ANJETA KUMAR

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF COMPUTER SCIENCE
COURSE CURRICULUM

PART- A: Introduction

| | | | |
|--|---------------------------------------|---|---|
| Program: Bachelor in Science (CS) <i>(Certificate / Diploma / Degree/Honors)</i> | | Semester – VIII | Session: 2024-2025 |
| 1 | Course Code | CSSE-09 | |
| 2 | Course Title | Soft Computing | |
| 3 | Course Type | DSE (Discipline Specific Elective) | |
| 4 | Prerequisite | <i>As per program</i> | |
| 5 | Course Learning Outcomes (CLO) | <p>At the end of this course, the students will be able to:</p> <ul style="list-style-type: none"> Analyze and appreciate the applications which can use fuzzy logic. Understand the difference between learning and programming and explore practical applications of Neural Networks (NN). Understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications Understand the importance of optimizations and its use in computer engineering fields and other domains. Introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience. | |
| 6 | Credit Value | 4 Credits | <i>Credit = 15 Hours - Learning & Observation</i> |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

PART -B: Content of the Course

Total No. of Teaching–Learning Periods (01 Hr. per period) – 60 Periods (60 Hours)

| Unit | Topics (Course contents) | No. of Period |
|------------|---|---------------|
| I | Introduction: Soft computing, Different tools of soft computing: Fuzzy logic, Artificial Neural Network, Genetic Algorithm), Area of application. Fuzzy Logic: Introduction to Classical Sets and Fuzzy Sets, Membership Function, properties and operations of classical set and Fuzzy set, a-cuts, Properties of a-cuts, Linguistic Variables, Membership function, Classical relation and Fuzzy Relation and its properties and operations, Defuzzification and its methods, Fuzzy rule base. | 15 |
| II | Artificial Neural Network(ANN): Architecture, Introduction, Evolution of Neural Network, Biological Neural Network Vs ANN, Basic Model of ANN, Different types of ANN, Single layer Perceptron, Solving XOR problem, Activation function, Linear separability, Supervised and unsupervised learning, perceptron learning, delta learning, Feed-forward and Feedback networks, Error Back Propagation Network (EBPN), Associative memories and its types, Hopfield Network, Kohonen self-organizing Map. | 15 |
| III | Genetic Algorithm: What is Optimization?, Introduction, Application, GA operators: selection, crossover and mutation, different techniques of selection, crossover and mutation, different types of chromosomes, Application of GA. | 15 |
| IV | Hybrid soft computing: Design of Neuro-Fuzzy model like ANFIS, Neuro-Genetic, Fuzzy-Genetic Neuro-Fuzzy-Genetic model. | 15 |

Keywords *Soft Computing, Fuzzy Logic, ANN, Genetic Algorithm.*

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
Chairman

Dr. Anil Kumar
Member

Dr. Shilpa
Member

Dr. Anand
Member

Dr. Anand
Member

Dr. Anand
Member

Dr. Anand
Member

Dr. Anand
Member

Dr. Anand
Member

Anjeeta Kujur
Member

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Principles of soft computing, S.N. Shivanandan and S.N. Deepa , Wiley publication, Wiley India Edition.
- Neural network and Learning Machines, Simon Haykin, Pearson Education, 2011.
- Artificial Neural Networks, Robert J. Scholkoff, McGraw Hill Education (India) Pvt. Limited, 1997.
- Fuzzy Sets, Uncertainty and Information, G. J. Klir and T.A. Folger, PHI learning private limited. Publisher- Pearson 3Edition 1999

Reference Books Recommended:

- Neural Networks and Fuzzy Systems, A dynamical Systems Approach to Machine Learning, Bart Kosko, PHI learning private limited.
- Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rakasekaran, G.A. VijayalakshmiPai, PHI learning private limited, 14th Edition. 2003.
- Neural Networks and Fuzzy Logic, K. Vinoth Kumar, R. Saravana Kumar, S. K. Kataraiia and Sons publication.
- Artificial Neural Networks, B.Yegnanarayana Prentice Halll of India (P) Limited.
- Introduction to Artificial Neural Systems, Jacek M. Zurada, Jaico Publication House.

Online Resources:

- Introduction to Soft computing: [What is soft computing - Javatpoint](#)
- Need for Soft Computing: [Need for Soft Computing - GeeksforGeeks](#)
- Introduction To Soft Computing: [Introduction To Soft Computing - Course \(nptel.ac.in\)](#)

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

| | | |
|--|---|---|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): 20 & 20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - 10 Total Marks - 30 | |

| | |
|--------------------------|--|
| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks |
|--------------------------|--|

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
chairman

[Signature]
Sanku

[Signature]
(Sanku Thakur)

[Signature]
Sudhendu Das

[Signature]
Dr. Anil Kumar

[Signature]
Anil Kumar

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ANJEEA KUMAR

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF COMPUTER SCIENCE
COURSE CURRICULUM

PART- A: Introduction

| | | | |
|--|--------------------------------|---|--|
| Program: Bachelor in Science (CS) (Certificate / Diploma / Degree/Honors) | | Semester – VIII | Session: 2024-2025 |
| 1 | Course Code | CSSE-10 | |
| 2 | Course Title | Advanced Operating Systems | |
| 3 | Course Type | DSE (Discipline Specific Elective) | |
| 4 | Prerequisite | As per program | |
| 5 | Course Learning Outcomes (CLO) | <p>At the end of this course, the students will be able to:</p> <ul style="list-style-type: none"> Gain knowledge about advanced concepts of OS. Understand the concept of distributed systems. Understand process synchronisation and concurrency control. Understand the architecture and functioning of mobile operating system. Develop modules for mobile devices. Understand the architecture of various advanced operating system. | |
| 6 | Credit Value | 4 Credits | Credit = 15 Hours - Learning & Observation |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

PART -B: Content of the Course

Total No. of Teaching–Learning Periods (01 Hr. per period) – 60 Periods (60 Hours)

| Unit | Topics (Course contents) | No. of Period |
|------|--|---------------|
| I | Multiprocessor Operating Systems: System Architectures, Structures of OS, OS design issues, Process synchronization, Process Scheduling and Allocation, memory management. | 15 |
| II | Distributed Operating Systems: System Architectures, Design issues, Communication models, clock synchronization, mutual exclusion, election algorithms, Distributed Deadlock detection, Distributed scheduling, Distributed shared memory, Distributed File system, Multimedia file systems, File placement, Caching. | 15 |
| III | Database Operating Systems: Requirements of Database OS, Transaction process model, Synchronization primitives, Concurrency control algorithms. | 15 |
| IV | Mobile Operating Systems: ARM and Intel architectures, Power Management, Mobile OS Architectures, Underlying OS, Kernel structure and native level programming, Runtime issues, Approaches to power management. | 15 |

Keywords Multiprocessor operating system, Distributed operating system, Database operating System, Mobile Operating system.

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
Chairman

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[Signature]
(Convener Member)

[Signature]
Shailendra
Arya

[Signature]
Law
Sachin
Kumar

[Signature]
ANJETA KUMAR

[Signature]

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Mukesh Singhal, Niranjan Shivaratri, "Advanced Concepts in Operating Systems", TMH, 2001
- William Stallings, "Operating Systems – Operating System: Internals and Design Principles", Prentice Hall, 2005.

Reference Books Recommended:

- Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education, 1995.
- Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", John Wiley & Sons Inc., 2006.

Online Resources:

- Advanced Concepts in Operating Systems:
https://books.google.co.in/books/about/Advanced_Concepts_in_Operating_Systems.html?id=ajx9NAEACAAJ&redir_esc=y
- Distributed Operating System:
<https://www.javatpoint.com/distributed-operating-system>
- Mobile Operating System
<https://www.sciencedirect.com/topics/computer-science/mobile-operating-system>
https://baou.edu.in/assets/pdf/PGDMAD_101_slm.pdf
- Database operating System:
[https://www.redswitches.com/blog/database-operating-system/#:~:text=A%20Database%20Operating%20System%20\(DBOS,storage%2C%20retrieval%2C%20and%20manipulation.](https://www.redswitches.com/blog/database-operating-system/#:~:text=A%20Database%20Operating%20System%20(DBOS,storage%2C%20retrieval%2C%20and%20manipulation.)
<https://www.ibm.com/docs/en/psfa/7.2.1?topic=logs-database-operating-system>
<https://eecs.berkeley.edu/230426-2/>

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

| | | | |
|--|---------------------------|--------|---|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 20 +20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - | 10 | |
| | Total Marks - | 30 | |

| | |
|--------------------------|--|
| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks |
|--------------------------|--|

Name and Signature of Convener & Members of CBoS:

Dr. H. S. Hota
Chairman

[Signature]

[Signature]
[Signature]
Suresh Thakur

[Signature]
[Signature]
Sheela Devi
Anjita

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ANJETA KUMAR

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Distributed Computing by Dollymore Cloud Computing (Wind) by Dr. Kumar Saurabh, 2nd Edition, Wiley India.

Reference Books Recommended:

- Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
- Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012.
- Handbook of Cloud Computing by Anand Nayyar, Publisher: BPB Publication.

