

# PAKISTAN ENGINEERING COUNCIL

## Syllabus for Engineering Practice Examination (EPE)

### Computer and Allied Engineering Disciplines

(Computer Engineering / Computer Systems Engineering / Software Engineering)

Total Marks: 60

#### PART-II

This is an open book breadth and depth examination, comprising 60 Multiple Choice Questions (MCQs) of one mark each (total 60 marks) with a duration of three hours. There shall be two sections of Part-II for each major discipline of EPE. Qualifying Marks for this part shall be **sixty per cent**.

#### SECTION-A / BREADTH (25 MCQs)

This section will generally confirm the latest (updated) B.E./equivalent qualifications in Computer Engineering and allied disciplines. The examination of this section shall comprise 25 MCQs (total 25 marks).

#### 1. Mathematics & Basic Sciences — 15%

- Calculus, Linear Algebra
- Differential Equations
- Complex Variables & Transforms
- Probability & Statistics
- Numerical Methods
- Applied Physics

#### Suggested Books:

- **Advanced Engineering Mathematics** by Erwin Kreyszig, John Wiley & Sons publisher, 10<sup>th</sup> Edition, 2011
- **Differential Equations and Linear Algebra** by Stephen W. Goode, Pearson / Prentice Hall publisher, 2<sup>nd</sup> Edition, 2000
- **Introduction to Probability and Statistics** by Susan Milton and Jesse Arnold, McGraw-Hill publisher, 4<sup>th</sup> Edition, 2003
- **Fundamentals of Physics** by Halliday, Resnick, and Walker, Wiley Publisher, 12<sup>th</sup> Edition, 2021

#### 2. Electrical & Electronics Engineering — 10%

- Circuit analysis (DC/AC)

- Basic electronics
- Digital logic design
- Signals & systems

#### **Suggested Books:**

- **Engineering Circuit Analysis** by W.H. Hayt, J.E. Kemmerly, and S.M. Durbin, McGraw-Hill publisher, 8<sup>th</sup> Edition, 2012
- **Microelectronic Circuits** by Adel S. Sedra and Kenneth C. Smith, Oxford University Press publisher, 7<sup>th</sup> Edition, 2014
- **Digital Fundamentals** by Thomas L. Floyd, Published by Pearson, 11<sup>th</sup> edition, 2025
- **Digital Design** by M. Morris Mano, Pearson publisher, 5<sup>th</sup> Edition, 2013

### **3. Programming & Problem Solving — 15%**

- C/C++/Python basics
- Control structures, pointers
- Problem-solving techniques
- Object Oriented Programming
- Web Programming

#### **Suggested Books:**

- **The C Programming Language** by Brian Kernighan and Dennis Ritchie, Pearson Publisher, 2<sup>nd</sup> Edition, 1988
- **The C++ Programming Language** by Bjarne Stroustrup, Addison-Wesley Publisher, 4<sup>th</sup> Edition, 2013
- **Python Crash Course** by Eric Matthes, No Starch Press, 2<sup>nd</sup> Edition, 2019

### **4. Data Structures & Algorithms — 10%**

- Arrays, stacks, queues
- Trees, graphs
- Sorting/searching
- Time complexity

#### **Suggested Books:**

- **Introduction to Algorithms** by Cormen, Leiserson, Rivest and Stein, MIT Press, 4<sup>th</sup> Edition, 2022
- **Data Structures (Schaum's Outline)** by Seymour Lipschutz, McGraw-Hill Publisher, Revised Edition, 2011

### **5. Computer Organization & Architecture — 10%**

- CPU design
- Instruction cycles

- Memory hierarchy

**Suggested Books:**

- **Computer Organization and Design** by David Patterson and John Hennessy, Morgan Kaufmann Publisher, 6<sup>th</sup> Edition, 2020
- Modern Computer Architecture and Organization by Jim Ledin, O'Reilly Publisher, 2<sup>nd</sup> Edition, 2022

**6. Basics of Software Engineering — 10%**

- Software Development Processes & Life Cycle
- Requirements Engineering
- Unified Modeling Language (UML)
- Project Management & Professional Practice

**Suggested Books:**

- **Software Engineering** by Ian Sommerville, Pearson Publisher, Global Edition, 2017
- **Software Engineering: A Practitioner's Approach** by Roger S. Pressman, McGraw-Hill Publisher, International Edition, 2020

**7. Database Systems — 10%**

- Database modeling and design
- Database programming and languages
- Normalization

**Suggested Books:**

- **Database System Concepts** by Silberschatz, Korth, and Sudarshan, McGraw-Hill Publisher, 7<sup>th</sup> Edition, 2019
- **Database Systems: Design, Implementation, & Management** by Carlos Coronel and Steven Morris, Cengage Learning Publisher, 12<sup>th</sup> Edition, 2017

