

**SCHEME OF INSTRUCTION & EXAMINATION
B.E. III YEAR (COMPUTER SCIENCE & ENGINEERING)**

With effect from the Academic year 2013-2014

SEMESTER - II

S. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L/T	D/P		Univ. Exam	Sessionals	
THEORY								
1	CS351 UE	Design and Analysis of Algorithms	4	-	3	75	25	4
2	CS365 UE	Computer Networks & Programming	4	-	3	75	25	4
3	CS353 UE	Software Engineering	4	-	3	75	25	4
4	CS354 UE	Web Programming	4	-	3	75	25	4
5	CM355 UE	Managerial Economics and Accountancy	4	-	3	75	25	4
6	*	Elective- I	4	-	3	75	25	4
PRACTICALS								
1	CS381 UE	Computer Networks & Programming Lab	-	3	3	50	25	2
2	CS382 UE	Web Programming Lab	-	3	3	50	25	2
3	**	Summer Internship (8 weeks)	-	-	-	-	-	-
TOTAL			24	6		550	200	28

***Elective – I**

CS 355 UE Artificial Intelligence
 CS 356 UE Simulation and Modeling
 EC 254 UE Signal Analysis and Transform Techniques

** Students will be attached to industry for 8 weeks during summer. The students will be submitting a report during 4th Year I Semester whose evaluation and grading is done during 4th Year I Semester.

**SCHEME OF INSTRUCTION & EXAMINATION
B.E. III YEAR
SERVICE COURSES OFFERED TO OTHER DEPARTMENTS**

With effect from the Academic year 2013-2014

SEMESTER – II

S. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L/T	D/P			Univ. Exam	
		THEORY						
1	CS 361 UE	Operating Systems (Elective - I)	4	-	3	75	25	4

DESIGN & ANALYSIS OF ALGORITHMS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

UNIT-I

Introduction & Elementary Data Structures: Order notation, Analysis of algorithms, Review of elementary data structures–Heaps and Heap sort, Hashing. Sets – representation, UNION, FIND operations.

UNIT-II

Divide-and-Conquer Method: The general method, Binary search, Finding maximum and minimum, Merge sort, Quick sort and Selection sort.
Greedy Method: Knapsack problem, Optimal storage on tapes, Job sequencing with deadlines, Optimal merge pattern, Minimum spanning trees, Single source shortest path.

UNIT-III

Dynamic programming method and traversal techniques: Multistage graphs, All pairs shortest paths, Optimal binary search trees, 0/1 Knapsack problem, Reliability design, Traveling salesman problem, Game trees, Biconnected components and Depth first search.

UNIT-IV

Backtracking and **Branch-and-bound** methods: N-queens problem, Graph coloring, Hamiltonian cycles, Knapsack problem, 0/1 Knapsack problem, Traveling salesperson problem. Lower-bound Theory.

UNIT-V

NP-hard and NP-complete problems: Basic concepts, Non-deterministic algorithms, NP-hard graph problems and scheduling problems, NP-hard code generation problem, Decision problem, Node cover problem.

Suggested Reading:

1. Horowitz E, Sahni S, Fundamentals of Computer Algorithms, 2nd Edition, Universities Press,2007
2. Aho A.V. Hopcroft J.E, Ullman J.D, The Design and Analysis of Computer Algorithms, Addison Wesley, 1974
3. Michael T. Goodrich , Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley & Sons, 2002

COMPUTER NETWORKS & PROGRAMMING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

Objectives:

- To understand the state-of-the-art technology in network protocols, network architecture and networked systems
- To learn the design principles of network infrastructure
- To gain proficiency in network programming

Outcomes:

This course enables the student to develop and demonstrate the following

- Ability to compare different network architectures
- Ability to understand the design principles of networking
- Ability to develop applications using network programming

UNIT-I

Review of ISO OSI Reference Model and TCP/IP Architectures.

Network Layer: Design issues, Services, Internal organization, Comparison of Virtual circuits and Datagram subnets. Routing Algorithms: The Optimality principle, Shortest path routing, Flooding, Flow-based algorithms, Distance vector, Link state, Hierarchical algorithms, Broadcast and Multicast routings. Congestion control algorithms: General principles, Traffic shaping, Congestion control in virtual circuit subnets, Choke packets, Load shedding, Jitter control and Congestion control for multicasting, Quality of Service (QoS)

UNIT-II

Internet working: How networks differ, Concatenated virtual circuits, Connectionless internet working, Tunneling, Internetwork routing, Fragmentation and Firewalls.