Online Resources:

- Introduction to Cloud Computing from W3shool: <https://www.w3schools.in/cloud-computing/tutorials/>
- Introduction to Cloud Computing from Coursera: <https://www.coursera.org/learn/introduction-to-cloud>
- Cloud Computing Basics: <https://www.coursera.org/learn/cloud-computing-basics>
- Cloud Computing Concepts: <https://www.coursera.org/learn/cloud-computing>
- Cloud Computing Specialization from Coursera: <https://www.coursera.org/specializations/cloud-computing>
- Cloud Computing from SWAYAM/NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs20/preview
<https://www.youtube.com/channel/UCK73enkjFQNDwdBqMyaMtRg>
- Cloud Computing Basics: https://terrorgum.com/tfox/books/cloudcomputingbasics_asefiteachingintroduction.pdf
- CLOUD COMPUTING Principles and Paradigms : https://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/CLOUD%20COMPUTING%20Principles%20and%20Paradigms.pdf
- Cloud Computing Tutorial For Beginners: https://www.youtube.com/watch?v=fLV_t2qKYyU
- Introduction to Cloud Computing: <https://www.youtube.com/watch?v=Dv0sjAYnVCY>
- Cloud Computing Tutorials: <https://www.youtube.com/watch?v=NyA9PB6j8bg>

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

| | | | |
|--|---------------------------|--------|---|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 20 +20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - | 10 | |
| | Total Marks - | 30 | |

| | |
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| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks |
|--------------------------|--|

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Moha
Chairman

Jubil

Krishna
(Suresh Kumar)

Shalendra
Arora

Dr. Al

Dr. Anil
Dr. Anil
Dr. Anil

Anjeeta
ANJEETA KUMAR

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF COMPUTER SCIENCE
COURSE CURRICULUM

| PART- A: Introduction | | | |
|--|--|---|---|
| Program: Bachelor in Science (CS) <i>(Certificate / Diploma / Degree/Honors)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | CSSE-12 | |
| 2 | Course Title | Major Project | |
| 3 | Course Type | DSE (Discipline Specific Elective) | |
| 4 | Prerequisite | As per program | |
| 5 | Course Learning Outcomes (CLO) | At the end of this course, the students will be able to: <ul style="list-style-type: none"> • Enhance knowledge on latest techniques. • Make ready for IT industry. • Upgrade skill set as per IT industry. • Handle real word applications. • Debug Problem to make DFD of proposed system. | |
| 6 | Credit Value | 4 Credits | <i>Credit = 15 Hours - Learning & Observation</i> |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |
| PART -B: Content of the Course | | | |
| Total No. of Teaching–Learning hours - 60 Hours | | | |
| | Important Guidelines for Project | | No. of Period |
| | <p>A project report has to be submitted as per the rules described below:</p> <ol style="list-style-type: none"> 1. Number of Copies: The student should submit One hard bound copy of the Project Report with one CD/DVD. 2. No of students: Every student has to submit separate project. 3. Acceptance / Rejection of Project Report: The student must submit a project report to the Head of Department/Project Guide for approval. The Head of Department/Project Guide holds the right to accept the project or suggest modifications for resubmission. 4. Format of the Project Report :The student must adhere strictly to the following format for the submission of the Project Report <ol style="list-style-type: none"> I. Paper: The report shall be typed on white paper, A4 size or continuous computer stationary bond, for the final submission. The report to be submitted to the University must be original and subsequent copies may be photocopied on any paper. II. Typing: The typing shall be of standard letter size, double-spaced and on one side of the paper only, using black ribbons and black carbons. III. Margins: The typing must be done in the following margins Left ----- 35mm, Right ----- 20mm Top ----- 35mm, Bottom ----- 20mm IV. Binding: The Report shall be Rexene bound in black. Plastic, spiral bound Project Reports not be accepted. V. Front Cover: The front cover should contain the following details: TOP: The title in block capitals of 6mm to 15mm letters. CENTER: Full name in block capitals of 6mm to 10mm letters. BOTTOM: Name of the University, year of submission- all in block capitals of 6mm to 10mm letters on separate lines with proper spacing and centring. | | 60 |

- VI. Blank Sheets:** At the beginning and end of the report, two white black bound papers should be provided, one for the purpose of binding and other to be left blank.
5. **Abstract:** Every report should have an abstract following the Institute's Certificate. The abstract shall guide the reader by highlighting the important material contained in the individual chapters, section, subsection etc.
 6. **Certificates etc:** The report should contain the following:
 - I. Institute Certificate: Successful completion of project by competent authority.
 - II. Acknowledgment
 - III. List of Figures
 - IV. Tables
 - V. Nomenclature and Abbreviations
 7. **Contents of the Project Report:** The project report must contain following in form of chapter, however student may include any other relevant chapter(s):
 - I. **Introduction to the project:** This chapter shall highlight the purpose of project work, it will also define the chapters to be followed in the Project Report.
 - II. **Scope of work:** Brief scope of the project work done
 - III. **Existing System and Need for proposed System:** If there is some system already in use, then give brief detail of it in order to help to understand the enhancements carried out by the student in the existing system.
 - IV. **Operating Environment:** Hardware and Software required and used.
 - V. **Proposed System:** Which may contain following:
 - a. **Objectives to be fulfilled:** clearly define the objective(s) of the system.
 - b. **User Requirements:** State the requirements of the use in an unambiguous manner.
 - c. **Requirements Determination Techniques and Systems Analysis Methods Employed:** Use the formal methods to describe the requirements of the use like Fact Finding Methods, Decision Analysis, and Data Flow Analysis etc.
 - d. **Prototyping:** If the prototypes has been developed prior to the detailed design, then give details of the prototype.
 - e. **System Feature:** Which includes as follows:
 - Module specifications
 - D.F.D. and ER
 - System flow charts
 - Data Dictionary
 - Structure charts
 - Database /File layouts
 - Design of Input Design of Output screens and reports
 - User Interfaces
 - Design of Control Procedures
 8. **Testing procedures and Implementation phase**
 9. **Problems encountered, Drawbacks and Limitations**
 10. **Proposed Enhancements/ Future enhancement**
 11. **Conclusions**
 12. **Bibliography**
 13. **Annexure**

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
Chairman
Sindhi

(Suresh Hota)

Shri Anand Arora

Dr. Anand Arora

Dr. Anand Arora

ANJEETA KUMAR

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Database system concept, H. Korth and A. Silberschatz, TMH Publications.
- Data Base Management System, Alexies & Mathews, Vikash publication.
- Roger S. Pressman, Software Engineering, A practitioner's Approach, 6th edition, McGraw Hill International Edition.

Reference Books Recommended:

- The Complete Reference, Kevin Loney, Oracle Press.
- SQL, PL/SQL the Programming Language of Oracle, Ivan Bayross, PustakKosh Publication.
- Microsoft SQL Server Management and Administration, Ross, STM Publications.
- James Rumbaugh, Ivar Jacobson, The unified modelling language user guide Grady Booch, Pearson Education.

Online Resources:

- SWAYAM URL link for DBMS and RDBMS: <https://youtu.be/f6LGtJutWyA>
- SWAYAM URL link for DBMS and RDBMS: <https://swayam.gov.in/courses/4434-data-base-management-system>
- Introduction of RDBMS from SWAYAM : https://onlinecourses.nptel.ac.in/noc19_cs46/preview
- Introduction to DMBS: <https://www.w3schools.in/dbms/intro>
- NPTEL YouTube Channel: Software Engineering Lectures by Prof Rajib Mall, IIT Kharagpur <https://youtube.com/playlist?list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt&si=tTBITZUdivHpNzIH>
- NPTEL YouTube Channel: Software Engineering Lecture Series https://youtube.com/playlist?list=PL8751DA481F0F0D17&si=071fYV7GP8_oelxZ

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

End Semester Exam (ESE): 100 Marks

Name and Signature of Convener & Members of CBoS:

Dr H.S. Bhatia
chairman

Juchit

SS
(Suresh Thakur)

Shailendra
Anj

Prakash Kumar

MP
Rande

ANJEETA KUMAR

Sum

FOUR YEAR UNDER GRADUATE PROGRAM(2024-25)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

| Part A: Introduction | | | |
|--|-------------------------------|--|--|
| Program: Bachelor in Science (Honors/Honors with Research) | | Semester - VIII | Session:2024-2025 |
| 1 | Course Code | MASC-08 | |
| 2 | Course Title | Advanced Abstract Algebra | |
| 3 | Course Type | Discipline Specific Course (DSC) | |
| 4 | Pre-requisite(if any) | Knowledge of Abstract Algebra | |
| 5 | Course Learning Outcome (CLO) | <p>At the end of the course, the students will be able to :</p> <ul style="list-style-type: none"> ➤ Demonstrate capacity for mathematical reasoning through analyzing, Proving and explaining concepts from advanced algebra. ➤ Understand the concept of Normal and subnormal series, solvable group, state and prove Jordan-Holder theorem. ➤ Understand the concepts of fields, extension of fields and splitting fields of polynomials ➤ . Create, select and apply appropriate algebraic structures such as Galois extensions, Automorphisms of groups and fixed fields, Fundamental theorem of Galois theory to understand and use the Fundamental theorem of Algebra, solvability of polynomials. ➤ Understand the concepts of modules, Noetherian and artinian modules. Prove Wedderburns theorem on finite division rings. | |
| 6 | Credit Value | 4 C | 1Credit = 15 hours- Learning and Observation |
| 7 | Total Marks | Maximum Marks : 100 | Minimum Passing Marks:40 |

| Part B: Content of the Course | | |
|--------------------------------------|---|--------------|
| Unit | Topics | No. of Hours |
| I | Counting Principle and Sylow's Theorem Group-Automorphism, inner automorphism, Automorphism groups and their computations. Conjugacy relation; Normalizer; Counting principle and the class equation of a finite group. Center for Group of prime order. Abelianizing of a group and its universal property ;Sylow's theorems. Sylow's subgroup; Structure theorem for finite Abelian groups. | 15 |
| II | Field Theory Extension fields; algebraic and transcendental extensions; Separable and inseparable extensions; Perfect fields; Finite fields; Algebraically closed fields. | 15 |
| III | Group Series and Galois Theory Normal and subnormal series; composition series; Jordan-Holder theorem. Automorphism of extensions; Galois extensions; Fundamental theorem of Galois Theory | 15 |

Dr. S. Dashgupta
(Dr. P. K. Sahu)

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|----|--|----|
| IV | Modules Modules. Submodules Quotient Modules. Homomorphism Isomorphism theorems. Cyclic modules; simple modules; Semi-simple modules; Schuler's lemma; free modules; Noetherian and Artinian modules and rings; Hilbert basis theorem; Wedderburn Artin theorem; Uniform modules; primary modules; Noether-Laskar theorem. | 15 |
|----|--|----|

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended:

1. P.B. Bhattacharya, S. K. Jain, S.R. Nagpaul : Basic Abstract Algebra, Cambridge University press
2. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd.
3. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.

References Books Recommended:

1. M. Artin, Algebra, Prentice -Hall of India, 1991.
2. P.M. Cohn, Algebra, Vols. I, II & III, John Wiley & Sons, 1982, 1989, 1991.
3. N. Jacobson, Basic Algebra, Vols. I, W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
4. S. Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups, Vol. II-Rings, Narosa Publishing House (Vol. I-1996, Vol. II-1999)
6. D.S. Malik, J.N. Mordeson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw-Hill, International Edition, 1997.
7. Quazi Zameeruddin and Surjeet Singh : Modern Algebra
8. I. Stewart, Galois theory, 2nd edition, Chapman and Hall, 1989.
9. J.P. Escofier, Galois theory, GTM Vol. 204, Springer, 2001..
10. Fraleigh, A first course in Algebra, Narosa, 1982.
11. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
12. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.
13. S. Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000.
14. T.Y. Lam, lectures on Modules and Rings, GTM Vol. 189, Springer Verlag, 1999.