**8. Computer Networks & Communication Systems — 10%**

- OSI & TCP/IP Models
- Routing & Switching
- Digital Communication
- Wireless Communication
- 4G/5G and Navigation Systems
- Modern Communication Technologies

**Suggested Books:**

- **Computer Networking: A Top-Down Approach** by Kurose & Ross, Pearson publisher, 8<sup>th</sup> Edition, 2021

- **Data Communications and Networking** by Behrouz A. Forouzan, McGraw Hill Publisher, 6<sup>th</sup> Edition, 2022
- **Computer Networks** by Andrew S. Tanenbaum, Nick Feamster, and David Wetherall, Pearson Publisher, 6<sup>th</sup> Edition, 2022
- **Wireless Communications: Principles and Practice** by Theodore S. Rappaport, Cambridge University Press, 08-Feb-2024

## 9. Operating Systems — 10%

- Processes, scheduling
- Memory management
- Deadlocks

### Suggested Books:

- **Operating System Concepts** by Silberschatz, Galvin, and Gagne, Wiley Publisher, 10<sup>th</sup> Edition, 2018
- **Operating Systems: Internals and Design Principles** by William Stallings, Pearson Publisher, 8<sup>th</sup> Edition, 2014

## SECTION-B: DEPTH (35 MCQs)

### 1. COMPUTER ENGINEERING / COMPUTER SYSTEMS ENGINEERING

#### i. **Advanced and Modern Computer Architectures**

- Microprocessors & Microcontrollers
- Advanced CPU design
- Embedded systems
- Distributed systems
- Parallelism & Parallel Programming Paradigms
- Real-time Operating Systems
- High Performance Computing
- Compiler Construction
- Cloud Computing
- IoT
- Digital Systems and VLSI

### Suggested Books:

- **Computer Architecture: A Quantitative Approach** by Patterson & Hennessy, Morgan Kaufmann Publisher, 6<sup>th</sup> Edition, 2017
- **Microprocessors and Interfacing** by Douglas V. Hall, McGraw-Hill Publisher, 2<sup>nd</sup> Edition, 1992

- **Introduction to Embedded Systems: A Cyber-Physical Systems Approach** by Edward Ashford Lee and Sanjit Arunkumar Seshia, MIT Press, 2<sup>nd</sup> Edition, 2015
- **High Performance Computing: Modern Systems and Practices** by Thomas Sterling, Matthew Anderson, and Maciej Brodowicz, Morgan Kaufmann (Elsevier) Publisher, 2<sup>nd</sup> Edition, 2025
- **Introduction to High Performance Computing for Scientists and Engineers** by Georg Hager and Gerhard Wellein, CRC Press, 1<sup>st</sup> Edition, 2011
- **CMOS VLSI Design** by Weste & Harris, Pearson Publisher, 4<sup>th</sup> Edition, 2010

## ii. Artificial Intelligence and Machine Learning

- Search Strategies, Knowledge Representation, Reasoning & Optimization
- Supervised & Unsupervised learning
- Neural Networks
- NLP
- Generative AI
- Big Data & Data Sciences

### Suggested Books:

- **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig, Pearson Publisher, 4th Edition, 2020
- **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow** by Aurélien Géron, O'Reilly Publisher, 3<sup>rd</sup> Edition, 2022

## iii. Computer & Network Security

- CIA Triad
- Cryptography Techniques
- Information Security
- Digital Certification and Digital Signatures
- Blockchain

### Suggested Books:

- **Cryptography and Network Security** by William Stallings, Pearson Publisher, 7<sup>th</sup> Edition, 2017
- **Network Security: Private Communications in a Public World** by Charlie Kaufman, Radia Perlman, Mike Speciner, and Ray Perlner, Addison-Wesley Publisher, 3<sup>rd</sup> Edition, 2020
- **Computer Security: Principles and Practice** by William Stallings and Lawrie Brown, Pearson Publisher, 5<sup>th</sup> Edition, 2024

## iv. Image Processing & Computer Vision

- Image sampling & quantization
- Spatial resolution

- Convolution and Fourier Transforms
- Image enhancement, restoration, compression, and segmentation
- Features extraction and analysis
- Image/Video Processing & AI

**Suggested Books:**

- **Digital Image Processing** by Rafael C. Gonzalez and Richard E. Woods, Pearson Publishers, 4<sup>th</sup> Edition, 2018
  - **Computer Vision: A Modern Approach** by David A. Forsyth and Jean Ponce, Pearson Publisher, 2<sup>nd</sup> Edition, 2011
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## 2. SOFTWARE ENGINEERING