The Network Layer of the Internet: The IP protocol, IP addresses, Subnets, Internet control protocols, Gateway routing protocols, Multicasting, CIDR.

UNIT-III

Transport Layer: Service primitives, Addressing, Establishing a connection, Releasing a connection, Flow control, Buffering, Multiplexing and Crash recovery.

Internet Transport Protocols (TCP and UDP): The TCP service model, The TCP protocol, The TCP Segment Header, TCP connection management, Transmission policy: Congestion control, Timer management and UDP, Performance issues.

UNIT-IV

Application Layer:

Domain Name System: DNS name space, Resource records, Name services.

SMTP and MIME, HTTP, SNMP, Telnet, ftp, Multimedia.

UNIT-V

Socket programming: Socket address, Elementary socket system calls, Advanced socket system calls, Reserved ports, Socket options, Asynchronous I/O, Input/Output Multiplexing, Out-of-Band data, Sockets and Signals, Internet Super Server, DNS.

Suggested Reading:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5th Edition, Pearson, 2012
2. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber Security, CRC Press, 2013
3. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 5th Edition, Addison-Wesley, 2012
4. W. Richard Stevens, Unix Network Programming, Prentice Hall/Pearson Education, 2009
5. W. Richard Stevens, Andrew M Rudoff, Bill Fenner, Unix Network Programming: Networking APIs: Sockets and XTI (Volume 1) 3rd Edition, PHI

CS353 UE

SOFTWARE ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

Objectives:

- To introduce the basic concepts of software development
- To impart knowledge on various phases, approaches and practices of software development
- To make the student industry ready with study of different techniques and tools

Outcomes:

- Working knowledge of alternative approaches and techniques for each phase of software development
- Skills necessary for independently developing a complete software project

UNIT-I

Introduction to Software Engineering:

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models.

UNIT-II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT-III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

UNIT-IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs, Mapping Data Flow into a Software Architecture.

Modeling Component-Level Design: Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-V

Software Quality Assurance: Basic Elements, Tasks, Goals and Metrics, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO 9000 Quality Standards, SQA Plan.

Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for O-O Software, Validation Testing, System Testing, The Art of Debugging.

Testing Tactics: Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods, Testing Methods applicable on the Class Level, Inter Class Test Case Design, Testing for Specialized Environments, Architectures and Applications, Testing Patterns.

Product Metrics: Software Quality, A Framework for Product Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance.

Suggested Reading:

1. Roger S.Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill, 2009
2. Ali Behforooz and Frederick J.Hudson, Software Engineering Fundamentals, Oxford University Press, 1996
3. Pankaj Jalote , An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2008

CS 354 UE

WEB PROGRAMMING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

UNIT-I

Introduction to World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, HTTP. HTML5: Introduction, Links, Images, Multimedia, Lists, Tables, Creating Forms, Styling Forms.

UNIT-II

Introduction to XML, XML document structure, Document Type Definition, Namespaces, XML Schemas, Displaying raw XML documents, Displaying XML documents with CSS, XPath Basics, XSLT, XML Processors.

UNIT-III

Introduction to Java script, Java Script and Forms Variables, Functions, Operators, Conditional Statements and Loops, Arrays DOM, Strings, Event and Event Handling, Java Script Closures. Introduction to Ajax, Pre-Ajax Java Script Communication Techniques, XML HTTP Request Object, Data Formats, Security Concerns, User Interface Design for Ajax. Introduction to Python, Objects and Methods, Flow of Control, Dynamic Web Pages.

UNIT-IV

Java Servlets: Java Servlets and CGI Programming, Benefits of Java Servlet, Life Cycle of Java Servlet, Reading data from client, HTTP Request Header, HTTP Response Header, working with Cookies, Tracking Sessions. Java Server Pages: Introduction to JSP, JSP Tags, Variables and Objects, Methods, Control Statements, Loops, Request String, User Sessions, Session Object, Cookies.

UNIT-V

Introduction to PHP: Overview of PHP, General Syntactic Characteristics, Primitives, Operations, Expressions, Control Statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session Tracking. Database access through Web: Architectures for Database Access- Database access with Perl - Database access with PHP-Database access with JDBC.