E-resources: <https://onlinecourses.nptel.ac.in>
<https://epqp.inflibnet.aci.in>
<https://swayam.gov.in>
<https://www.mooc.org>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

| | |
|--|------------------|
| Maximum Marks: | 100 Marks |
| Continuous Internal Assessment (CIA): | 30 Marks |
| End Semester Examination (ESE): | 70 Marks |

S. Dasgupta
 Dr. S. Dasgupta

P.K. Sahu
 (Dr. P.K. Sahu)


Dr. S. Dasgupta

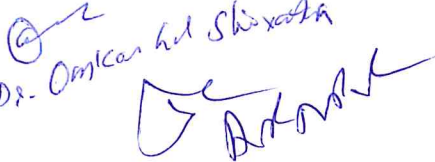
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Dr. S. Dasgupta *Dr. S. Dasgupta*


| | | |
|--|---|---|
| Continuous Internal Assessment (CIA) (Conducted by course teacher) | Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks | Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks |
| End Semester Examination (ESE) | Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks | |

Name and signature of convener & members of CBOS-



 Dr. S. Dasgupta


 Dr. Omkar Lal Shrivastava


 Dr. M. M. Maiti


 (Dr. P. K. Sahu)

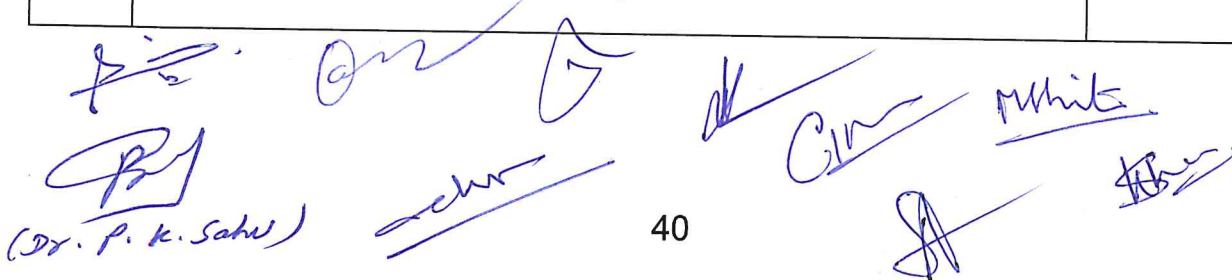




FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

| Part A: Introduction | | | |
|---|-------------------------------|--|--|
| Program: Bachelor in Science (Honors/Honors with Research) | | Semester - VIII | Session:2024-2025 |
| 1 | Course Code | MASE-09 | |
| 2 | Course Title | Measure Theory | |
| 3 | Course Type | Discipline Specific Elective (DSE) | |
| 4 | Pre-requisite(if any) | Knowledge of real analysis | |
| 5 | Course Learning Outcome (CLO) | This Course will enable the students to: <ul style="list-style-type: none"> ➤ Understand development of measure and integration theory and Borel, Lebesgue measurability, and compare integration theory of Lebesgue and Riemann with examples and counter examples. ➤ Understand the concept and properties of functions of bounded variation. . | |
| 6 | Credit Value | 4C | 1Credit = 15 hours- Learning and Observation |
| 7 | Total Marks | Maximum Marks : 100 | Minimum Passing Marks:40 |

| Part B: Content of the Course | | |
|--|---|----------------|
| Total no of teaching – learning period =60 Periods (60 Hours) | | |
| Unit | Topics | No. of Periods |
| I | Measurable Sets: Lebesgue outer measure, Lebesgue measure, Properties of measurable sets, Borel sets and their measurability characterization of measurable sets, Non measurable set. | 15 |
| II | Measurable Function: Definition and properties, Simple, Step and characteristics function, Continuous function, sets of measure Zero. Sequence of functions, Egoroff's theorem structure of measurable function, Lusin theorem, Frechet theorem, Convergence in measure, Riesz theorem. | 15 |
| III | Lebesgue Integral: Lebesgue integral of a bounded function, Comparison of Riemann integral and Lebesgue integral, Bounded Convergence Theorem, Integral of non negative measurable functions, Fatou's lemma, Monotone convergence theorem, General Lebesgue integral, Lebesgue dominated convergence theorem. | 15 |
| IV | Differentiation and Integration: Dini derivatives, Differentiation of monotone functions, Lebesgue theorem, Function of bounded variation, Differentiation of an integral, Lebesgue sets, Absolutely Continuous Functions, Integral of the derivatives | 15 |



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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
2. P.K. Jain and V.P. Gupta, Lebesgue Measure and , New Age International (P) Limited Published, New Delhi, 1986 Reprint 2000).
3. Inder K. Rana, An Introduction to Measure and Integration, Norosa Publishing House, Delhi, 1997

Reference Books Recommended :

1. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
2. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962
5. P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.
6. T.G. Hawkins, Lebesgue's Theory, of Integration: Its Origins and Development, Chelsea, New York, 1979.
7. K.R. Parthasarathy, Introduction to Probability and Measure, Macmillan Company of India Ltd., Delhi, 1977.
8. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc. New York, 1966.

E-Recourses:

- <https://onlinecourses.nptel.ac.in>
- <https://epqp.inflibnet.aci.in>
- <https://swayam.gov.in>
- <https://www.mooc.org>

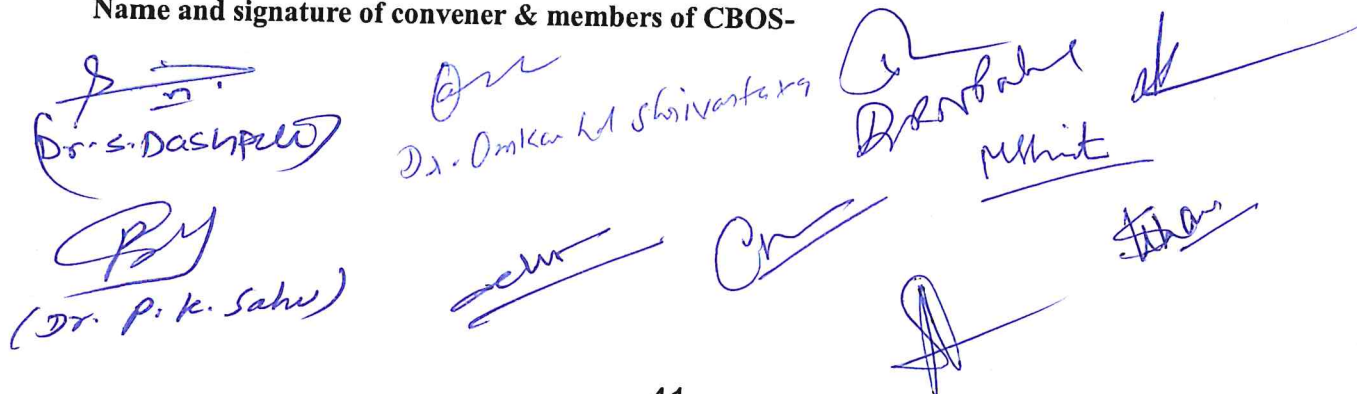
Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

| | |
|--|------------------|
| Maximum Marks: | 100 Marks |
| Continuous Internal Assessment (CIA): | 30 Marks |
| End Semester Examination (ESE): | 70 Marks |

| | | |
|--|---|---|
| Continuous Internal Assessment (CIA) (Conducted by course teacher) | Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks | Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks |
| End Semester Examination (ESE) | Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks | |

Name and signature of convener & members of CBOS-

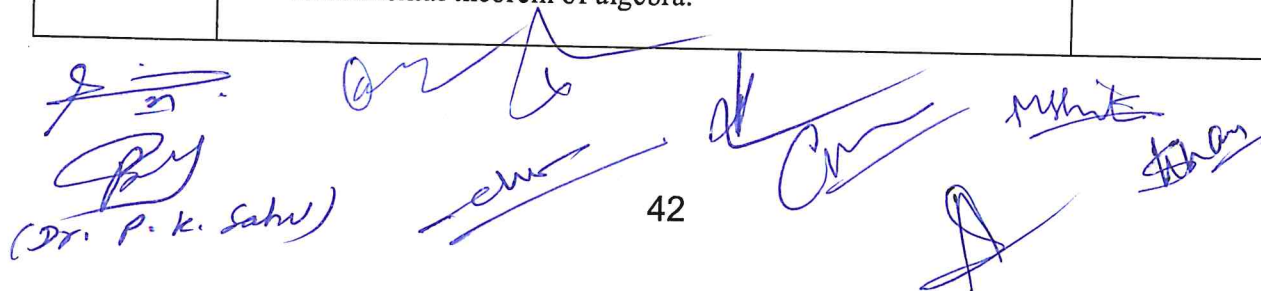


 (Dr. S. Dashputra) Dr. Omkar Lal Shivastava Dr. Babbar ak

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

| Part A: Introduction | | | |
|---|-------------------------------|--|--|
| Program: Bachelor in Science (Honors/Honors with Research) | | Semester - VIII | Session:2024-2025 |
| 1 | Course Code | MASE – 10 | |
| 2 | Course Title | General and Algebraic Topology | |
| 3 | Course Type | Discipline Specific Elective (DSE) | |
| 4 | Pre-requisite(if any) | Knowledge of Topological spaces and related concepts | |
| 5 | Course Learning Outcome (CLO) | At the end of the course, the students will be able to : <ul style="list-style-type: none"> ➤ Understand the concept of products in different topological spaces. ➤ Understand embedding, metrization and its related theorems. ➤ Understand the concept of net, filter and its various topological properties and their inter-relations. ➤ Understand fundamental group and covering spaces. | |
| 6 | Credit Value | 4C | 1Credit = 15 hours- Learning and Observation |
| 7 | Total Marks | Maximum Marks :100 | Minimum Passing Marks :40 |

| Part B: Content of the Course | | |
|--|--|----------------|
| Total no of teaching – learning period =60 Periods (60 Hours) | | |
| Unit | Topics | No. of Periods |
| I | Product Topology Tychonoff product topology; Separation axioms and product spaces; Compactness and product spaces; Connectedness and product spaces; Countability and product spaces. | 15 |
| II | Embedding and metrization Embedding lemma and Tychonoff embedding. The Urysohnmetrization theorem. Metrization theorems and Paracompactness-Local finiteness. The Nagata-Smirnov metrization theorem. Para compactness. The Smirnov metrization theorem. | 15 |
| III | Nets and filter Topology and convergence of nets.Hausdorffness andnets. Compactness and nets. Filters and their convergence. Canonical way of converting nets to filters and vice-versa. Ultra-filters and Compactness. | 15 |
| IV | The fundamental group and Covering spaces Homotopy of paths; The fundamental group; Covering Spaces; The fundamental group of the circle and the fundamental theorem of algebra. | 15 |