### i. **Advanced Software Engineering**

- Agile & Modern Development Practices
- DevOps Engineering
- Microservices Architecture, REST, API Gateways
- Software Reusability & Maintenance
- Software Reverse Engineering
- Software Metrics & Measurement
- Software Reliability & Fault Tolerance
- Secure Software Development
- Software Project Management
- Human Computer Interaction

**Suggested Books:**

- **Clean Code: A Handbook of Agile Software Craftsmanship** by Robert C. Martin, O'Reilly Media, 2<sup>nd</sup> Edition, 2025
- **The DevOps Handbook** by Gene Kim, Jez Humble, Patrick Debois, and John Willis, IT Revolution Press, 1<sup>st</sup> Edition, 2016
- **Building Microservices** by Sam Newman, O'Reilly Media, 2<sup>nd</sup> Edition, 2021
- **Software Engineering: A Practitioner's Approach** by Roger S. Pressman, McGraw-Hill Publisher, 8<sup>th</sup> Edition, 2014

### ii. **Software Testing & Quality Assurance**

- Software quality models (ISO, CMMI)
- Verification vs validation
- Testing levels (Unit, Integration, System, Acceptance)
- Black-box & white-box testing
- Regression testing

- Test case design
- Debugging & fault localization
- Software maintenance

#### **Suggested Books:**

- **The Art of Software Testing** by Glenford J. Myers, Wiley Publisher, 3<sup>rd</sup> Edition, 2011
- **Software Testing and Quality Assurance** by Kshirasagar Naik, Wiley Publisher, 1<sup>st</sup> Edition, 2008

#### **iii. Software Design & Architecture**

- Design principles (SOLID)
- Coupling & cohesion
- Architectural styles
- UML modeling (Use case, class, sequence)
- Design patterns (GoF)

#### **Suggested Books:**

- **Design Patterns: Elements of Reusable Object-Oriented Software** by Gamma, Helm, Johnson, and Vlissides, Addison-Wesley Publisher, 1<sup>st</sup> Edition, 1994
- **Software Architecture in Practice** by Bass, Clements, and Kazman, Addison-Wesley Publisher, 3<sup>rd</sup> Edition, 2012

#### **iv. Web Engineering & Modern Applications**

- Web architecture (client-server, REST APIs)
- Frontend basics (HTML, CSS, JavaScript)
- Backend fundamentals
- API design & integration
- Web services (REST vs SOAP)
- Mobile app basics

#### **Suggested Books:**

- **Internet & World Wide Web: How to Program** by Deitel & Deitel, Pearson Publisher, 5<sup>th</sup> Edition, 2011
- **Web Engineering** by Emilia Mendes, Springer Publisher, 1<sup>st</sup> Edition, 2006

#### **v. Advanced Databases**

- Advanced SQL & query optimization
- Transactions & concurrency control
- Distributed databases
- NoSQL databases
- Data warehousing

- Big Data & Data Sciences

**Suggested Books:**

- **Fundamentals of Database Systems** by Elmasri & Navathe, Pearson Publisher, 7<sup>th</sup> Edition, 2016
- **Database System Concepts** by Silberschatz, Korth, and Sudarshan, McGraw-Hill Publisher, 7<sup>th</sup> Edition, 2019

**vi. Artificial Intelligence and Machine Learning**

- Search Strategies, Knowledge Representation, Reasoning & Optimization
- Supervised & Unsupervised learning
- Neural Networks
- NLP
- Generative AI

**Suggested Books:**

- **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig, Pearson Publisher, 4<sup>th</sup> Edition, 2020
- **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow** by Aurélien Géron, O'Reilly Publisher, 3<sup>rd</sup> Edition, 2022

**vii. Cloud / Distributed Systems**

- Distributed system models
- Cloud computing models (IaaS, PaaS, SaaS)
- Virtualization & Containerization (Docker basics)
- Microservices deployment
- IoT

**Suggested Books:**

- **Distributed Systems: Concepts and Design** by Coulouris, Dollimore, and Kindberg, Pearson Publisher, 5<sup>th</sup> Edition, 2011
- **Cloud Computing: Concepts, Technology & Architecture** by Thomas Erl, Pearson Publisher, 1<sup>st</sup> Edition, 2013

**viii. Network & Information Security**

- CIA Triad
- Cryptography Techniques
- Information Security
- Digital Certification and Digital Signatures
- Blockchain

### **Suggested Books:**

- **Cryptography and Network Security** by William Stallings, Pearson Publisher, 7<sup>th</sup> Edition, 2017
- **Network Security: Private Communications in a Public World** by Charlie Kaufman, Radia Perlman, Mike Speciner, and Ray Perlner, Addison-Wesley Publisher, 3<sup>rd</sup> Edition, 2020
- **Computer Security: Principles and Practice** by William Stallings and Lawrie Brown, Pearson Publisher, 5<sup>th</sup> Edition, 2024