Suggested Reading:

1. Robert W. Sebesta, Programming the World Wide Web, 3rd Edition, Pearson Education, 2006
2. Wendy Willard, HTML5, McGraw Hill Education (India) Edition, 2013
3. Thomas Powell, The Complete Reference: Ajax, Tata-McGraw-Hill, 2011
4. John Pollock, Java Script, 4th Edition, McGraw Hill Education (India) Edition, 2013
5. Jim Keogh, J2EE : The Complete Reference, Tata-McGraw-Hill, 2002

CM 355 UE

MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

Objectives:

- To learn important concepts of Managerial Economics and apply them to evaluate business decisions.
- To understand various parameters that determine the consumers' behavior.
- To evaluate the factors that affect production.
- To understand the concepts of capital budgeting and payback period.
- To study the concepts of various book-keeping methods.

Unit-I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

Unit-II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked)

Unit - III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly (theory and problems can be asked)

Unit-IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked)

Unit-V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement, calculation of some ratios)

Suggested Reading:

1. Mehta P.L., Managerial Economics —Analysis, Problems and Cases , Sulthan Chand & Sons Educational Publishers, 2011
2. Maheswari S.N., Introduction to Accountancy , Vikas Publishing House, 2005
3. Pandey I.M., Financial Management , Vikas Publishing House, 2009

CS 355 UE

ARTIFICIAL INTELLIGENCE
(Elective –I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

Objectives:

- To impart knowledge of the principles of Artificial Intelligence
- To impart proficiency in the techniques for knowledge representation and inference
- To cover issues and techniques involved in the creation of Intelligent Systems.
- To cover various applications like Game Playing, Expert Systems, Machine Learning and Natural Language Processing

Outcome:

This course enables the student to develop and demonstrate the following

- Ability to analyze and think logically
- Ability to understand and analyze the working of an AI Technique
- Ability to apply the knowledge acquired in this course to build real life applications and also explore the tremendous potential for research

UNIT-I

Introduction, History, Intelligent Systems, Foundations of AI, Sub-areas of AI, Applications, Problem Solving. State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening, A*, Constraint Satisfaction. Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning

UNIT-II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming. Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames

UNIT-III

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools. Uncertainty Measure-Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT-IV

Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees (Suggested Reading 2), Deductive Learning, Clustering, Support Vector Machines.

Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.

UNIT-V

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.

Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Suggested Reading:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011
2. Russell, Norvig, Artificial Intelligence- A Modern Approach, Pearson Education, 2nd Edition, 2004
3. Rich, Knight, Nair, Artificial Intelligence, Tata McGraw Hill, 3rd Edition, 2009

CS 356 UE

SIMULATION AND MODELING
(Elective –I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

UNIT-I

Introduction to Simulation, Advantages and Disadvantages of Simulation, Areas of applications, Systems and System Environment, Concepts of a System, Discrete and Continuous Systems. Models, Types of Models, Steps in a Simulation Study-examples, Discrete-event System Simulation.

UNIT-II

Overview of Statistical Models and Queuing Systems, Programming Languages for Simulation. Continuous and Discrete Simulation Languages – FORTRAN, GPSS, SIMAN, SIMSCRIPT, SLAM and MODSIM III.

UNIT-III

Random Numbers: Generation, Properties of Random Numbers, Generation of Pseudo-random Numbers, Tests for Random Numbers, Random variate: Generation, Inverse Transformation Technique, Uniform distribution, Exponential distribution, Weibull distribution, Triangular distribution, Empirical Continuous distributions, Discrete distributions, Direct transformation for the Normal distribution, Convolution method of Erlang distribution.

Acceptance / Rejection techniques: Poisson distribution, Gamma distribution.

UNIT-IV

Input Data Analysis: Data collection-Identification of the Distribution, Parameter & Estimation. Goodness of fit tests: Chi square test-KS test. Multivariate and Time Series Input Models, Verification and Validation of Simulation models, Model building, Calibration and Validation of Models, Face Validity, Validation of Model assumptions, Validation of input/output Transformations, Input/output Validation using Historical input data, Input/output validation using Turing test.

UNIT-V

Output Data Analysis, Stochastic nature of Output data, Types of Simulation with respect to Output Analysis, Measures of Performance and their Estimation, Output Analysis for terminating simulations, Output Analysis for steady-state simulations. Comparison and Evaluation of Alternative System Designs: Comparison of several system designs, Statistical models for estimating the effect of design alternatives.

