Deenbandhu Chhotu Ram University of Science & Technology,
Murthal (Sonepat) SCHEME OF STUDIES & EXAMINATIONS
B.Tech. 3rd YEAR (SEMESTER –VI) COMPUTER SCIENCE AND ENGINEERING
Choice Based Credit System Scheme of Studies & Examinations w.e.f. 2020-21

Sl. No.	Course Code	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credits	Duration of Exam
			L	T	P		Theory	Practical			
1.	CSE302C	Compiler Design	3	0	0	25	75	0	100	3	3
2.	PEC-II	Program Elective-II	3	0	0	25	75	0	100	3	3
3.	PEC-III	Program Elective-III	3	0	0	25	75	0	100	3	3
4.	OEC-I	Open Elective-I	3	0	0	25	75	0	100	3	3
5.	OEC-II	Open Elective-II (Humanities)	3	0	0	25	75	0	100	3	3
6.	CSE382C	Compiler Design Lab	0	0	4	25	0	75	100	2	3
7.	PEC-II Lab	Program Elective-II Lab	0	0	4	25	0	75	100	2	3
Total			**15**	**0**	**8**	**175**	**375**	**150**	**700**	**19**	**21**

For B.Tech (Hons) degree the students will study the following subjects in addition to the subjects mentioned above.

SEMESTER-VI											
Sl. No.	**Course Code**	**Course Title**	**Teaching Schedule**			**Marks of Class work**	**Examination Marks**		**Total**	**Credits**	**Duration of Exam**
			L	**T**	**P**		**Theory**	**Practical**			
B.Tech. (Hons.) in CSE with specialization in Blockchain (H1)											
1.	CSEH302C	Cryptocurrency with Ethereum	3	0	0	25	75	0	100	3	3
2.	CSEH382C	Cryptocurrency with Ethereum Lab	0	0	4	25	0	75	100	2	3
3.	CSEH304C	Foundations of Blockchain Technology	3	0	0	25	75	0	100	3	3
B.Tech. (Hons.) in CSE with specialization in Cyber Security (H2)											
1.	CSEH306C	Information Security and Data Hiding	3	0	0	25	75	0	100	3	3
2.	CSEH386C	Information Security and Data Hiding Lab	0	0	4	25	0	75	100	2	3
3.	CSEH308C	Mobile and Smart Forensics	3	0	0	25	75	0	100	3	3

B.Tech. (Hons.) in CSE with specialization in Data Science (H3)											
1.	CSEH310C	Data Analytics with Python	3	0	0	25	75	0	100	3	3
2.	CSEH390C	Data Analytics with Python Lab	0	0	4	25	0	75	100	2	3
3.	CSEH312C	Data Mining	3	0	0	25	75	0	100	3	3
Total(H1/H2/H3)			**6**	**0**	**4**	**75**	**150**	**75**	**300**	**8**	**9**

Program Elective-II

Course Code	Course Title	Course Code	Course Title
CSE324C	Mobile Applications Development	CSE330C	IoT Architecture & Protocols [4]
CSE326C	Digital Image Processing	CSEH306C	Information Security and Data Hiding[2]
CSE328C	Advanced Java	CSEH310C	Data Analytics with Python[3]

Program Elective-II Lab

Course Code	Course Title	Course Code	Course Title
CSE384C	Mobile Applications Development Lab	CSE390C	IoT Architecture & Protocols Lab
CSE386C	Digital Image Processing Lab	CSEH386C	Information Security and Data Hiding Lab[2]
CSE388C	Advanced Java Lab	CSEH390C	Data Analytics with Python Lab[3]

Program Elective-III

Course Code	Course Title	Course Code	Course Title
CSE340C	Artificial Intelligence and Expert System	CSEH304C	Foundations of Blockchain Technology[1]
CSE342C	Advanced Computer Networks	CSEH312C	Data Mining[3]
CSE344C	Software Testing		