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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Introduction to General Topology By K.D. Joshi, Wiley Eastern Ltd., 1983.
2. Topology, A First Course By James R. Munkres, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

References Books Recommended:

1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
2. George F. Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.
3. J. Hocking and G. Young, Topology, Addison-Wiley Reading, 1961.
4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1955.
5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.
6. W. Thron, Topologically Structures, Holt, Rinehart and Winston, New York, 1966.
7. N. Bourbaki, General Topology Part I (Transl.), Addison Wesley, Reading, 1966.
8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York, 1964.
10. E.H. Spanier, Algebraic Topology, McGraw-Hill, New York, 1966.
11. S. Willard, General Topology, Addison-Wesley, Reading, 1970.
12. Crump W. Baker, Introduction to Topology, Wm C. Brown Publisher, 1991.
13. Sze-Tsen Hu, Elements of General Topology, Holden-Day, Inc. 1965.

E-Recourses:

<https://onlinecourses.nptel.ac.in>
<https://epqp.inflibnet.aci.in>
<https://swayam.gov.in>
<https://www.mooc.org>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:

100 Marks

Continuous Internal Assessment (CIA):

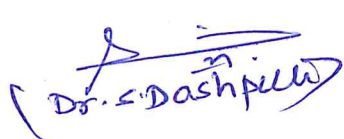
30 Marks

End Semester Examination (ESE):

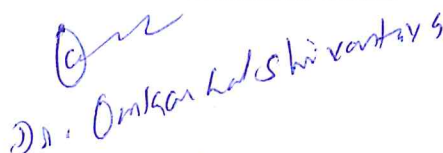
70 Marks

| | | |
|---|---|---|
| Continuous Internal Assessment (CIA) (Conducted by course teacher) | Test /Quiz – 20+20 Marks | Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks |
| | Assignment/Seminar- 10 Marks | |
| End Semester Examination (ESE) | Two Section-A&B Section-A: Q1. Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks | |

Name and signature of convener & members of CBOS-


(Dr. S. Dashpila)


(Dr. P. K. Sahu)


Dr. Anil Kumar


Dr. S. K. Sahu


Dr. S. K. Sahu


Dr. S. K. Sahu

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

| Part A: Introduction | | | |
|---|-------------------------------|--|--|
| Program: Bachelor in Science (Honors/Honors with Research) | | Semester - VIII | Session:2024-2025 |
| 1 | Course Code | MASE-11 | |
| 2 | Course Title | Complex Analysis - II | |
| 3 | Course Type | Discipline Specific Elective (DSE) | |
| 4 | Pre-requisite(if any) | Basic discussion of complex numbers, complex variable functions and analytic functions. | |
| 5 | Course Learning Outcome (CLO) | <p>This Course will enable the students to:</p> <ul style="list-style-type: none"> ➤ Understand the fundamental Complex integration. ➤ Understand the concept of residues and apply Cauchy's residue theorem to evaluate integrals. Understand the concept of conformal mappings, bilinear transformations, their properties and classifications. Understand the concept about the spaces of analytic functions. ➤ Understand the concept of Weierstrass' factorization theorem, Riemann Zeta function, Gamma function and its properties. Understand the concept of Analytic Continuation and its properties. Gain knowledge of power series of analytic function. Understand the concept and properties of Harmonic functions on a disc. ➤ Understand the concept of Canonical products, entire function and exponent of Convergence. ➤ Understand the advanced concepts of Analytic functions and its properties. | |
| 6 | Credit Value | 4C | 1Credit = 15 hours- Learning and Observation |
| 7 | Total Marks | Maximum Marks :100 | Minimum Passing Marks :40 |

| Part B: Content of the Course | | |
|--|--|----------------|
| Total no of teaching – learning period =60 Periods (60 Hours) | | |
| Unit | Topics | No. of Periods |
| I | Complex integration: Complex integration, Cauchy-Goursat. Theorem. Cauchy's integral formula. Higher order derivatives. Morera's Theorem. Cauchy's inequality and Liouville's theorem. The fundamental theorem of algebra. Taylor's theorem. Laurent's series. Isolated singularities. Meromorphic functions. Maximum modulus principle. Schwarz lemma. The argument principle. Rouché's theorem Inverse function theorem. | 15 |
| II | Calculus of Residues: Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to $\arg z$, $\log z$ and z^a . Bilinear transformations, their properties and classifications. Definitions and | 15 |

(Dr. P. K. Sahu)

| | | |
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| | examples of Conformal mappings. Spaces of analytic functions. Hurwitz's theorem. Montel's theorem Riemann mapping theorem. | |
| III | Entire Functions and Analytic Continuation: Weierstrass' factorisation theorem. Gamma function and its properties. Riemann Zeta function. Riemann's functional equation. Runge's theorem. Mittag-Leffler's theorem. Analytic Continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation Schwarz Reflection Principle. Monodromy theorem and its consequences. | 15 |
| IV | Harmonic Function and Canonical products: Harmonic functions on a disk. Harnack's inequality and theorem. Dirichlet Problem. Green's function, Canonical products. Jensen's formula. Poisson-Jensen formula. Hadamard's three circles theorem. Order of an entire function. Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem. | 15 |

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Complex Analysis By L.V.Ahlfors, McGraw - Hill, 1979.
2. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House, 1980.
3. H.K. Pathak, Complex Analysis and Applications, ShikshaSahityaPrakashan , 2019

References Books Recommended:

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
2. Complex Function Theory By D.Sarason
3. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
4. S. Lang, Complex Analysis, Addison Wesley, 1977.
5. D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
6. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998.
7. E. Hille, Analytic Function Theory (2 Vols.) Gonn& Co., 1959.
8. W.H.J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D.VanNostrand Co., 1967.
9. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
10. M.Heins, Complex Function Theory, Academic Press, 1968.
11. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.
12. S.Saks and A.Zygmund, Analytic Functions, MonograficMatematyczne, 1952.
13. E.C Titchmarsh, The Theory of Functions, Oxford University Press, London.
14. W.A. Veech, A Second Course in Complex Analysis, W.A. Benjamin, 1967.
15. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.


E-Recourses:

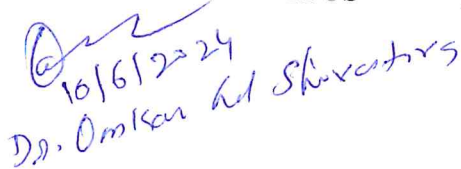
- <https://onlinecourses.nptel.ac.in>
- <https://epqp.inflibnet.aci.in>
- <https://swayam.gov.in>
- <https://www.mooc.org>

(Dr. P.K. Sahu)

| | | |
|--|---|---|
| Part D: Assessment and Evaluation | | |
| Suggested Continuous Evaluation Methods: | | |
| Maximum Marks: | | 100 Marks |
| Continuous Internal Assessment (CIA): | | 30 Marks |
| End Semester Examination (ESE): | | 70 Marks |
| Continuous Internal Assessment (CIA) (Conducted by course teacher) | Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks | Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks |
| End Semester Examination (ESE) | Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks | |

Name and signature of convener & members of CBOS-

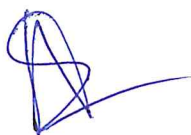

(Dr. S. Dasgupta)


16/6/2024
Dr. Omkar K. Shivastava


Dr. Anurag
Mishra


(Dr. P. K. Sahu)







FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

| Part A: Introduction | | | |
|---|-------------------------------|--|--|
| Program: Bachelor in Science (Honors/Honors with Research) | | Semester - VIII | Session:2024-2025 |
| 1 | Course Code | MASE-12 | |
| 2 | Course Title | Graph Theory | |
| 3 | Course Type | Discipline Specific Elective (DSE) | |
| 4 | Pre-requisite(if any) | Basic discussion of Graph , Trees and matrices. | |
| 5 | Course Learning Outcome (CLO) | This Course will enable the students to: <ul style="list-style-type: none"> ➤ Appreciate the definition and basics of graphs along with types and their examples. ➤ Understand the definition of a tree and learn its applications to fundamental circuits. ➤ Know the applications of graph theory to network flows. ➤ Understand the notion of planarity of a graph. ➤ Relate the graph theory to the real-world problems. | |
| 6 | Credit Value | 4C | 1Credit = 15 hours- Learning and observation |
| 7 | Total Marks | Maximum Marks :100 | Minimum Passing Marks :40 |