Suggested Reading:

1. Jerry Banks, John S. Carson and Barry L.Nelson , Discrete Event System Simulation, Prentice Hall of India,2001
2. Narsing Deo ,System Simulation with Digital Computers ,Prentice Hall of India,1979
3. Averill M. Law and W. David Kelton ,Simulation Modeling and Analysis ,McGraw Hill,2001

EC 254 UE

SIGNAL ANALYSIS AND TRANSFORM TECHNIQUES
(Elective –I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

UNIT-I

Definitions and classification of various signals and systems, The exponential signal, Analogy between a vector and a signal, Signal representation by a discrete set of orthogonal functions, Orthonormality and completeness, Exponential and trigonometric Fourier series, Convergence, Dirichlet's conditions, The Discrete spectrum, Application of Fourier series to electrical networks.

UNIT-II

Signal representation by continuous exponentials, The direct and inverse Fourier transform, Continuous spectrum, Existence and properties of Fourier transform, Singularity functions, Parseval's theorem.

UNIT-III

Signal representation by generalized exponentials, The Laplace transform, Properties of Laplace transform, Initial and Final value theorems, Solution of networks by Laplace transform, Response of networks to periodic excitation.

UNIT-IV

Sampling of continuous time signals, Discrete time signals, Discrete system, The Z-transform and its properties, Difference equations, Realization of discrete systems.

UNIT-V

Random signals, Continuous and discrete random variables, Stochastic processes, Auto and cross-correlation functions and their properties.

Suggested Reading:

1. B.P. Lathi, Signals and Systems, John Wiley, 1967
2. A.V. Oppenheim, A.S. Willsky, I.J. Young, Signals and Systems, Prentice-Hall, 1983
3. G.R. Cooper, C.D. McGillem, Probabilistic Methods of Signal and System Analysis, Holt, Rinehart and Winston, 1971

CS 361 UE

OPERATING SYSTEMS
(Service Course)
(Elective - I)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	4

Objectives:

- To understand CPU, Memory, File and Device managements
- To learn about concurrency control, protection and security
- To gain knowledge of Unix and Windows NT internals

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Interprocess communication, CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory management: Swapping, Contiguous allocation, Paging, Static and dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging.

File system interface: File concepts, Access methods and protection.

File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and recovery.

Protection: Goals, Domain of protection, Access matrix.

Security: Authentication, Threat monitoring, Encryption.

UNIT-IV

Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU-device interactions, I/O optimization.

UNIT-V

Case Studies:

Unix Operating system – General architecture, Unix system calls, Unix Shell, Files and directories in Unix.

Windows NT – General architecture, The NT kernel, The NT executive.

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts, Addison Wesley, 2006
2. William Stallings, Operating Systems-Internals and Design Principles, 5th edition, PHI, 2005
3. Andrew S Tanenbaum, Modern Operating Systems, PHI, 1996

CS 381 UE

COMPUTER NETWORKS & PROGRAMMING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

1. Examples using IPC
2. Echo Server using TCP(Concurrent or Iterative) and UDP
3. Time of the day server
4. Talker and Listener
5. Ping routine
6. Trace route
7. Mini DNS

Note: The above experiments [2-7] have to be carried out using socket programming interface. Multi-threading has to be employed wherever it is required.

CS 382 UE

WEB PROGRAMMING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

1. Develop College Website using HTML5 and CSS
2. Develop HTML5 form with client validations using Java Script
3. Publishing XML document using XSLT
4. XML document processing using SAX and DOM
5. Write a program to encrypt the given number to display the encrypted data using Java Script
6. Write a Python program which generates an output file based on one-line instructions in an input file
7. Develop a simple Java Servlet application
8. Develop a Java Servlet application with session tracking
9. Develop a simple JSP application
10. Creation of an application to have access from a database using JDBC
11. Develop a full-fledged web application with database access spreading over to 3 sessions
12. Write a web application using Ajax to do the following:
 - A. check to make sure that the credit card number is composed of exactly 16 numerical digits
 - A check to make sure that a Visa card number starts with a "4" and a MasterCard number starts with a "5"

You can check for these things using regular expressions in combination with the PHP function `preg_match`. A really good regex will allow for an optional “-“ between every grouping of 4 numbers. For example, 4111111111111111 and 4111-1111-1111-1111 would both be valid credit card numbers. If the user has not supplied a card number with the correct number of digits, show an error message.