[1]Not to be opted by B.Tech (Hons) students opting specialization in Blockchain. [2]Not to be opted by B.Tech(Hons) students opting specialization in Cyber Security [3]Not to be opted by B.Tech(Hons) students opting specialization in Data Sciences [4]Not to be opted by B.Tech(Hons) students opting specialization in IoT

NOTE:

1. Students will be permitted to opt for any one elective each from the list of Program Elective-II and Program Elective-III. The minimum strength of the students should be 20 to run an elective course.
2. The student pursuing B.Tech (Hons.) will choose subjects as per the specialization opted in the V semester.
3. The students pursuing B.Tech (Hons.) can choose one subject each from the list of Program Elective –II and Program Elective – III except already opted as per the specialization (Blockchain (H1), Cyber security (H2) and Data Science (H3)). The students should choose different subjects.

Each student has to undergo Professional Training (Level-3) of at least 4 weeks from the industry, institute, research lab, training centre etc. during summer vacation and its evaluation shall be carried out in the VII semester.

4. Students will be permitted to opt for one elective each from the list of Open Elective-I and Open Elective-II that are run by other departments. The minimum strength of the students should be 20 to run an elective course.
5. Students will be allowed to use non-programmable scientific calculator. However, sharing of calculators will not be permitted in the examinations.

OPEN ELECTIVES

Open Elective-I			Open Elective-II		
No	**ourse No.**	**ourse Title**	**No**	**ourseNo.**	**Course Title**
1.	HUM350C	Communication Skills for Professionals (Except BME & BTE)	1.	CSE305C	Computer Networks
2.	HUM352C	Soft Skills And Interpersonal Communication	2.	CSE431C	Cyber Security
3.	MGT402C	Human Values, Ethics And IPR	3.	CHE457C	Industrial Safety
4.	MGT404C	Human Resource Management	4.	CE406C	Disaster Management
5.	HUM354C	Introduction To French Language	5.	ECE327C	Consumer Electronics
6.	HUM356C	Introduction To German Language			

SYLLABUS: B Tech (CSE)

Department: Computer Science & Engineering – 6thSemester

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	-	-	3	25	75	3 hours	100

Subject: Compiler Design **Subject Code: CSE302C**

UNIT-I

Introduction:

Topic no.1:Compilers and translators need of translators,
Topic no.2: Structure of compiler: its different phases,
Topic no.3: Compiler construction tools**.**

Lexical Analysis:

Topic no.4:Role of lexical analyzer; Design of lexical analyzer;
Topic no.5: Regular expressions ; Specification and recognition of tokens;
Topic no.6:Input buffering; Finite automata;
Topic no.7: Conversion from regular expression to finite automata, and vice versa;
Topic no.8: Minimizing the number of states of DFA, Implementation of lexical analyzer.

UNIT-II

Syntactic Techniques & Parsing:

Topic no.9: Context free Grammars; Derivations & parse trees;
Topic no.10: Capabilities of CFGs; Role of parsers, Shift- Reduce Parsing ;
Topic no.11 Operator precedence parsing; top down parsing;
Topic no.12:Predictive parsing, LR parsers; LR(0) items SLR,
Topic no.13:LALR and Canonical LR parser.

UNIT-III

Syntax Directed Translation , Symbol Table & Error Handling :

Topic no.14:Syntax directed definition, construction of syntax trees,
Topic no.15:Syntax directed translation scheme,
Topic no.16:Implementation of syntax directed translation,
Topic no.17: Intermediate Code ;Parse trees & Syntax trees;
Topic no.18: Three address code, quadruples and triples;
Topic no.19: Translation of Boolean Expressions.
Topic no.20:Symbol tables, its contents and data structure for symbol tables;
Topic no.21: Trees, arrays, linked lists, hash tables ;
Topic no.22: Operations on symbol table;
Topic no.23: Errors(lexical phase error, syntactic phase error, semantic error).