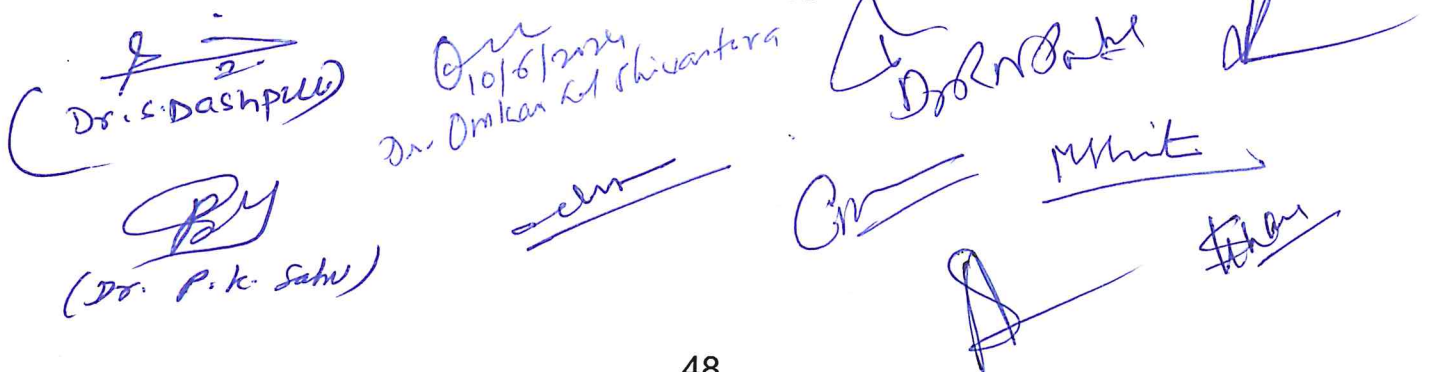
| Part B: Content of the Course | | |
|--|---|----------------|
| Total no of teaching – learning period =60 Periods (60 Hours) | | |
| Unit | Topics | No. of Periods |
| I | Paths, Circuits and Graph Isomorphisms : Definition and examples of a graph, Subgraph, Walks, Paths and circuits; Connected graphs, disconnected graphs and components of a graph; Euler and Hamiltonian graphs, Graph isomorphisms, Adjacency matrix and incidence matrix of a graph, Directed graphs and their elementary properties. | 15 |
| II | Planar Graphs : Planar graph, Euler theorem for a planar graph, Various representations of a planar graph, Dual of a planar graph, Detection of planarity, Kuratowski's theorem. Weighted graph, Travelling salesman problem, shorted path Dijkstra's algorithm. | 15 |

47

| | | |
|---|--|----|
| III | Cut-Sets and Cut-Vertices : Cut-set of a graph and its properties, Fundamental circuits and cut-sets, Cut-vertices, Connectivity and separability, Network flows, 1-isomorphism and 2- isomorphism. | 15 |
| IV | Trees and Fundamental Circuits : Definition and properties of trees, Rooted and binary trees, Cayley's theorem on a counting tree, Spanning tree, Fundamental circuits, Minimal spanning trees in a connected graph. | 15 |
| Part C - Learning Resource | | |
| Text Books, Reference Books, Other Resources | | |
| Text Books Recommended : | | |
| <ol style="list-style-type: none"> 1. R. Balakrishnan & K. Ranganathan (2012). A Textbook of Graph Theory. Springer. 2. Narsingh Deo (2016). Graph Theory with Applications to Engineering and Computer Science. Dover Publications. | | |
| References Books Recommended : | | |
| <ol style="list-style-type: none"> 3. Reinhard Diestel (2017). Graph Theory (5th edition). Springer. 4. Edgar G. Goodaire & Michael M. Parmenter (2018). Discrete Mathematics with Graph Theory (3rd edition). Pearson. 5. Douglas West (2017). Introduction to Graph Theory (2nd edition). Pearson. : | | |
| E-Recourses: | | |
| https://onlinecourses.nptel.ac.in https://epqp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org | | |

| | | |
|--|---|---|
| Part D: Assessment and Evaluation | | |
| Suggested Continuous Evaluation Methods: | | |
| Maximum Marks: | | 100 Marks |
| Continuous Internal Assessment (CIA): | | 30 Marks |
| End Semester Examination (ESE): | | 70 Marks |
| Continuous Internal Assessment (CIA) (Conducted by course teacher) | Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks | Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks |
| End Semester Examination (ESE) | Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks | |

Name and signature of convener & members of CBOS-



 (Dr. S. Dashpalle)

 (Dr. P. K. Sahu)

 Dr. Omkar Lal Shivastava

 Dr. R. D. Bhat

 Dr. M. H. Patil

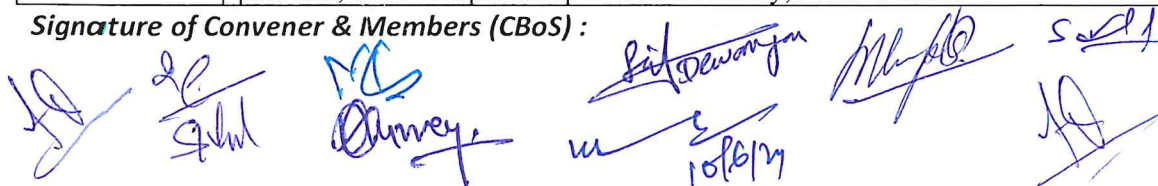
 Dr. A. S. Patil

 Dr. H. S. Patil

FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

| PART – A: INTRODUCTION | | | |
|--|---|--|--|
| Program: Bachelor in Science <i>(Honors/ Honors with Research)</i> | | Semester: VIII | Session: 2024-25 |
| 1 | Course Code | PHSC-08 | |
| 2 | Course Title | Quantum Mechanics | |
| 3 | Course Type | Discipline Specific Course | |
| 4 | Pre-requisite (if any) | As per Program | |
| 5 | Course Learning Outcomes (CLO) | At the end of this course, the students will be able to: <ul style="list-style-type: none"> ➤ Explore uncertainty relations and states with minimum uncertainty. Learn and apply commutation relationships ➤ Master matrix representation of operators and solve the harmonic oscillator. Comprehend angular momentum in quantum mechanics. ➤ Explore spin angular momentum and Pauli's matrices. Master the concept of Clebsch- Gordon coefficients. ➤ Analyze central force problems and spherically symmetric potentials in 3D. Explore parity, square-well potentials, and hydrogen atom solutions | |
| 6 | Credit Value | 04 Credits | 1 Credit = 15 Hours- Learning & Observation |
| 7 | Total Marks | Maximum Marks: 100 | Minimum Pass Marks: 40 |
| PART – B: CONTENT OF THE COURSE | | | |
| Total No. of Teaching-learning Periods (01 Hr. per period) – 60 Period (60 Hours) | | | |
| Unit | Topics | | No. of Period |
| I | Super position principle, State with minimum uncertainty product, commutation relationship, completeness and normalization of eigen functions, Dirac-delta function, Bra & Ket notation, matrix representation of an operator, harmonic oscillator and its solution by matrix method, Heisenberg equation of motion. | | 15 |
| II | Angular momentum in quantum mechanics, matrix representation of angular momentum, commutation relationships of orbital angular momentum, eigen values and eigen functions of L^2 and L_z , Spin angular momentum: basic introduction, Total angular momentum and its commutation relationship, Pauli's spin matrices, addition of angular momentum, Clebsch-Gordon coefficients. Applied problem based on momentum and positions. | | 15 |
| III | Central force problem, spherically symmetric potentials in three dimensions, separation of wave equation, parity, three-dimensional square-well potential and energy levels, the hydrogen atom; solution of the radial equation, energy levels and stationary state wave functions, discussion of bound states, degeneracy. | | 15 |
| IV | Time- independent perturbation theory, non-degenerate case, first order and second perturbations with the example of an oscillator, degenerate cases, removal of degeneracy in second order, Zeeman effect without electron spin, first-order Stark effect in hydrogen, perturbed energy levels, correct eigen function, occurrence of permanent electric dipole moments. | | 15 |
| Keywords: | Uncertainty principle, normalization of wavefunction, angular momentum spherically symmetric potential, Time independent perturbation theory, Zeeman effect | | |

Signature of Convener & Members (CBOS) :



PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended -

1. Principles of Quantum Mechanics by R. Shankar
2. Modern Quantum Mechanics" by J. J. Sakurai and Jim Napolitano
3. Introduction to Quantum Mechanics" by David J. Griffiths and Darrell F. Schroeter
4. Quantum Mechanics: A Modern Development" by Leslie E. Ballentine
5. Quantum Mechanics by Leonard I. Schiff

Reference Books Recommended -

1. L. I. Schiff : Quantum mechanics (McGraw-Hill).
2. S. Gasiorowicz, Quantum Physics (Wiley).
3. Landau and Lifshitz : Non-relativistic quantum mechanics.
4. B. Craseman and Z. D. Powell: Quantum mechanics (Addison Wesley)
5. A. P. Messiah : Quantum Mechanics.
6. J. J. Sakurai : Modern Quantum Mechanics.
7. Mathews and Venkatesa: Quantum Mechanics.
8. G. Aruldas: Quantum Mechanics (II Edition)

Online Resources (e-books/ learning portals/ other e-resources)

1. All e-books of physics <https://www.e-booksdirectory.com/listing.php?category=2>
2. Free physics textbook in PDF
https://www.motionmountain.net/?gclid=CjwKCAjwmq3kBRB_EiwAjkNDp5v8Yy6xK1s0
3. [Kma0VR0AWGlichRwFfCC0-vpZK1jrPoEOAnBq8fcqRoCILsQAvD_BwE](https://www.kma0vr0awglichrwffcc0-vpzk1jrpoEOAnBq8fcqRoCILsQAvD_BwE)
4. Cambridge University Books for Physics <https://www.cambridgeindia.org/>
5. Books for solving physics problems <https://bookboon.com/en/physics-ebooks>
6. NPTEL Online courses: https://onlinecourses.nptel.ac.in/noc21_ph05/preview
7. Quantum Mechanics <https://archive.nptel.ac.in/courses/115/101/115101107/>
8. Quantum Mechanics <https://nptel.ac.in/courses/115106066>

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

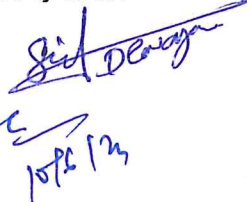
End Semester Examination (ESE): 70 Marks

| | | | |
|---|---|--------------|--|
| Continuous Internal Assessment (CIA): (By course teacher) | Internal Test/ Quiz (2): | 20+20 | Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against 30 Marks |
| | Assignment/ Seminar (1): | 10 | |
| | Total Marks: | 30 | |
| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type, 1 out of 2 from each unit- 4x10 =40 Marks | | |

Name and Signature of Convener & Members of CBoS:











FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

| PART-A: INTRODUCTION | | | |
|---|---|--|---|
| Program: Bachelor in Science <i>(Honors/Honors with Research)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | PHSE- 09 T | |
| 2 | Course Title | Solid State Physics | |
| 3 | Course Type | Discipline Specific Elective | |
| 4 | Pre-requisite (if, any) | As per Program | |
| 5 | Course Learning Outcomes (CLO) | By course end, students will master: <ul style="list-style-type: none"> ➤ Energy band concept in solids, including energy gap analysis. ➤ Bloch function, Kronig-Penny model application for electron description. ➤ Hall effect in semiconductors, Fermi-Dirac distribution temperature impact, and free electron gas behavior in 3D. ➤ Zone schemes exploration, Fermi surface construction, and understanding of nearly free electrons, holes, and open orbits. | |
| 6 | Credit Value | 3 Credits | Credit = 15 Hours - learning & Observation |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |
| PART -B: CONTENT OF THE COURSE | | | |
| Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours) | | | |
| Unit | Topics (Course contents) | | No. of Period |
| I | Electrical Properties of solid Free electron model; Solution of one-dimensional Schrodinger equation in a constant potential; density of states; Fermi energy; Energy bands and origin of energy gap and its magnitude, Bloch function, Kronig-Penny model, Wave equation of electron in periodic potential, crystal moment of an electron, Hall effect Magnetic properties of solids Dia, para and ferromagnetism; Langevin's theory of dia and paramagnetism, Curie-Weiss law | | 11 |
| II | Effect of temperature on F-D distribution, free electron gas in three dimensions. Different zone schemes, reduced and periodic zones, construction of Fermi surfaces, nearly free electrons, electron, hole, open orbits, Calculation of energy bands, Tight binding, Wigner-Seitz, cohesive energy, pseudo potential methods. Experimental methods in Fermi surface studies, quantization of orbits in a magnetic field, de Haas van Alphen Effect, External orbits, Fermi surface of copper | | 11 |
| III | Lattice dynamics in monoatomic and diatomic lattice: two atoms per primitive basis, optical and acoustic modes, quantization of elastic waves, phonon momentum, inelastic neutron scattering by phonons, Anharmonic crystal interactions-thermal expansion, thermal conductivity, thermal resistivity of phonon gas, umklapp processes, imperfections | | 11 |
| IV | Superconductivity Experimental survey: occurrence of superconductivity, Destruction of superconductivity by magnetic field, Meissner effect, heat capacity, energy gap, MW, and IR properties, isotope effect. Theoretical survey: thermodynamics of superconducting transition, London equation, Coherence length, Cooper pairing due to phonons, BCS theory of superconductivity, BCS ground state, flux quantization of superconducting ring, duration of persistent currents, Type II superconductors, Vortex states, estimation of Hc1 and Hc2, single particle and Josephson superconductor tunneling, DC/AC Josephson effect, Macroscopic quantum interference. High-temperature superconductors, critical fields and currents | | 12 |
| Keywords | <i>Free electron model, Kronig Penny Model, Hall effect, Zone schemes, fermi surfaces, optical and acoustic modes, Superconductivity, BCS theory</i> | | |

Signature of Convener & Members (CBs):

PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Solid State Physics by Neil W. Ashcroft and N. David Mermin
2. Introduction to Solid State Physics by Charles Kittel
3. Solid State Physics by J. S. Blakemore
4. Quantum Theory of Solids by Charles Kittel
5. Introduction to Superconductivity by Michael Tinkham

Reference Books Recommended-

1. Principles of the Theory of Solids by J. M. Ziman
2. Electronic Properties of Materials by Rolf E. Hummel
3. Solid State Physics: An Introduction by Philip Hofmann
4. Lattice Dynamics by A. A. Maradudin
5. Superconductivity, Second Edition by J. B. Ketterson and S. N. Song
6. Fundamentals of Superconductivity by John Robert Schrieffer
7. The Physics of Solids by Richard Turton
8. Solid State Physics: Structure and Properties of Materials by M. A. Wahab

Online Resources-

e-Resources / e-books and e-learning portals

1. Condensed Matter Physics <https://archive.nptel.ac.in/courses/115/106/115106061/>
2. Advanced Condensed Matter Physics <https://archive.nptel.ac.in/courses/115/103/115103102/>
3. Introduction to condensed matter physics
[https://homepages.iitb.ac.in/~kdasgupta/pdf/PH409\[Aug2013\].pdf](https://homepages.iitb.ac.in/~kdasgupta/pdf/PH409[Aug2013].pdf)
4. Introduction to solid state physics <https://archive.nptel.ac.in/courses/115/104/115104109/>

PART -D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

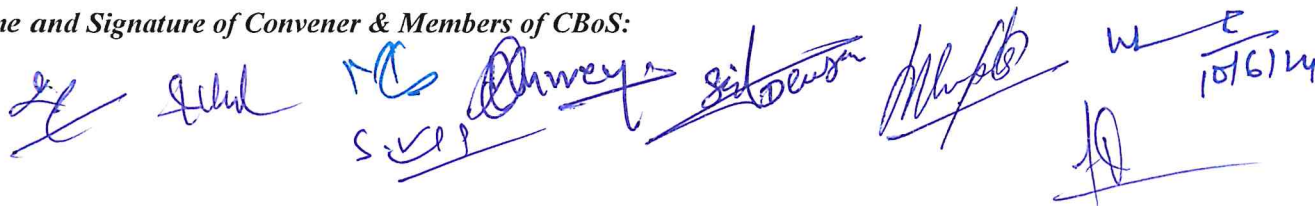
Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

EndSemester Exam(ESE): 70 Marks

| | | | |
|--|--|----------|---|
| Continuous Internal Assessment(CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 20 +20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - Total Marks - | 10 30 | |
| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks | | |

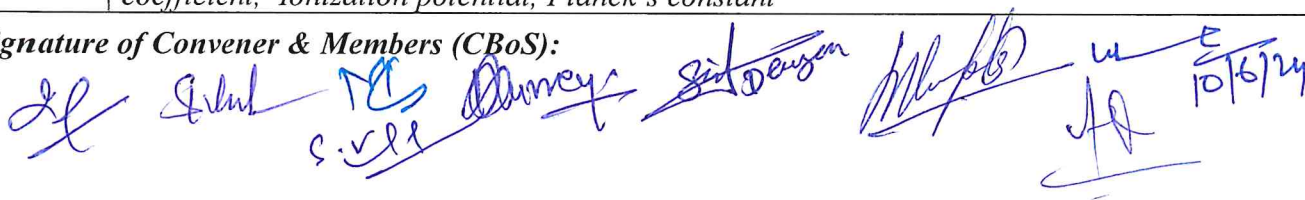
Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

| PART-A: INTRODUCTION | | | |
|--|--|---|---|
| Program: Bachelor in Science <i>(Honors/ Honors with Research)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | PHSC-09 P | |
| 2 | Course Title | Solid State Physics | |
| 3 | Course Type | Discipline Specific Elective | |
| 4 | Pre-requisite (if, any) | As per Program | |
| 5 | Course Learning Outcomes(CLO) | After the completion of the course, the Students are expected to : <ul style="list-style-type: none"> ➤ Analyse recorded data and formulate it to get desired results. ➤ Interpret results and check for attainment of proposed objectives related to theory of semiconductors. ➤ Apply theory and principle of semiconductors for various device applications ➤ Various electronics experiments and some advanced experiments in Physics | |
| 6 | Credit Value | 1 Credits | <i>Credit =30 Hours Laboratory or Field learning/Training</i> |
| 7 | Total Marks | Max. Marks:50 | Min Passing Marks:20 |
| PART -B: CONTENT OF THE COURSE | | | |
| Total No. of learning-Training/performancePeriods:30 Periods (30 Hours) | | | |
| Module | Topics(Course Contents) | | No. of Period |
| Lab./ Experiment Contents of Course | At least 10 of the following or related Experiments | | |
| | 1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method) 2. To measure the Magnetic susceptibility of Solids 3. To determine the Coupling Coefficient of a Piezoelectric crystal 4. To measure the Dielectric Constant of a dielectric Materials with frequency 5. To study the PE Hysteresis loop of a Ferroelectric Crystal 6. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis 7. Determination of ionization potential of Lithium/Mercury 8. To study I-V characteristics of photovoltaic solar cell and its efficiency 9. Study of optoelectronic devices and verification of inverse square law 10. Determination of 'h' Planck's constant by Photoelectric effect 11. Determination of 'e/m' by Thomson method 12. Determination of Ionization Potential using Thyatron valve 13. Study of absorption coefficient of KMnO4 | | 30 |
| Keywords | <i>Magnetic susceptibility, Dielectric constant, PE hysteresis loop, BH curve, Resistivity, Hall coefficient, Ionization potential, Planck's constant</i> | | |

Signature of Convener & Members (CBoS):



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

| PART-A: INTRODUCTION | | | |
|---|---------------------------------------|--|---|
| Program: Bachelor in Science <i>(Honors/Honors with Research)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | PHSE- 10 | |
| 2 | Course Title | Atomic and Molecular Physics | |
| 3 | Course Type | Discipline Specific Elective | |
| 4 | Pre-requisite (if, any) | As per Program | |
| 5 | Course Learning Outcomes (CLO) | <ul style="list-style-type: none"> ➤ Explain Vector atom model and use it for analyzing hydrogen spectra. ➤ Analyze various spectra and check for possibility of a given transition ➤ Explain and Apply Raman's effect and spectroscopy for various application. ➤ Appreciate the extraordinary characteristic of lasers and differentiate it from an ordinary light. ➤ Explore more about scientific contribution of Sir C V Raman | |
| 6 | Credit Value | 4 Credits | Credit = 15 Hours - learning & Observation |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

PART -B: CONTENT OF THE COURSE
Total No. of Teaching-learning Periods (01 Hr. per period) – 60 Periods (60 Hours)

| Unit | Topics (Course contents) | No. of Period |
|-----------------|---|----------------------|
| I | Vector atom model, quantum numbers associated with vector atom model, Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules, singlet, triplet fine structure in alkaline earth spectra, L-S and J-J coupling | 15 |
| II | Different types of Spectra, Discrete set of electronic energies of molecules, quantization of vibrational energies, determination of inter-nuclear distance, Transition rules for vibration and electronic vibration spectra. Pure rotational and rotation vibration spectra, Quantization of States Dissociation limit for the ground and other electronic states, transition rules for pure rotation and electronic- rotation Spectra | 15 |
| III | Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy. Application of Raman Spectroscopy, Resonance Spectroscopy, X-Rays, Production of X-rays, X-ray spectra, Mosley's law, X-Ray Spectroscopy, | 15 |
| IV | Atom Radiation interactions: Semi-classical description of radiation. Absorption, spontaneous and stimulated emissions, Einstein's A and B coefficients, Coherent and Incoherent emissions, LASERs and MASERs, Line widths, various types of line broadening, two-level atoms in a radiation field | 15 |
| Keywords | Vector atom model, hydrogen spectra, electronic transitions, vibrational spectra, rotational spectra, Raman effect | |

Signature of Convener & Members (CBoS) :

PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended –

1. Atomic Physics by J.B. Rajam
2. Molecular Spectroscopy by Ira N. Levine
3. Fundamentals of Molecular Spectroscopy by C.N. Banwell and E.M. McCash
4. Lasers: Theory and Applications by K. Thyagarajan and A.K. Ghatak
5. Spectroscopy by B.P. Straughan and S. Walker
6. Modern Spectroscopy by J. Michael Hollas.