UNIT-IV

Code Optimization & Code Generation:

Topic no.24:Sources of code optimization;
Topic no.25: Loop optimization (Denominators, Reducible flow graphs,)
Topic no.26:(Depth first search,loop invariant computation,Induction variable elimination)
Topic no.27: Directed acyclic representation of basic blocks Code generation,
Topic no.28: Forms of objects code, machine dependent code,
Topic no.29:Register allocation for temporary and user defined variables;
Topic no.30: Problems in code generation; Peephole optimization

TEXT / REFERENCE BOOKS:

1. **Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi& J.D. Ullman; - 1998Ad heory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.**

For students admitted in B Tech 1st year (C-Scheme) in 2019 and all training students:

Examination and evaluations of students shall be conducted as per guidelines AICTE Examinations reforms covering the entire syllabus. The students shall be made aware about the reforms.

Course Outcomes:

1. Students will get the concepts of Compilers and the actual roles of the lexical analyzer
2. Students will get the concepts of different Parsing techniques and Construction of syntax trees
3. Students will get the concepts of Type checking and Run time environments
4. Students will get the concepts of Intermediate code generation, Code optimization and Code generations

SYLLABUS: B Tech (CSE)

Department: Computer Science & Engineering – 6thSemester

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	-	-	3	25	75	3 hours	100

Subject: Mobile Applications Development **Subject Code: CSE324C**

UNIT-II

Infrastructure:

Topic no.10:Describe mobile and cell phone technologies (CDMA, GSM, 3G, 4G),
Topic no.11:Compare and contrast 3G and 4G,
Topic no.12:Internet terms: IP address, subnet mask, gateway,
Topic no.13: DNS, static vs Dynamic IP, transport including HTTP, routing,
Topic no.14: Secure connections, proxies and reverse proxies.
Topic no.15:Need for storage, local Storage, storage on Web.

UNIT-III

HTML/CSS/DOM and Scripting:

Topic no.16:Basic HTML: validation, rendering and web browser,
Topic no.17: Cascading Style Sheets (CSS) and how to use them,
Topic no.18: Document object model (DOM):
Topic no.19:Document, objects, model, DOM tree and DOM's utilization in web design,
Topic no.20: Basic JavaScript code and constructs of the JavaScript language.

UNIT-IV

Designing mobile user interfaces and Mobile Platforms:

Topic no.21: Design mobile interfaces, usability, ways to test user interfaces,
Topic no.22: Various types of user interfaces for mobile apps:
Topic no.23: Interactive voice response (IVR), SMS/MMS, Mobile web,
Topic no.24: Native applications, Hybrids,
Topic no.25:Mobile application development design considerations:
Topic no.26:Text entry, screen size, user interface and user context.
Topic no.27:Mobile Platforms: URIs for mobile apps,
Topic no.28: Compare and contrast native mobile platforms such as tightly controlled (IPhone),
Topic No. 29: Open (Android), and licensed (Windows Mobile), web as a mobile application.

Text Book:

Lauren Darcey and Shane Conder, "Android Wireless Application

1. **Gordon Schulmeyer, Zero Defect Software , McGraw-Hill, New York, 1990.**
2. **Watts Humphrey, Managing the Software Process , Addison Wesley Pub. Co. Inc., Massachusetts, 1989.**

Note:

In semester Examinations, the examiner will set two questions from each unit (total 8 questions in all) covering the entire syllabus. The students will be required to attempt only five questions selecting at least one question from each unit.

For students admitted in B Tech 1st year (C-Scheme) in 2019 and all training students:
and evaluations of students shall be conducted as per guidelines AICTE Examinations reforms covering the entire syllabus. The students shall be made aware about the reforms

Course Outcomes:

After completing the course the student will be able to:

1. Have an ability to apply software testing knowledge and engineering methods and design and conduct a software test process for a software testing project.
2. Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.
3. Have an ability to use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.
4. Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems

SYLLABUS: B Tech (CSE)

Department: Computer Science & Engineering 6thSemester

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	-	-	3	25	75	3 hours	100

Subject: Communication Skills for Professionals **Subject Code: HUM350C**

UNIT I

Mechanics of Report Writing:

Topic no.1:Objectives of Report Writing
Topic no.2:Types of Reports on the basis of forms and content.
Topic no.3: Introduction to Formats of Report
Topic no.4:Structure of Reports: Front Matter, Main Body, Back Matter

UNIT II

Writing Business and Technical
Topic no.5:Preliminary Strategies for Report Writing: Data Collection,
Topic no.6:Report Planning, Use of Illustrations, Point Formation,
Topic no.7:Preparing Notes/Drafts Using Appropriate Formats: Memo Format,
Topic no.8: Letter Format, Manuscript Format, Printed Forms

UNIT III

Oral Communication and Soft Skills:

Topic no.9: Group Discussions;
Topic no.10: preparation and facing them Professional:
Topic no.11: Power Point Presentation, Oral Presentation,
Topic no.12: Role of Kinesics (Body Language) in Communication,
Topic no.13: General Etiquettes in Office areas,
Topic no.14: Corporate lunch and dinner Handling, Telephone calls

UNIT IV

Resumes and Job application:

Topic no.15:Writing of Resume--Chronological Resume
Topic no.16: Request for Reference/Recommendation,
Topic no.17: Writing Application Letters for Job; Writing Covering letter

RECOMMENDED READING

1. Sharma,Sangeeta, and Binod Mishra. Communication PHI,2009. Skills for Engineers and Scientists.
2. Tyagi,Kavita, and Padma Mishra. Advanced Technical Communication. PHI, 2011.
3. Rizvi, M. Ashraf. Effective Technical Communication. McGraw Hill Education,2014.
4. Kumar, Sanjay, and PushpLata. Communication Skills. OUP, 2011.

Department: Computer Science & Engineering 6thSemester

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	-	-	3	25	75	3 hours	100

Subject: Software Testing **Subject Code: CSE344C**

UNIT I

Introduction:-
Topic no.1: What is software testing and why it is so hard?
Topic no.2:Error, Fault, Failure, Incident, Test Cases, Testing Process,
Topic no.3: Limitations of Testing, No absolute proof of correctness,
Topic no.4:Overview of Graph Theory.
Functional Testing:-
Topic no.5: Boundary Value Analysis, Equivalence Class Testing,
Topic no.6:Decision Table Based Testing, Cause Effect Graphing Technique.

UNIT- II

Topic no.7:Path testing, DD-Paths, Cyclomatic Complexity,
Structural Testing:-
Topic no.8:Graph Metrics, Data Flow Testing, Mutation testing.
Testing Activities:-
Topic no.9: Unit Testing, Levels of Testing, Integration Testing,
Topic no.10:System Testing, Debugging, DomainTesting.

UNIT- III

Reducing the number of test cases:-
Topic no.11: Prioritization guidelines, Priority category, Scheme,
Topic no.12:Risk Analysis, Regression Testing, and Slice based testing.
Object Oriented Testing:-
Topic no.13: Issues in Object Oriented Testing, Class Testing,
Topic no.14:GUI Testing, Object Oriented Integration and System Testing.

UNIT- IV

Testing Tools:
Topic no.15: Static Testing Tools, Dynamic Testing Tools,
Topic no.16: Characteristics of Modern Tools and Implementation with example.
Topic no.17: Advanced topics in software testing: web based testing,
Topic no.18: Client server testing, Automated test cases generation,
Topic no.19: Regular expression and FSM based testing.

TEXT/ REFERENCE BOOKS:

1. William Perry, Effective Methods for Software Testing , John Wiley & Sons, New York, 1995.
2. Cem Kaner, Jack Falk, Nguyen Quoc, Testing Computer Software , Second Edition, Van Nostrand Reinhold, New York, 1993.
3. Boris Beizer, Software Testing Techniques , Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, Software Testing , Pearson Education Asia, 2002
5. Roger S. Pressman, Software Engineering – A Practitioner's Approach , Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
6. Boris Beizer, Black-Box Testing – Techniques for Functional Testing of Software and Systems , John Wiley & Sons Inc., New York, 1995.