Reference Books Recommended –

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, 2009, PHI Learning
3. Modern Physics, R.A. Serway, C.J. Moses, and C. A. Moyer, 2005, Cengage Learning
4. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

Online Resources– e-Resources / e-books and e-learning portals

1. <https://archive.nptel.ac.in/courses/115/105/115105100/>
2. <https://archive.nptel.ac.in/courses/115/101/115101003/#>

PART -D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

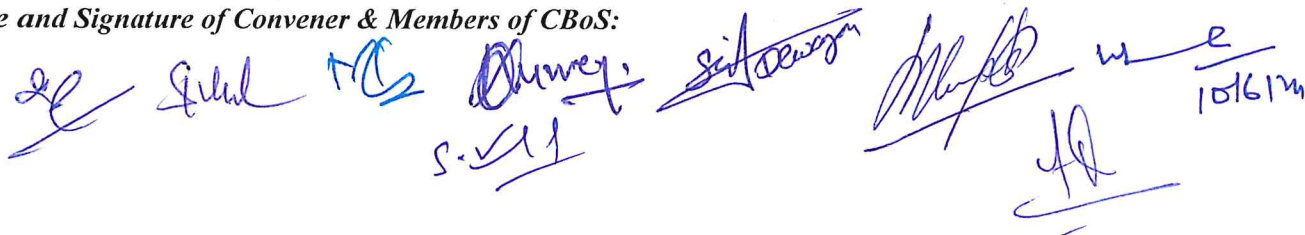
Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

EndSemester Exam(ESE): 70 Marks

| | | | |
|---|--|----------|---|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 20 & 20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - Total Marks - | 10 30 | |
| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks | | |

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

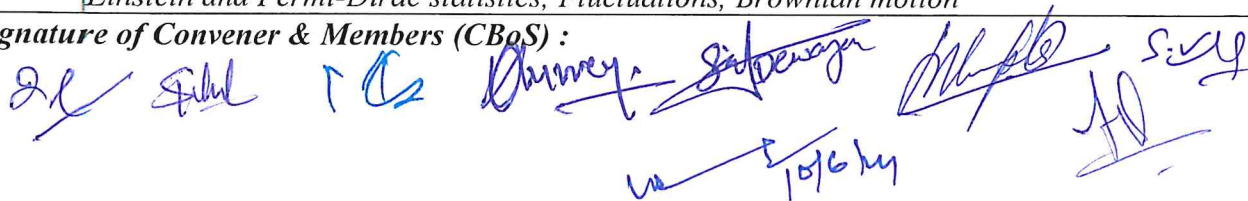
| PART-A: INTRODUCTION | | | |
|---|---------------------------------------|--|---|
| Program: Bachelor in Science <i>(Honors/Honors with Research)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | PHSE-11 | |
| 2 | Course Title | Statistical Mechanics | |
| 3 | Course Type | Discipline Specific Elective | |
| 4 | Pre-requisite (if, any) | <i>As per Program</i> | |
| 5 | Course Learning Outcomes (CLO) | At the end of this course, the students will be able to: <ul style="list-style-type: none"> ➤ Explain the connection between statistics and thermodynamics. Define the phase space of the classical system. ➤ Define three different types of Ensembles and discuss corresponding theories. Define partition functions for different canonical systems. ➤ Explain energy, energy-density fluctuations, and correspondence of various ensembles. Explain statistics of different quantum mechanical ensembles. ➤ Discuss Bose-Einstein (BE) Condensate w.r.t. liquid Helium II, Define and discuss electron gas behavior w.r.t. Fermi Dirac Statistics ➤ Discuss Virial expansion of the equation of state. Discuss Brownian motion and Einstein and Smoluchowski theory | |
| 6 | Credit Value | 4 Credits | <i>Credit = 15 Hours - learning & Observation</i> |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

PART -B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) – 60 Periods (60 Hours)

| Unit | Topics (Course Contents) | No. of Period |
|-----------------|---|---------------|
| I | Foundation of Statistical Mechanics Macroscopic and microscopic states, contact between statistics and thermodynamics, physical significance of $\Omega(N, V, E)$, the classical gas, entropy of mixing and Gibb's paradox, phase space of classical system, Liouville's theorem and its consequences, quantum states and phase space. | 15 |
| II | Elements of ensemble theory A system in microcanonical, canonical, and grand canonical ensembles, partition functions, physical significance of statistical quantities, example of classical system, energy and energy-density Fluctuations and mutual correspondence of various ensembles | 15 |
| III | Formulation of quantum statistics Quantum mechanical ensemble theory, density matrix, statistics of various quantum mechanical ensembles, system composed of indistinguishable particles. Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac distributions Thermodynamic behavior of an ideal Bose gas, Bose-Einstein condensation and, elementary excitations in liquid helium II, Thermodynamic behavior of an ideal Fermi gas, the electron gas, non-relativistic and relativistic degenerate electron gas, theory of white dwarf stars. | 15 |
| IV | Statistical Mechanics of interacting systems The method of cluster expansion for a classical gas, Virial expansion of the equation of state. Theory of phase transition – general remark on the problem of condensation, Fluctuations: thermodynamic fluctuations, Spatial correlation in a fluid Brownian motion: Einstein Smoluchowski's theory of Brownian motion | 15 |
| <i>Keywords</i> | <i>Macro and microstates, ensembles, phase space, partition function, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics, Fluctuations, Brownian motion</i> | |

Signature of Convener & Members (CBoS) :



PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Reference Books Recommended –

1. L. D. Landau & E. M. Lifshitz (Butter worth and Heinemann Press).
2. Federick Reif, Fundamental of statistical and thermal physics (McGraw-Hill publishers)
3. Kerson Huang, Statistical Mechanics (Wiley Eastern)
4. Charles Kittel, Elemental Statistical Physics

Text Books Recommended –

1. Brij Lal, N. Subrahmanyam, P S Hemne; Heat and Thermodynamics and Statistical Physics
2. R. K. Pathria, Statistical Mechanics (Pergamon Press)
3. Statistical and Thermal Physics an introduction; Michael J R Hoch

Online Resources– e-Resources / e-books and e-learning portals

1. Statistical Mechanics <https://archive.nptel.ac.in/courses/115/106/115106126/>
2. Introduction to Statistical Mechanics <https://archive.nptel.ac.in/courses/115/103/115103113/>
3. Statistical Mechanics <https://archive.nptel.ac.in/courses/115/106/115106111/>
4. Statistical mechanics <http://www.digimat.in/nptel/courses/video/115106126/L01.html>

PART -D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

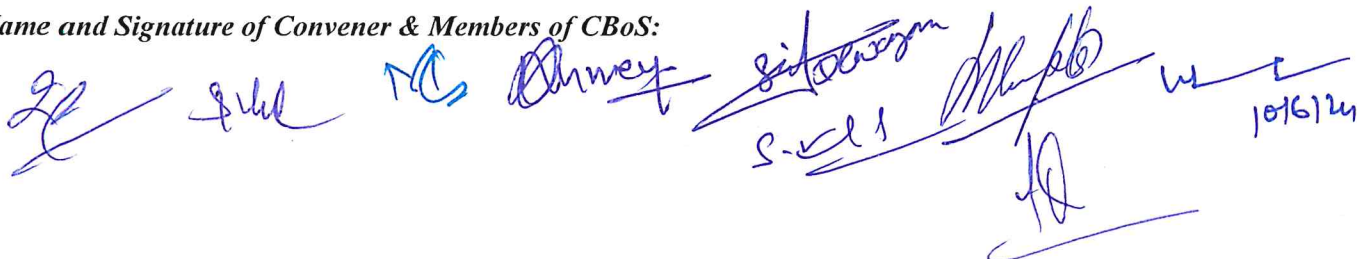
Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

EndSemester Exam(ESE): 70 Marks

| | | | |
|---|---|----------|---|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 20 & 20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - Total Marks - | 10 30 | |
| End Semester Exam (ESE): | Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks | | |

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

| PART-A: INTRODUCTION | | | |
|---|---|---|---|
| Program : Bachelor in Science <i>(Honors/Honors with Research)</i> | | Semester -VIII | Session: 2024-2025 |
| 1 | Course Code | PHSE-12 T | |
| 2 | Course Title | Microprocessor | |
| 3 | Course Type | Discipline Specific Elective | |
| 4 | Pre-requisite (if, any) | As per program | |
| 5 | Course Learning Outcomes (CLO) | After completion of this course a student will be able to- <ul style="list-style-type: none"> ➤ Understand the basics of digital computer, Clarify the concept of memories used in computer system ➤ Familiar with buses and registers available in microprocessor ➤ Understand the addressing modes, data transfer group, arithmetic group, logical group etc. Know about Assembly Language, High-Level and Area of applications of various languages ➤ Able to use Assembly Language for programming of microprocessor | |
| 6 | Credit Value | 3 Credits | Credit = 15 Hours - learning & Observation |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |
| PART -B: CONTENT OF THE COURSE | | | |
| Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours) | | | |
| Unit | Topics (Course contents) | | No. of Period |
| I | Digital Computer: Generation of computer, Digital Computer, Its basic components: Input and output devices, Central Processing Unit (CPU) and its organization, Primary memory: Introduction, Types of Primary memory - RAM, SDRAM, SGRAM, DDR SDRAM, SIMM, DIMM, ROM, PROM, EPROM, EEPROM, Secondary memory: Construction and working principles of Hard Disc, Floppy Disc, Optical Disc, Magnetic Bubble Memory. Cache memory, Real and Virtual Memory. Memory hierarchy | | 11 |
| II | Microprocessor: Introduction and evaluation, Architecture and functional organization of Intel 8085, ALU, Timing and Control unit, Buses: Address Bus, Data Bus and Control Bus. Bus architecture: PCI, ISA, USB and AGP. Registers: ACC, General purpose register, Stack pointer, Program counter, Instruction register, Temporary register. Processing speed of processor, Types of processors (Basic Idea), Opcode and Operand, Pin Diagram and Pin Configuration of 8085, Intel 8085 instructions, Instruction cycle, Timing diagram | | 12 |
| III | Instruction set of 8085: Addressing modes, Data transfer group, Arithmetic group, Logical group, Branch group, Stack, I/O and Machine control group. Programming of Microprocessor: Assembly Language, High-Level languages. Advantages and Disadvantages of high-level languages, Area of applications of various languages, Stack, Subroutines, Modular programming, Structured programming | | 11 |
| IV | Assembly Language Programs: Addition of two 8-bit number; sum 8-bit, Addition of Two 8-bit number; sum 16-bit, 8-bit subtraction, Shift an 8-bit/ 16-bit number left by 1-bit, Shift an 8-bit/ 16-bit number left by 2-bit, Find larger number of two numbers, Find the largest number in a data array, Find smaller number of two numbers, Find the smallest number in a data array, To arrange a series of numbers in Descending order, To arrange a data array in ascending order, 8-bit multiplication; product in 16-bit, 8-bit division | | 11 |
| Keywords | CPU, Memory, Microprocessor, Buses, Registers, Opcode, Instructions, Addressing mode, Assembly Language, Programming. | | |