7. K.K. Aggarwal & Yogesh Singh, Software Engineering , New Age International Publishers, New Delhi, 2003.
8. Marc Roper, Software Testing , McGraw-Hill Book Co., London, 1994.
9. Gordon Schulmeyer, Zero Defect Software , McGraw-Hill, New York, 1990.
10. Watts Humphrey, Managing the Software Process , Addison Wesley Pub. Co. Inc., Massachusetts, 1989.

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Course Outcomes:
After completing the course the student will be able to:

1. Have an ability to apply software testing knowledge and engineering methods and design and conduct a software test process for a software testing project.
2. Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.
3. Have an ability to use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.
4. Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems

Campus:
Puran Murti Campus
Kami Road, Sonepat (Delhi-NCR), Haryana - 131001, India
Contact no.:7438900900
Website: www.puranmurti.com
E-mail: info@puranmurti.com

Study Scheme				Evaluation Scheme			Total Marks
Lectures per week				Internal Assessment	External Assessment (Examination)		
L	T	P	Credits	Max. Marks	Max. Marks	Exam Duration	
3	-	-	3	25	75	3 hours	100

Subject: Computer Networks **Subject Code: CSE305C**

UNIT- I

OSI Reference Model and Network Architecture:

Topic no.1 Introduction to Computer Networks, Example Networks ARPANET,
Topic no.2: Internet, Private Networks
Topic no.3:Network Topologies: Bus, Star, Ring, Hybrid, Tree, Complete, Irregular –Topology;
Topic no.4:Types of Networks: Local Area Networks, Metropolitan Area Networks,
Topic no.5:Wide Area Networks; layering architecture of networks
Topic no.6: OSI model, Functions of each layer, Services and Protocols of each layer.

UNIT-II

TCP/IP:

Topic no.7 Introduction, History of TCP/IP, Layers of TCP/IP,
Topic no.8: Protocols, Internet Protocol, Transmission Control Protocol ,
Topic no.9: User Datagram Protocol, IP Addressing, IP address classes,
Topic no.10: Subnet Addressing, Internet Control Protocols, ARP, RARP, ICMP
Topic no.11 Application Layer, Domain Name System,
Topic no.12:Email – SMTP, POP,IMAP; FTP, NNTP, HTTP, Overview of IP version 6.

UNIT-III

Local Area Networks:

Topic no.13: Introduction to LANs, Features of LANs, Components of LANs,
Topic no.14: Usage of LANs, LAN Standards, IEEE 802 standards,
Topic no.15: Channel Access Methods, Aloha, CSMA
Topic no.16: Token Passing, Ethernet, Layer 2 & 3 switching,
Topic no.17: Fast Ethernet and Gigabit Ethernet, Token Ring,
Topic no.18: LAN interconnecting devices: Hubs, Switches, Bridges, Routers, Gateways.

UNIT-IV

Wide Area Networks:

Topic no.19:Introduction of WANs, Routing, Congestion Control,
Topic no.20: WAN Technologies, Distributed Queue Dual Bus (DQDB),
Topic no.22:Asynchronous Transfer Mode (ATM),
Topic no.23:Frame Relay, Wireless Links

Introduction to Network Management:

Topic no.24:Management, Class of Service, Quality Firewalls, VLANs, Proxy Servers.
Topic no.25:Remote Monitoring Techniques: Polling, Traps,
Topic no.26: Performance of Service, Security management, Digital signatures, SSL

Text Book/ Reference Books:

1. **Computer Networks (3rd edition), Tanenbaum Andrew S., International edition, 1996.**
2. **Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred, 2000, Addison Wesley, Low Price Edition.**
3. **Business Data Communications, Fitzgerald Jerry, Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2nd Edition.**

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For students admitted in B Tech 1st year (C-Scheme) in 2019 and all training students:

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Course Outcomes:

After successful completion of the course, students will be able to:

1. Understand the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks.
2. Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
3. Design a network routing for IP networks.
4. Demonstrate proper placement of different layers of ISO model and illuminate its function and determine proper usage of the IP address, subnet mask and default gateway in a routed network.

Subject Code: CSE382C **Subject: COMPILER DESIGN LAB**

B. Tech. Semester – VI (Computer Science and Engg.)

L	T	P	Credits			
0	0	4	2	Class Work	:	25 Marks
				Examination	:	75Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

Course Objectives:

1. To acquire knowledge in different phases and passes of Compiler.
2. To use the Compiler tools like LEX, YACC, etc.
3. To design different types of compiler tools to meet the requirements of the realistic constraints of compilers.
4. To use Top-down and Bottom-up parsers. Construction of LL, SLR, CLR and LALR parse table.

List of Practicass:

1. Practice of LEX/YACC of compiler writing.
2. Write a program to check whether a string belong to the grammar or not.
3. Write a program to generate a parse tree.
4. Write a program to find leading terminals.
5. Write a program to find trailing terminals.
6. Write a program to compute FIRST of non-terminal.
7. Write a program to compute FOLLOW of non-terminal.
8. Write a program to check whether a grammar is left Recursion and remove left Recursion.
9. Write a program to remove left factoring.
10. Write a program to check whether a grammar is operator precedent.
11. To show all the operations of a stack.
12. To show various operations i.e. red, write and modify in a text file.

Course Outcomes:

After completing the course the students will be able to:

1. Understand the concepts of Compilers
2. Understand the concepts of The actual roles of the lexical analyzer
3. Understand the concepts of different Parsing techniques and Construction of syntax trees
4. Understand the concepts of Type checking

Subject Code: CSE384C **Subject: MOBILE APPLICATIONS DEVELOPMENT LAB**

B. Tech. Semester – VI (Computer Science and Engg.)

L	T	P	Credits			
0	0	4	2	Class Work	:	25 Marks
				Examination	:	75 Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

Course Objectives:

1. To describe and compare different mobile application models/architectures and patterns.
2. To apply mobile application models/architectures and patterns to the development of a mobile software application.
3. To describe the components and architecture of a mobile development framework (Google's Android Studio).
4. To apply a mobile development framework to the development of a mobile application.

List of Practicals:

1. Getting Started with Android Development.
2. Activities and Views: Android Manifest.xml, Activity Class, Basic View Components: Layouts and Buttons.
3. Navigation with Data: Working with Intent, Sharing Data Between Activities, Application Class.
4. Android Resources: String Resources, Loading Strings in XML, Loading Strings in Code, The Resource Values Folder.
5. Drawables - Image Basics, Drawable Folders and Qualifiers, Dimensions, Image Padding, The ImageButton Widget.
6. Lists: Implementing an Android List, ListView, ListActivity, Empty Lists, ListAdapter, Sorting the Adapter, Overriding ArrayAdapter, List Interaction.
7. Dialogs, New and Old: AlertDialog, Custom Dialog, Support Library, Fragments, DialogFragment
8. Menus: Options Menu, Modifying an Options Menu, Context Menu.
9. Saving Data with Shared Preferences: Shared Preferences, Getting Started with SharedPreferences, PreferenceActivity.
10. Saving Data with a Database: Setting Up SQLite, Creating a Helper, using the Helper, Cursor and CursorAdapater.
11. Threading with AsyncTasks: Threading in Android, AsyncTask, Tracking Progress.
12. Styles and Themes: Introduction to Styling: Defining Styles, Defining Themes, Style Inheritance, Direct Theme References.

Course Outcomes:

After completing the course the student will be able to:

1. Understand the concepts of mobile application models/architectures and patterns.
2. Apply mobile application models/architectures and patterns to the development of a mobile software application.
3. Understand the components and architecture of a mobile development framework (Google's Android Studio).
4. Apply a mobile development framework to the development of a mobile application.

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