Signature of Convener & Members (CBoS):

PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended–

1. Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall
2. Digital electronics and Microcomputers, R K Gaur, Dhanpat Rai Publications
3. Fundamentals of Microprocessors and Microcontrollers, B Ram, Dhanpat Rai Publications

Reference Books Recommended –

1. Introduction to microprocessor – Aditya Mathur, Tata McGraw Hills, New Delhi
2. Microprocessor 8085: Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning
3. Microprocessors and Interfacing Devices, Rupender Singh & Sunita Jain, CBS Publications

Online Resources–

e-Resources / e-books and e-learning portals

1. <https://www.freebookcentre.net/Electronics/MicroProcessors-Books.html>
2. <https://www.phindia.com/Books/ShoweBooks/MTMyNg/Microprocessors-Microcontrollers>
3. https://books.google.co.in/books?id=P-n3kelycHQC&printsec=frontcover&redir_esc=y#v=onepage&q&f=false
4. https://www.youtube.com/watch?v=UjagUR2i_Ok
5. <https://www.youtube.com/watch?v=dLGw66gKKkQ>
6. <https://www.classcentral.com/course/swayam-microprocessors-and-microcontrollers-9894>
7. <https://www.youtube.com/watch?v=hwwhsNOqqm8>
8. <https://www.youtube.com/watch?v=wUmi3roAqmk>

PART -D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

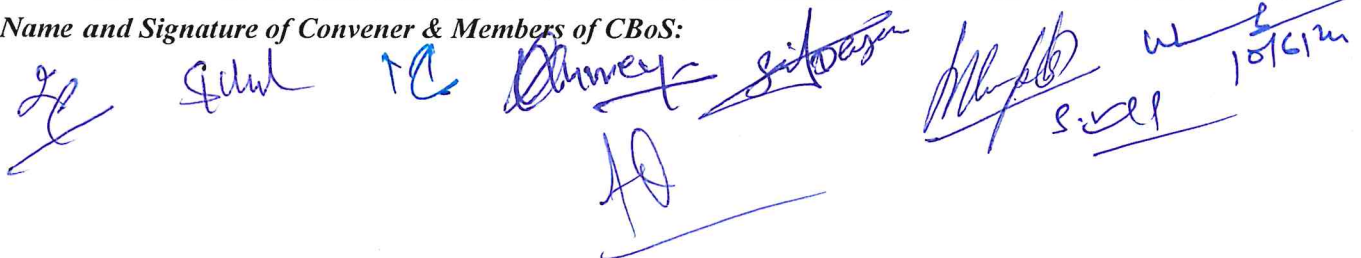
Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

| | | | |
|---|---------------------------|--------|---|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 20 +20 | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks |
| | Assignment / Seminar - | 10 | |
| | Total Marks - | 30 | |

| | | |
|---------------------------------|--|--|
| End Semester Exam (ESE): | Two section – A & B | |
| | Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks | |
| | Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks | |

Name and Signature of Convener & Members of CBoS:



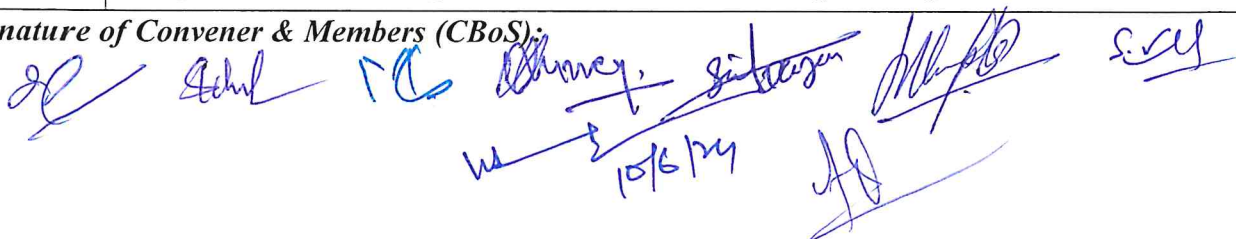
FOUR YEAR UNDER GRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

| PART-A: INTRODUCTION | | | |
|---|--|---|---|
| Program : Bachelor in Science <i>(Honors/Honors with Research)</i> | | Semester - VIII | Session: 2024-2025 |
| 1 | Course Code | PHSE-12 P | |
| 2 | Course Title | Microprocessors | |
| 3 | Course Type | Discipline Specific Elective | |
| 4 | Pre-requisite (if, any) | As per Program | |
| 5 | Course Learning Outcomes(CLO) | After completion of this course a student will be able to- <ul style="list-style-type: none"> ➤ Understand the working of logic gates and realization of Functions ➤ Clarify the concept of combinational logic circuits ➤ Understand the differences between MUX, DMUX, Encoder and Decoder and their use ➤ Familiar with basic memory elements (Flip-flop) | |
| 6 | Credit Value | 1 Credits | Credit =30 Hours Laboratory or Field learning/Training |
| 7 | Total Marks | Max. Marks:50 | Min Passing Marks:20 |
| PART -B: CONTENT OF THE COURSE | | | |
| Total No. of learning-Training/performance Periods:30 Periods (30 Hours) | | | |
| Module | Topics (Course Contents) At least 10 of the following or related Experiments | | No. of Period |
| Lab./ Experiment Contents of Course | <ol style="list-style-type: none"> 1. Write the program using 8085 Microprocessor for Addition and Subtraction of numbers using direct addressing mode 2. Write the program using 8085 Microprocessor for Addition and Subtraction of numbers using indirect addressing mode 3. Write the program using 8085 Microprocessor for Multiplication by repeated addition 4. Write the program using 8085 Microprocessor for Division by repeated subtraction 5. Write the program using 8085 Microprocessor for Handling of 16-bit Numbers 6. Write the program using 8085 Microprocessor to Use of CALL and RETURN Instruction 7. Write the program using 8085 Microprocessor to add two hexa decimal & decimal numbers 8. Write the program using 8085 Microprocessor to subtract two hexadecimal & decimal numbers 9. Write the program using 8085 Microprocessor for Addition of two 8-bit numbers 10. Write the program using 8085 Microprocessor for Addition of two 16-bit numbers 11. Write a program to perform multiplication of two 8-bit numbers using bit addition method 12. Write a program to perform multiplication of two 8-bit numbers using bit rotation method 13. Write a program to perform division of two 8-bit numbers using Repeated Subtraction method 14. Write a program for Finding the largest and smallest number from an array 15. Write a program for Find 1's & 2's complement of a 8 bit number 16. Write a program to Transfer Block of data bytes from one memory location to another 17. Any Similar programming | | 30 |
| Keywords | Microprocessor, Addressing mode, CALL, RETURN, Programming | | |

Signature of Convener & Members (CBoS):



PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Microprocessor Architecture, Programming, and Applications with the 8085 by Ramesh S. Gaonkar
2. Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096 by Krishna Kant
3. Fundamentals of Microprocessors and Microcontrollers by B. Ram
4. 8085 Microprocessor and its Applications by A. Nagoor Kani
5. The 8085 Microprocessor: Architecture, Programming and Interfacing by K. Udaya Kumar and B.S. Umashankar

Reference Books Recommended-

1. Digital Electronics: Theory and Practical- Virendra Kumar, New Age International Publications
2. Digital Electronics – A Comprehensive Lab Manual- Cherry Bhargava, B S Publication
3. Digital electronics experiment manual- Toger Tokheim, McGraw Hill
4. Handbook of Experiments in Electronics and Communication- B Sasikala & S P Rao, Vikas Publishing
5. Practical Digital Electronics Manual- Nigel P Cook, Prentice Hall

Online Resources-

e-Resources / e-books and e-learning portals

1. <https://www.ssit.edu.in/dept/assignment/8085labmanual.pdf>
2. https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/Microprocessor_Lab_Manual.pdf
3. <https://people.iitism.ac.in/~download/lab%20manuals/ece/5.%20ECC211%20Microprocessor%20&%20Microcontroller%20Lab.pdf>
4. https://www.technicalsymposium.com/microprocessor_lab.pdf
5. <https://mjcollege.ac.in/images/labmanuals/MICROPROCESSORLABMANUALBIT281.pdf>

PART-D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

| | | | |
|---|---|------------|--|
| Continuous Internal Assessment (CIA): (By Course Teacher) | Internal Test / Quiz-(2): | 10 & 10 | Better marks out of the two Test / Quiz +obtained marks in Assignment shall be considered against 15 Marks |
| | Assignment/Seminar +Attendance- Total Marks - | 05 15 | |
| End Semester Exam (ESE): | Laboratory / Field Skill Performance: On spot Assessment | | Managed by Course teacher as per lab. status |
| | A. Performed the Task based on lab. work | - 20 Marks | |
| | B. Spotting based on tools& technology (written) - | 10 Marks | |
| | C. Viva-voce (based on principle/technology) - | 05 Marks | |

Name and Signature of Convener & Members of CBoS: