Government of Karnataka
Department of Collegiate and Technical Education

C-20 Second Year Diploma Curriculum
Information Science and Engineering

Curriculum Development Cell, DTE
2021-22

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Curriculum Structure

III Semester Scheme of Studies- Diploma in Information Science and Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	Hours per week			Total contact hrs /week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min					
Integrated Courses																	
1	PC/CS	20IS31P	Python Programming	3	1	4	8	6	60	24	40	16	100	40			Both SGPA & CGPA
2	PC/CS	20IS32P	Computer Hardware, Maintenance and Administration	3	1	4	8	6	60	24	40	16	100	40			
3	PC/CS	20IS33P	Computer Networks	3	1	4	8	6	60	24	40	16	100	40			
4	PC/CS	20IS34P	Database System Concepts and PL/SQL	3	1	4	8	6	60	24	40	16	100	40			
Audit Course																	
5	AU/KA	20KA31T	ಸಾಹಿತ್ಯ ಸಿಂಚನ-II/ ಬಳಕೆ ಕನ್ನಡ-II	2	0	0	2	2	50	20	-	-	50	20			
			Total	14	4	16	34	26	290	116	160	64	450	180			

PC: Programme Core:: AU-Audit Course:: KA: Kannada:: L: Lecture:: T: Tutorial:: P: Practice

IV Semester Scheme of Studies- Diploma in Information Science and Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	Hours per week L	T	P	Total contact hrs /week	Credits	CIE Marks Max	Min	SEE Marks Max	Min	Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
			Integrated Courses														
1	PC/CS	20IS41P	Data structures with Python	3	1	4	8	6	60	24	40	16	100	40			Both SGPA & CGPA
2	PC/CS	20IS42P	Operating System and Administration	3	1	4	8	6	60	24	40	16	100	40			
3	PC/CS	20IS43P	Object Oriented Programming and Design with Java	3	1	4	8	6	60	24	40	16	100	40			
4	PC/CS	20IS44P	Software Engineering principles and practices	3	1	4	8	6	60	24	40	16	100	40			
			Audit Course														
5	AU/CS	20IS45T	Indian Constitution	2	0	0	2	2	50	20	-	-	50	20			
	Total			14	4	16	34	26	290	116	160	64	450	180			

*PC: Programme Core:: AU-Audit Course:: L: Lecture:: T: Tutorial:: P: Practice

3RD SEMESTER

Programme	Information Science and Engineering	Semester	III
Course Code	20IS31P	Type of Course	Programme Core
Course Name	**Python Programming**	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale

Computer programming is the core of the computer science and strong fundamentals of programming can give competitive edge in this technology driven world. It not only instils coding skills but also enhances problem solving ability. Python is one of the programming languages which is versatile and feature rich yet simple and easy to learn, has applications in various domains. Python programming sets the basis for further study of web development, data science, IoT, machine learning etc.

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Install the latest version of python distribution and configure it for an appropriate workspace as needed for a given project.
CO-02	Write a program by selecting python constructs needed to solve a given problem and then code, execute, test and debug the program to obtain the desired result.
CO-03	Demonstrate how a program can be optimized by using modular programming approach.
CO-04	Identify and resolve both syntactical and semantic errors in a given code snippet.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,2	1,4	**Fundamental Concepts:** brief history; features; applications of python; python distributions; versions; python IDEs; Python interpreter; Execution of python programs, debugging python code; Indentation, Comments; best practices for python programming; Character set; tokens; keywords, variables, naming rules for variables, Assignment,	Refer Table 1	1. Setup python environment 2. Executing python: explore different ways to run python program 3. debug python code
2	2,4	1,2,4	**Basics I/O operations** Input- input (), raw_input() ; output – print (), formatting output. **Datatypes**		1. Code, execute and debug programs that a) Use i/o statements

			Scalar type: Numeric (int, long, float, complex), Boolean, bytes, None; Type casting **Operators** Arithmetic, Comparison/Relational, Logical/Boolean, Bitwise; string operators; Expressions and operator precedence		b) Evaluate expressions and displays formatted output c) Evaluate expressions to examine the operator precedence 2. Identify and resolve syntactic and semantic issues in the given code snippet
3	2,4	1,2,4	**Control Flow: Conditional blocks** If statement: general format; Multiway branching; Sufficient examples;		1. Identify and Code, execute and debug programs using conditional statements. 2. Identify and resolve syntactic and semantic issues in the given code snippet
4	2,4	1,2,4	**Control Flow: Loops** While loop: general format; examples For loop: general format, examples. Range();nesting loops and conditional statements; Controlling loop execution: Break, continue, pass statements;		1. Code, execute and debug programs using loops. 2. Code, execute and debug programs using loops and conditional statements 3. Identify and resolve syntactic and semantic issues in the given code snippet
5	2,4	1,2,4	**Data Collections** Concept of mutability Set – features, declaration, initialization, operations, comprehension; Tuple-features; declaration, initialization, basic operations; indexing; slicing; built in functions; Nested tuples;		1. Code, execute and debug programs to perform following ▪ set operations ▪ set comprehension 2. Code, execute and debug programs to perform following ▪ basic operations on tuples ▪ tuple indexing and slicing 3. Identify and resolve syntactic and semantic issues in the given code snippet
6	2,4	1,2,4	**List** features; declaration, initialization, basic operations; indexing; List iterations; Slicing; built in functions; Nested Lists; Comprehensions; Applications		1. Write code snippet to perform following on List ▪ basic operations on List ▪ indexing and slicing ▪ comprehension

					2. Identify and resolve syntactic and semantic issues in the given code snippet
7	2,4	1,2,4	**Dictionary** features; declaration, initialization, basic operations; indexing; adding and removing keys, iterating through dictionaries; built in functions; Comprehensions; Applications		1. Code, execute and debug programs to perform basic operations on Dictionary 2. Code, execute and debug programs to perform Dictionary indexing Iterating comprehension 3. Identify and resolve syntactic and semantic issues in the given code snippet
8	2,4	1,2,4	**Arrays and Strings** Arrays: features; create, initialize, indexing, traversal, manipulation; Strings: create, assign, indexing, built in functions;		1. Code, execute and debug programs to perform string manipulation 2. Code, execute and debug programs to perform array manipulation 3. Identify and resolve syntactic and semantic issues in the given code snippet
9	2,3,4	1,2,4	**Functions** Need of function; types; define function, calling function, function arguments; return and yield; None keyword; Scope of variables; Recursion; anonymous functions; sufficient examples;		1. Code, execute and debug programs to solve the given problem using built in functions 2. Code, execute and debug programs to solve the given problem by defining a function 3. Code, execute and debug programs to solve the given problem using recursion 4. Define anonymous function and code to solve the given problem 5. Identify and resolve syntactic and semantic issues in the given code snippet
10	2,3,4	1,2,4	**Modules and Packages**		1. Create Modules and Packages

1			Why modules? Module creation; Importing modules; Module Namespace; Packages: basics; path setting; Package __init__.py Files; Commonly used modules: Math, random; Emoji;		2. Code, execute and debug programs using built in modules
11	2,3,4	1,2,4	**NumPy** Brief about NumPy module; NumPy arithmetic functions; NumPy array manipulation functions; NumPy statistical functions; **Pandas** Introduction, series, data frame; Create dataframes; formatting data; fundamental data frame operations;		1. Code, execute and debug programs using NumPy module. 2. Code, execute and debug programs using series. 3. Code, execute and debug programs using dataframes. 4. Identify and resolve syntactic and semantic issues in the given code snippet
12	2,3,4	1,2,4	**Files** Concept; features; file operations; Opening Files; Closing Files; Writing to Files; Reading to Files; File methods; Working with files using data frame.		1. write code snippet to perform following operations on different types of files ▪ read file ▪ write to file. 2. Write code to perform file operations using dataframes on different file types. 3. Identify and resolve syntactic and semantic issues in the given code snippet
13	2,3,4	1,2,4	**Error and Exception Handling:** Python errors; exceptions: built in, user defined. How to catch exceptions? Raising exceptions;		1. Integrate exception handling into above code 2. Write code snippet to raise exceptions 3. Identify and resolve syntactic and semantic issues in the given code snippet
Total in hours		39		13	52

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

Sl no	Activity
1	1. Compare and contrast excel and python 2. Identify various python IDEs and identify differences between them.
2	1. Identify use cases like reading student name and contact details and display in a required format 2. Compare and contrast input () and raw_input() and identify its appropriate use.

	3. Identify use of operators and develop algorithms to solve the same 4. Compare and contrast different types of operators	
3	1. Identify use cases that involve decision making and develop algorithms to solve the same 1. Identify common syntactical errors when using control flow statements	
4	1. Identify use cases that involve iteration and develop algorithms to solve the same 2. Compare and contrast different types of loops 2. Identify common syntactical errors when using loops	
5	1. Identify use cases and solve them using sets 2. Identify use cases and solve them using tuples 3. Identify common syntactical errors when working with sets and tuples	
6	1. Identify use cases and solve them using List 2. Identify common syntactical errors when working with List 3. Reimplement built in list functions	
7	1. Identify use cases and solve them using dictionary 2. Reimplement built in dictionary functions 3. Identify common syntactical errors when working with dictionary	
8	1. Identify use cases and solve them using arrays 2. Reimplement built in string functions 3. Identify common syntactical errors when working with arrays and strings	
9	1. Optimize previously written programs by using modular programming approach	
10	1. Identify and present pros and cons of modules and packages 1. Explore and present python built in modules.	
11	1. Identify the applications of Pandas 2. Perform data analysis using Pandas module on a dataset such as .	
12	1. Identify use cases on files concept and develop algorithms to solve the same 2. Explore regular expressions and present how they can be used for file manipulation	
13	3. Compare and contrast error and exception. 4. Rewrite the programs using exceptions if needed	

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Python Programming**	Test	I/II/III	Sem	III/IV
Course Code	**20IS31P**	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			

	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Core python programming, Wesley J. Chun Publisher: Prentice Hall PTR
2	Fluent Python by Luciano Ramalho
3	https://www.softcover.io/read/e4cd0fd9/conversational-python
4	https://realpython.com/
5	https://www.python-course.eu/
6	https://www.datacamp.com/
7	https://www.w3schools.com/

8. CIE Skill Test and SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Develop an algorithmic solution for the given problem statement based on the documentation of each of the steps involved, including input, output and logic.	20
2	Write program for the above given problem choosing relevant python constructs.	20
3	Code, execute, test and debug the above program.	30
4	Demonstrate how your program has solved the given problem In the event of, a student fails to get the desired result (with no syntactical and least semantic errors), the examiner shall use viva voce to assess the student's problem-solving and python programming skills	20
5	Portfolio evaluation based on aggregate of all practice sessions	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Python 3.8		20
2	Editor such as iPython, Jupyter, spider, PyCharm , google CoLab		20
3	Computers		20

Programme	Information Science and Engineering	Semester	III
Course Code	**20IS32P**	Type of Course	Programme Core
Course Name	**Computer Hardware, Maintenance and Administration**	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1. Rationale

Professional computer maintenance ensures computer hardware and software systems run efficiently to increase productivity while lowering the chances of downtime. This course aims to help understand the internal working of computers/laptops and prepare the student for a role as an entry-level IT support technician. This course sets a basis for different facets of information technology like computer hardware, software, trouble shooting and customer service.

2. Course Outcomes: At the end of this course, students will be able to:

CO-01	Assemble a computer as per given technical specifications following all necessary safety protocols and install, configure and setup an administrator for a Windows Operating System.
CO-02	Diagnose a computer using the right diagnostic tools, identify the hardware problem and troubleshoot to resolve the problem following all safety protocols.
CO-03	Diagnose an installed software using the right diagnostic tools, identify the bug/issue, troubleshoot to resolve bugs/issues and ensure all data and applications are backed up before troubleshooting.
CO-04	Explain e-waste protocols to be followed while disposing computer hardware, to ensure compliance with all required state pollution control board regulations.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	01	1, 4	**I/O devices and Interfaces** Types of I/O devices and ports on astandard PC for connecting I/O devices. Function of serial port, parallel port, and brief principle of communication through these ports,types of devices that can be connected and interface standards. Explain basic cable types, features and their purposes. Importance of USB and HDMI interfaces- Types and Features. Working of Common	Refer Table 1	1. Hardware Identification: • Computer Case- Types, Features- Front panel, back panel; A look inside the computer case. • Identify the front and rear panel controls andports on a PC cabinet. • Identify and understand different cables and connectors:Video cables- VGA, HDMI, Mini-HDMI, Display port, DVI; Peripheral cables- Serial; Hard drive cables- SATA, PATA, IDE,

4			Input/Outputdevices- Keyboard, Mouse, display monitor, printer and speaker.		SCSI; Adapters-DVI to HDMI, USB to ethernet, DVI to VGA. • Installation of a localprinter. • Shared printer. • Installing wireless andcloud printers.
2	01	1,4	**Power supplies** Safety Basics: safety protocols; anti- static basic hand tools, Know the danger of static electricity, power variation; Precautions to be taken while mounting and unmounting power supply into/ from the cabinet;DC power source to PC - Need for SMPS, Specifications, Ratingof SMPS based on type of motherboard and devices used (AT/ATX, Micro ATX, mini ATX, higher watts PSU for gaming PC), color coding adopted, Types of connectors used- ATX, ATX12V, Molex, SATA, PCIe; Output voltage levels, measuring technique; choosing power supply based on wattage rating; Heat sink; 80 plus rating system; Modular power supply. Symptoms of SMPS failure; Commonproblems from a faulty SMPS. Trouble shooting Power supplies.		1. Unmount the power supply from PC cabinet.Identify the types of output connectors. 2. Identify output voltagesusing color coding. 3. Measure voltage levelsusing multi meter. 4. Mount the power supply into the PC cabinet, connect different componentsand test PC. 5. Trouble shoot Power supply through SMPS fan. 6. Diagnose power supply faults using PSU Tester.
3	1	1,4	Basic Electronics –Electricity, Electrical quantities- Voltage, current and resistance; Active components: Diodes- PN junction diodes, biasing conditions- forwardbias and reverse bias, transistors- BJT, MOSFET; Passive components-Resistors, capacitors, inductors, transformers, sensors, and transducers; Integrated Circuits Digital Electronics- PWM, opto- coupler; checking AC to DC converter.		1. Identify the electrical and electronic components used in a computer and tabulatethem as active and passive components. 2. Identify the working and non-working stateof basic components and semiconductor devices. 3. Using multi meter- Check Output voltage ofbasic components and semiconductor devices. 4. Check different voltage levels of opto-coupler, PWM and rectifier.
4	01,03	01, 04	**Mother board** – Example Motherboards; Functional description of mother board; specification and variation. Form factor- what is Motherboard Form factor? Types and features of Motherboard formfactors- ATX, Micro-ATX, Mini-ITX,		1. Precautions to be takenbefore removing the mother board from PC cabinet. 2. Using the CPUID CPU-Ztool, find different features of CPU. 3. Check the Electric flowpath and data flow path 4. Windows resourcemonitor

			Nano-ITX, andPico-ITX. Functional components of Motherboard; CPU and CPU socket-Types of sockets; Overview of microarchitecture of INTEL and AMD CPU.		5. Using the CPUID CPU-Ztool, identify the CPU cache features of your working system.
5	01, 03	01, 04	Chipsets- Function, Types andFeatures. Buses- System bus architecture Importance of POST; UEFI – why is itrequired, possible configurations through UEFI. IDE ports; Methods of adding SCSIdrives. CMOS battery: Why? Its specifications. Impact of removingthe battery from mother board.		1. Identify system faults using POST diagnosticscard. 2. Understand basic onboard configurationsthrough UEFI. 3. Test different motherboards to determine support forUEFI 4. Replace the CMOS battery in a computer following the procedures. 5. Understand and modifyBIOS settings and observe the consequences of CMOS failure.
6	01, 03	01, 04	Memory– Memory Units (B, KB, MB,GB, TB), memory locations and address space, Access methods, Memory Classification. Main memory Types and Features.Auxiliary memory – Types and features. Memory modules.		1. Identify RAM chips and HDD/SSD, study their features and note their technical specifications. 2. Identify SIMM and DIMM memory modules, their number of pins, specs and type. 3. Identify the interface type of a hard drive andconnect it to a PC for data recovery.
7	01,03	01, 04	RAM Technology- SDRAM, DDR, DDR2, DDR3, DDR4 – Clock speed, Bandwidth, Memory speed rating, PCspeed rating; RAM capacity- single- sided and double-sided RAM, Channels; RAM features- Parity/ECC RAM, SODIMM, SPDR chip. Mass storage media- Hard drive, Principle of working, reliability, performance, SSD, optical drive; Logical Block Addressing (LBA); Memory capacity- physical and logical addressing; M.2 drives, SATA, NVMe. Causes of Hard drive failure; Signs offailure; Backup and recovery of data;		1. Use CPUID-CPUZ tool toidentify capacity, speed,technology, and related features of RAM. 2. Check for RAM and Motherboard compatibility and install additional RAMstick. 3. Find on Windows system properties tocheck the RAM for correct installation. 4. Query the SPD RAM chip to identify all 5. possible informationusing CPUID CPUZ.
8	02, 03		Windows Installation – Overview windows 10; general features; Versions; architecture;prerequisites for windows 10 installation: hardware compatibility,BIOS compatibility, driver requirements. Clean install of		1. Windows Installation Inspect prerequisites for windows 10 installationon a given computer. 2. Perform cleaninstallation. 3. Upgrade to windows10. 4. Create dual boot for a given system, learn andrectify errors

			windows 10; upgrade to windows 10; disk partitioning; troubleshooting installation problems; Multiple boot options; windows service packs. Imaging: create a Windows system image; How to Backup/Restore your Windows partition with the bootable image.		in dual boot. 5. Practice on recoverypartition. 6. Practice 10 registrytweaks. 7. Practice disk management utilities.
9	01, 02, 03		File system overview, types, properties, conversion from one filesystem to another, configuration. Configuring system and data recovery: Recover files, recover apps and the registry; recover windows 10. Configure and manage windows updates: auto/manually; testing and troubleshooting updates. Monitor and manage: Performance monitoring; optimizewindows services; tune scheduled tasks. Customizing windows desktop.		1. Practice data recoverymethods 2. Working with task manager to troubleshoot configuration and otherperformance related issues. 3. Working with taskscheduler. 4. Customizing windows desktop.
10	01, 03	01, 04, 07	Windows Command line; PowerShell; basic commands; writing simple PowerShell scripts. File security.		1. Execute basic commands in Windows using command prompt and PowerShell like listing the drives in a system, creating a new file, removing a file or directory, retrieving the list of processes and services, etc., 2. Use command line to encrypt and decrypt files and folders.
11	02, 03, 04	01, 04	**Portable computing-Troubleshooting Laptops- I** Difference between laptop and desktop Motherboards; Checking Power connector and adaptor pins, AC adapter of Laptop circuit diagram, Fault finding; trouble-shooting voltage transfer section, AC-DC conversion, Generation of stand by voltage, fault finding- No power ON, power switch, Battery charging circuit;		1. Observe the layout of a laptop and compare it with a desktop. 2. Follow/review manufacturer maintenance guide forrepair and maintenance. 3. Power Issues: Battery not charging, No power. 4. Trouble shoot computer hardware issues in the following scenarios- -Unexpected shutdowns. -Lockups -POST & Boot -Continuous reboot -No Power -Loud Noises. -Intermittent devicefailure -Smoke and burning smell 5. -Indicator lights.

12	03, 04,	01, 04	**Troubleshooting Laptops- II** Dual MOSFET pin details, Two N- channel MOSFET in place of dual MOSFET, one p-channel and one N- channel MOSFET, problems and faultfinding; CPU voltage generation circuits, keyboard interface, problem and fault finding. Touch pad connector, BIOS details, SATA HDD details, Audio section, internal display, LED screen pin details. Malware mitigation: introduction, types, symptoms, malware removal;		1. Perform the same operations in week#7on a laptop. 2. LCD display trouble-shoot: No display/dim video/flickering video. 3. Wireless troubleshooting: Multiple antennae, check presence of wireless cards. 4. Scan and remove malwares in eachcomputer or mobiledevice. 5. Perform Antivirus and anti-malware updates.
13	04,	01, 04	**E-waste management:** What is EEE and E-waste? Different scenarios of E-waste management, StEP initiatives to solve e-waste problems, impact of e-waste on health of children and workers. **E-waste management in India:** EPR and e-waste, the informal sector in e-waste management, Technologies for e-waste management, Financing e-waste management systems- Key steps, milestones to achieve a robust E-waste system. **Case studies.**		• Visit https://greene.gov.in and https://kspcb.karnataka.gov.in/ to find the latest regulations and policies taken up by the Government of India. • Visit a nearby e-waste management plant and understand the management process.
Total in hours		**39**		**13**	**52**

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

SL NO	Activity
1	1. Study multipurpose cables used with different models of computers and their applications. 2. Identify the cables and list the devices that can be connected to computer using these cables. 3. Identify commercially available brands of keyboard, mouse and monitor and their distinguishable features.
2	1. Identify preventive measures that help to eliminate or reduce electrostatic discharge. 2. Describe effective ways to reduce the risk of injury or damage while working with respect to powersupply in computer systems. 3. Make your observations on why a technician may choose to use a UPS instead of a surge suppress or to protect a computer. 4. Identify the components that are powered by the PSU. 5. Identify the common causes of PSU/SMPS failure and explain how it can be maintained in a healthy state.

	6. Explain the factors on which the PSU wattage is decided. 7. Describe the features of different Power supplies available commercially that support a gaming PC.	
3	1. Calculate the value of resistors onboard using the color code. 2. Identify the terminals of a BJT and MOSFET.	
4	1. Identify the units MHz and GHz with respect to CPU. 2. Compare and contrast the characteristics of different motherboard formfactors. 3. Identify and present the factors to select an appropriate Motherboard based on the purpose-Basic applications, Gaming, Workstations/servers. 4. Study the features and specifications of the processors (Intel: Pentium family, dualcore, quad core, core 2 duo, i3, i5, i7, i9 and AMD processors). 5. Study the CPU benchmarks of the trending processors. 6. Compare features of CPU and GPU.	

5	1. Explain bus standards with respect to evolution, speed, and recent trends (ISA, PCI, AGP).
	2. Explain how to clear CMOS password.
	3. Explain the importance of UEFI and configuration settings for –
	    a Overclocking of CPU frequencies
	    b. Set RAM timings
	4. Setting BIOS passwords Specify boot options.	

6	1. Describe the classification of memories. 2. Study different types of memory devices and features that are commercially available.	
7	1. Study the characteristics of different types of SSDs. 2. Compare DDR4 and DDR5 memory. 3. Study and identify what happens when the hard drive fails.	
8	1. Identify system requirements for Windows 10 installation. 2. Study and list the features of different versions of windows 10. 3. Explore file backup in Windows file history feature.	
9	1. Study best practices followed in scheduled backups and scheduled disk maintenance. 2. Study the necessity of TPM in Windows 11.	
10	**1.** Compare relative merits and demerits of the two command shells.	
11	1. Relate the components of a laptop to a desktop and compare their features. **2.** Identify the upgradable and non- upgradable components in laptops.	
12	**1.** Document the common faults that may occur on the motherboard.	
13	1. Study the e-waste rules 2016 and their amendments there-off as prescribed by the Karnataka state pollution control board and explain the process for the polytechnic to follow safe disposal of e-waste. 2. Study the global e-waste key statistics. 3. Sketch the e-waste policies and regulations, you think, must be regulated at each stakeholder's level.	

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Computer Hardware, Maintenance and Administration**	Test	I/II/III	Sem	III/IV
Course Code	**20IS32P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section		Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	https://www.dell.com/support/kbdoc/en-in/000139662/what-does-the-msconfig-utitility-do-in-windows-7-on-your-dell-pc#TOC
2	https://www.google.co.in/amp/s/www.ufsexplorer.com/amp/articles/how-to/connect-sata-disks-instruction.php
3	http://www.qiguaninc.com/met/faq/faq35_en.html
4	https://www.ciscopress.com/articles/article.asp?p=2999386&seqNum=3
5	https://www.crucial.in/articles/pc-builders/what-is-computer-hardware
6	https://www.udemy.com
7	https://www.pluralsight.com

8. CIE Skill Test and SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Document technical specifications of the right hardware components to assemble a computer to meet the given requirement and also necessary safety protocols to be followed.	20
2	Demonstrate the configuration and setting up an administrator for a Windows Operating System.	10

3	Identify the hardware problem and trouble shoot using appropriate diagnostic toolsin a given computer following all safety protocols.	20
4	Identify the software issues and trouble shoot using appropriate diagnostic tools in a given computer ensuring that all data and applications are backed up.	20
5	Explain the issues identified and how they have been resolved: In the event of student failing to diagnose and troubleshoot the issues either softwareor hardware, the examiner shall use viva-voce to explain the protocols to be followed in e-waste management.	20
6	Portfolio evaluation of practice sessions	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers		10
2	PSU Tester		10
3	Multimeter		10
4	Individual components- SMPS/PSU	400 watts	10
5	SMPS/PSU	800 watts	10
6	Motherboard – ATX		10
7	Motherboard – Micro ITX		10
8	RAM stick – DDR3		10
9	RAM stick – DDR4		10
10	CMOS battery		10
11	Windows 10/11 OS user license for multi users		
12	POST diagnostic card		10

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Information Science and Engineering	Semester	III
Course Code	**20IS33P**	Type of Course	Programme Core
Course Name	Computer Networks	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale

The computer networking skills are essential in today's information and communication technology driven world. It enables students with essential skills and knowledge to explore the world of communication and networking for further study and career.

2. Course Outcomes: At the end of the course, the student will be able to:

CO-01	Select an appropriate communication technology for a given network and ensure optimal performance by addressing issues arising from transmission impairments.
CO-02	Design a network for a given specification by using the right network components, devices, topologies, protocols and software.
CO-03	Design, build, test and troubleshoot a SOHO network for a given premises.
CO-04	Demonstrate the configuration of IP address, routing, subnetting, client-server interaction (TCP, UDP) and DNS for a given WAN network using a network simulator and troubleshoot common network issues

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria) 3 hours/week	Tutorial (Activity Criteria) 1 hour/week	Practice (Performance Criteria) 4 hours/week(2 hours/batch twice in a week)
1	01	1, 2	**Electromagnetic waves** - Generation of electromagnetic waves and their properties **Electromagnetic spectrum** - classification and its applications **Communication Systems** - Basic elements of communication systems with block diagram, List commonly used terms in electronic communication systems, Data representation, Data flow, Modulation, Demodulation Analog and Digital Signals, Periodic and Non-Periodic Signals, Sine Wave, Phase, Wavelength, Digital Signals, Bit-rate, Bit-length.	Refer Table 1	1.Build a circuit to Generate and detect of BASK signal and BFSK signal using communication kit.
2	01	1,2	**Transmission Impairment** – Attenuation, Distortion and Noise,		1. Explore all ISP in your area/locality and select best internet ISP/plan

			Performance - Bandwidth, Throughput, Latency, Jitter (Basic concepts only). **Transmission Modes** – Parallel and Serial Transmission. Asynchronous and Synchronous Transmission. **Satellite communication**- Introduction, advantages and disadvantages		based on cost and performance. 2. Test the download/upload speed in your computer/mobile phone also check type, bandwidth and ISP. 3. Explore Bluethooth, Wifi, NFC in your smartphone and note their key technical attributes (Radio spectrum band, range, pathloss, throughput, mode etc)
3	01, 02	1, 2, 3	**Perspectives on Networking** – End user perspectives on Networking and Internet, Overview of Networking. Categories of networks - LAN, MAN, WAN, Internetworking (Illustrate Network from LAN connected using a HUB to Internetwork). The communication rules (Method, language, Confirmation) – Protocols, the Internet. The Network Standard Organizations, Protocol Stack. **OSI Model** : OSI Layers and Their Functions, OSI Layering Concepts and Benefits, OSI Encapsulation Terminology.		1. My Protocol Rules Objectives a) Relate computer network protocols to the rules that you use every day for various forms of communication. b) Define the rules that govern how to communicate in a group of students. c) Play the communication game. d) List what would happen if the sender and receiver did not agree on the details of the protocol. 2. Manual and Automatic address assignment (Windows) a) IPv4 address b) Subnet mask c) DNS 3. Manual and Automatic address assignment (Android) a) IPv4 address b) Subnet mask c) DNS
4	01, 02	1, 2, 3	**TCP/IP Networking Model** - History Leading to TCP/IP, Overview of the TCP/IP Networking Model. TCP/IP Application Layer, HTTP Overview, HTTP Protocol Mechanisms. TCP/IP Transport Layer, TCP Error Recovery Basics, Same-Layer and Adjacent-Layer Interactions. TCP/IP Network Layer, Internet Protocol and the Postal Service, Internet Protocol Addressing Basics, IP Routing Basics. TCP/IP Link Layer (Data Link Plus Physical), TCP/IP Model and Terminology, Data		1. Organize and play games to understand working of TCP/IP like: Create 2 group of students, each playing role of a layers of TCP/IP (intermediate network devices roles can also be considered). Start the communication between two with a sender and receiver. 2. Determine the IP Address Configuration of a

			Encapsulation Terminology. Names of TCP/IP Messages.		Computer (Windows) and Test the Network Interface TCP/IP Stack (Ping).
5	02, 03	1, 2, 4,	**Hardware and Software components of Network** - Common network devices - Computers, Access points, Hub, Switch, Router, repeaters, NIC, Modem. LAN Cables – Co-axial, twisted pair, optical fibre, LAN connectors- co-axial cable, and twisted pair cable, optical fibre, Connectors, Firewall, Firm wares, ISPs.		1. Demonstrate working of common network devices. 2. Demonstrate different network cables and connectors. 3. Install and configure NIC. 4. Crimping of RJ45: Straight and Cross. a) Punching Cat 6 cable to I/O Box. Use punching tool. b) Check connectivity using LAN tester
6	01, 02	1, 2, 3, 4,	**Overview of network topologies** - Basic topologies- bus, ring, star, mesh and hybrid. **Network Simulator**: Network simulator like Packet Tracer, Installation, User Interface. Deploy devices and cables GUI and CLI Configuration. Configure end Devices		1. Install Network simulator like Cisco packet tracer. 2. Create simple network in simulator. 3. Create and Demonstrate all possible network topologies using simulator.
7	02, 03	1, 2, 3, 4,	**An Overview of LANs** - Typical SOHO LANs, Typical Enterprise LANs, The Variety of Ethernet Physical Layer Standards, Consistent Behaviour over All Links Using the Ethernet Data Link Layer. Building Physical Ethernet Networks with UTP - Transmitting Data Using Twisted Pairs, Breaking Down a UTP Ethernet Link, UTP Cabling Pinouts for 10BASE-T and 100BASE-T, Straight-Through Cable Pinout, Crossover Cable Pinout, Choosing the Right Cable Pinouts, UTP Cabling Pinouts for 1000BASE-T, Sending Data in Ethernet Networks.		1. Build a physical Ethernet LAN Network and demonstrate file sharing, printer sharing. 2. Install and configure wireless access point over the LAN. 3. Use pathping command to find actual path between source to destination with information about network latency/delay & network loss.
8	02, 03	1, 2, 3, 4,	**Ethernet Data Link Protocols** – The Rise of Ethernet, The Ethernet MAC address and Ethernet Addressing, Identifying Network Layer Protocols with the Ethernet Type Field, Error Detection with FCS. Encapsulation, Ethernet Frame. **Hierarchical Network Design** – Physical and logical addresses, Benefits of a Hierarchical Design, Access, Distribution, and Core layers Sending Ethernet Frames with Switches and Hubs, Sending in Modern Ethernet LANs Using Full-Duplex, Using Half-Duplex with LAN Hubs. **Ethernet access layer devices** – Hub, Switch, The MAC address table,		1. Determine the MAC Address of a Host(PC and Phone). 2. View Wireless and Wired NIC Information and make a table explaining each. 3. Configure and install a ethernet switch/Hub (Use simulator if hardware devices are not available) 4. Create/model a simple Ethernet network using 3 hosts and a switch, Observe traffic behavior on the network and Observer

			Ethernet Broadcast and Broadcast domain, ARP.		data flow of ARP broadcasts and pings.
9	02, 03, 04	1, 2, 3, 4,	**Routing:** The Need for Routing - Criteria for Dividing the Local Network - Now We Need Routing **Overview of Network Layer Functions** - Network Layer Routing (Forwarding) Logic, Host Forwarding Logic: Send the Packet to the Default Router, Routing Data Across the Network, Delivering Data to the End Destination, How Network Layer Routing Uses LANs and WANs, IP Addressing and How Addressing Helps IP Routing, Routing Protocols. **IPv4 Addressing** - Rules for IP Addresses, Rules for Grouping IP Addresses, Class A, B, and C IP Networks, The Actual Class A, B, and C IP Networks, IP Subnetting, How to create subnets, Subnet mask, CIDR, variable length subnet mask.		1. Build a simple peer-to-peer network and verify physical connectivity and Assign various IPv4 addresses to hosts and observe the effects on network communication 2. Configure IP addresses of a network (real or simulated) and ping across to test and troubleshoot. 3. Subnetting of a network (either using real network or in Simulator). 4. Connect to web server using simulator, Observe how packets are sent across the Internet using IP addresses.
10	02, 03, 04	1, 2, 3, 4, 7	**IPv4 Routing** - IPv4 Host Routing, Router, Forwarding Decisions and the IP Routing Table, The default gateway, A Summary of Router Forwarding Logic, A Detailed Routing Example. **Routing Protocols** - IPv4 Routing Protocols – static and dynamic. **Other Network Layer Features** - Using Names and the Domain Name System, The Address Resolution Protocol, ICMP Echo and the ping Command. **DHCP** – Static address assignment, Dynamic address assignment, DHCP servers.		1. Implement simple static routing. 2. Troubleshooting of IP Addressing- a) Change a routing table entry b) Wrong address c) incorrect subnet mask 3. Configure and test DHCP on a wireless router (real or simulated)
11	02, 03, 04	1, 2, 3, 4,	**Pv4 and IPv6 Address Management** - Network Boundaries -Gateways to Other Networks, Routers as Gateways. **Network Address Translation** - Introduction, NAT operation. **IPv4 Issues** - Need of IPv6, Ipv4 vs IPv6, IPv4 and IPv6 Coexistence. **IPv6 features** - IPv6 Address Representation. **Concept of Virtual LAN's**(VLAN's)		1. Packet Tracer - Examine NAT on a Wireless Router 2. Identify IPv6 Addresses a) Identify the different types of IPv6 addresses. b) Examine a host IPv6 network interface and address. c) Practice IPv6 address abbreviation. 3. Setup, configure and test VPN in your smartphone.
12	02, 03, 04	1, 2, 3, 4,	**The Client Server relationship** – Client Server interaction. URI, URN, URL **TCP/IP Layer 4 Protocols**: TCP and UDP - Transmission Control Protocol, Multiplexing Using TCP Port Numbers, Popular TCP/IP Applications, Connection Establishment and Termination, User Datagram Protocol.		1. Create a client – server model in simulator and observe the client interaction between the server and PC using packet tracer. 2. Observe DNS Name Resolution

			Port Numbers – TCP and UDP. Socket pairs, the netstat command. **Application Layer Services -** Common Network Application Services, Domain Name System, Domain Name Translation, DNS Servers, HTTP, Web Clients and Servers, FTP, Virtual Terminals, Remote Access with Telnet or SSH, Telnet, Security Issues with Telnet, SSH, Email- Email protocols, Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP3), Internet Message Access Protocol (IMAP4).		a) Observe the conversion of a URL to an IP address. b) Observe DNS lookup using the nslookup command. 3. Use simulator to demonstrate Telnet and SSH
13	02, 03, 04	1, 2, 3, 4,	**Troubleshoot Common Network Problems** - The Troubleshooting Process, Network Troubleshooting Overview, Gather Information - Nature of problem, Equipment, Configuration and Topology, Previous Troubleshooting. **Structured Troubleshooting Methods** - Bottom-Up, Top-Down, Divide-and-Conquer, Follow-the-Path, Substitution, Comparison, Educated Guess. Guidelines for Selecting a Troubleshooting Method **Troubleshoot Wireless Issues** - Causes of Wireless Issues, Authentication and Association Errors.		1. Demonstrate troubleshooting Commands with a scenario- ipconfig, ping , netstat, tracert, nslookup. 2. Interpret the output of commonly used network command line utilities and Determine which network utility can provide the necessary information to perform troubleshooting activities in a bottom-up troubleshooting strategy 3. Physical Layer Problems - Common Layer 1 Problems, how to use the five senses to troubleshoot, Wireless Router LEDs, Cabling Problems 4. Common Internet Connectivity Issues - DHCP Server Configuration Errors, Check Internet Configuration, Check Firewall Settings.
Total in hours			**39**	**13**	**52**

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

Sl. No	Activity
1	Prepare a report on advanced communication systems and suggest best way to connect remote villages of India.
2	Prepare a report on Communication satellites of Indian Space Research Organization.
3	Prepare a presentation on 5 networking protocols being used in your smart phone.
4	My Protocol Rules Objectives a) Relate computer network protocols to the rules that you use every day for various forms of communication. b) Define the rules that govern how you send and interpret text messages.

	c) Explain what would happen if the sender and receiver did not agree on the details of the protocol.

5	My Local Network
	  a) Record all the different network-attached devices in your home or classroom.
	  b) Investigate how each device connects to the network to send and receive information.
	  c) Create a diagram showing the topology of your network.
	  d) Label each device with its function within the network.

6	Detailed study of Packet tracer and present the same.

7	Trace a Route
	  a) Determine network connectivity to a destination host
	  b) Trace a route to a remote server using tracert

8	Presentation on wireless Ethernet protocols
9	1. Calculate whether destination address is local or remote using IP address. 2. Calculate whether destination address is local or remote using mask. 3. Use logical AND to determine network address

10	Identify IPv6 Addresses
	  a) Identify the different types of IPv6 addresses.
	  b) Examine a host IPv6 network interface and address.
	 c) Practice IPv6 address abbreviation.

11	Prepare a report on ICANN List the popular port numbers with their use.
12	Prepare e report on popular application layer protocols and present the same.
13	Identify and correct any misconfiguration of a wireless device (Scenario : A small business owner learns that a wireless user is unable to access the network. All the PCs are configured with static IP addressing. Identify and resolve the issue)

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2Written Test	9	80	30	
3	CIE-3Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Computer Network**		Test	I/II/III	Sem	III/IV
Course Code	**20IS33P**		Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.						
Section	Assessment Questions			Cognitive Levels	Course Outcome	Marks
I	1					
	2					
II	3					

	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks=(8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	www.netcad.com
2	Computer Networks - Behrouz A. Forouzan
3	www.howtonetwork.com
4	vlab.co.in

8. CIE Skill Test and SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Identify the network devices, cables, Connectors, software and other tools required as per the given specification and write their technical details.	20
2	Design/Create/Configure the given network as per the specification given.	25
3	Configure and troubleshoot the network (devices, address, port, software, tools, protocol).	25
4	Demonstrate the solution. In the event of, a student fails to get the desired result, the examiner shall use viva voce to assess the student's understanding of computer networks.	20
5	Portfolio evaluation based on aggregate of all practice sessions.	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity

1	Computer		20
2	Lan cable		20
3	Crimping tool		20
4	Networking Switch, Modem		2
5	Network simulator like packet tracer		20
6	Communication trainer kit		10

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Information Science and Engineering	Semester	III
Course Code	**20IS34P**	Type of Course	Programme Core
Course Name	Database System Concepts and PL/SQL	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale

Data, factual information, is the main driving force that is changing the face of our world. Database is an organized collection of related data which is stored and accessed electronically using a computer. Database management has evolved from a specialized computer application to a central component of virtually all enterprises, and, as a result, knowledge about database systems has become an essential part of an education in computer science. SQL is a powerful language for both querying and updating data in relational databases. Study of SQL empowers students to implement and work with relational data model.

2. Course Outcomes: At the end of the course, the student will be able to:

CO-01	Identify the elements of ER model for a given requirement, draw ER diagram and validate with the given requirement.
CO-02	Translate the given ER diagram to a relational model and verify against integrity constraints. Also refine and normalize the relational database design against first three normal forms.
CO-03	Use appropriate SQL statements to create a database and other DB objects using a DBMS software.
CO-04	Perform insert, delete and/or update operations on the database and query the database to retrieve the required information using appropriate SQL statements and clauses.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria) 3 hours/week	Tutorial (Activity Criteria) 1 hour/week	Practice (Performance Criteria) 4 hours/week (2 hours/batch twice in a week)
1	1	1,4	**Introduction** Overview of DB: why a database? Purpose of database; Classification; Application; DBMS: features, providers; Functional components of DBMS; Types of DBMS architecture; View of data in DBMS; Database users; Role and responsibilities of DBA; Case study: Example of any database application, recruitment database	Refer Table 1	1. Install and setup DBMS software such as MySQL, PostgreSQL 2. Learn the interface and explore the features of installed DBMS
2	1	1,3,4	**Database design** Data model; types; importance of data modeling; Overview of database design; phases		1. Identify and ER-model elements and draw ER

			of database design; database development life cycle;
			Conceptual design: ER-Model: entity: types; attribute: types; relationships: types, constraints, Symbols and Notations;
			Case study: conceptual design for a set of specifications
			    i. Restaurant
			    ii. Retail shop
			    iii. Recruitment
			    iv. College
			    v. Library
					diagram for the given specifications using tools.

3	2	1,3	Relational model: Overview; characteristics; Constraints: types; Operations; Advantages and Disadvantages; applications; Design anomalies; Features of good DB design;		1. Map ER Model to relational model 2. Identify various constraints
4	2	1,3	Functional dependency: overview, rules, types; Normalization: normalization process; importance of normalization;1NF,2NF,3NF Sufficient examples to understand the concept		1. Normalize the above design
5	3	1,4	database languages: types, commands/tasks in each type; Integrity constraints; MySQL/PostgreSQL: overview; features; datatypes; Standardization guidelines;		1. Validate the above design against integrity constraints
6	3	1,3,4	Defining Data: DDL CREATE, ALTER, DROP different DB objects; Temporary tables: types, create and use; external tables; Managing constraints		1. Use MySQL/PostgreSQL DDL statements to create database and other DB objects for above design
7	3,4	1,3,4	Insert, delete and update data Modifying data: UPDATE and DELETE Update anomalies; impact of constraints Querying of available data: SELECT; Aliases; sorting data: ORDER BY		1. Perform single table and multi table insertion 2. Perform delete and update operations 3. Querying single table 4. Sort the result set of a query
8	4	1,4	filtering data: WHERE, AND, OR, row limiting clause, IN, BETWEEN, LIKE; Joining table: INNER JOIN, LEFT JOIN,		1. Querying single table 2. Filtering data 3. query multiple tables with joins
9	4	1,4	Grouping data: Aggregate functions, GROUP BY, HAVING; Set operators: UNION, INTERSECT, MINUS;		1. Queries that use set operators 2. Report aggregated data using group functions
10	4	1,4	Subqueries: Comparator operators; subqueries: Single Row Subqueries; Multiple Row Subqueries; correlated subqueries; EXISTS, NOT EXISTS, ANY, ALL, SOME;		1. Write sub queries to retrieve information from the created database
11	4	1,4	Views: create, drop and update; realization of views based on single and multiple tables;		1. Create view and query

12	4	1,4	DCL: Controlling user access: Differentiating system privileges from object privileges; Granting privileges on tables		2. Create users and assign privileges for DB operations
			PL/SQL: variables, datatypes; control statements (decision making); Stored procedures and Functions Concept; syntax and structure of store procedure; syntax and structure of functions; calling a function; Examples;		1. Create and execute store procedures 2. Create and execute functions
13	4	1,4	**Managing and controlling transactions:** Introduction of transaction, ACID properties; states of transaction; Transaction control; Overview of transaction management, using transaction control commands: COMMIT, ROLLBACK, SAVE POINT, SET TRANSACTION; sufficient examples;		1. Create and execute transactions 2. Call previously created store procedure or function in transaction
Total in hours			**39**	**13**	**52**

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

1	1. Identify the drawbacks of file system and how DB enables us to overcome them. Identify distinguishable features of each of DBMS available in the market.
2	1. Transform given n-ary relationship to binary relationship 2. Document the steps to create ER diagram. 3. Identify the components of ER model in the given requirements.
3	1. Document the steps to create logical design 2. Discuss and document Codd's 12 rules
4	**1.** Explore and document other normal forms
5	1. study and present the working of SQL optimizer 2. Learn and report optimization techniques
6	1. Learn and demonstrate use of DISTINCT, ALL, IS NULL; 2. Learn and present RIGHT JOIN;
7	1. Identify the advantages of Cascading Referential Integrity Constraints
8	**1.** Identify need of subqueries
9	1. identify the advantages and disadvantages of store procedure and functions,
10	**1.** presentation on the latest developments in research and industry related to this course
11	1. Learn and present need of scalar subqueries
12	1. Learn iterative statements in PL/SQL
13	**1.** Does Relational model support storage of unstructured data, if no, what are the alternatives to store unstructured data.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	

5	CIE-5 Skill Test-Practice	12	180	100	Average of two skill tests reduced to 20
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	Database System Concepts and PL/SQL	Test	I/II/III	Sem	III/IV
Course Code	**20IS34P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section		Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Database System Concepts by Abraham Silberschatz, Henry F. Korth, S . Sudarshan
2	https://binaryterms.com/
3	https://beginnersbook.com/
4	https://www.oracletutorial.com/

8. CIE Skill Test Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Draw ER diagram for the given specifications.	30

2	Translate ER diagram to relational model, verify against integrity constraints and refine and normalize DB design	40
3	Explain above DB design In the event of student failing to verify integrity constraints and apply normalization the examiner shall use viva voce to assess the student understanding of normal forms and integrity constraints	20
4	Portfolio evaluation of practice sessions	10
	Total Marks	**100**

Note: For CIE skill test 2, SEE scheme of evaluation shall be used.

9. SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Draw ER diagram for the given specifications.	10
2	Translate ER diagram to relational model, verify against integrity constraints and refine and normalize DB design	20
3	Use appropriate SQL statements to create the database and other DB objects using a DBMS software for the above design	10
4	Perform insert, delete and/or update operations on the database and query the database to retrieve the required information using appropriate SQL statements and clauses.	30
5	Demonstrate the working of above queries. In the event of not working of above queries (with no syntactical errors), the examiner shall use viva voce to assess the student understanding of ER model, Relational model concepts and SQL.	20
6	Portfolio evaluation of practice sessions	10
	Total Marks	**100**

10. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers		20
2	MySQL workbench/ or equivalent software; Lucid chart, draw.io		

ಮೂರನೇ ಸೆಮಿಸ್ಟರ್

ಕನ್ನಡ ಬಲ್ಲ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

(ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಪರಂಪರೆ ಕುರಿತು)

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	**ಸಾಹಿತ್ಯ ಸಿಂಚನ – 2**	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	02 Hrs Per Week 26 Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಸಾಹಿತ್ಯ ಸಿಂಚನ – 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

26 ಗಂಟೆಗಳು

ಪಠ್ಯಕ್ರಮದ ಪರಿವಿಡಿ	ಬೋಧನಾ ಅವಧಿ
1. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಪ್ರಭಾವಗಳು ಮತ್ತು ಪ್ರೇರಣೆಗಳು	01 ಗಂಟೆ
2. ಹೊಸಗನ್ನಡ ಕಾವ್ಯದ ಪ್ರಕಾರಗಳು -	02 ಗಂಟೆ
• ನವ್ಯೋದಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.	03 ಗಂಟೆ
• ನವ್ಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.	03 ಗಂಟೆ
• ಬಂಡಾಯ ಮತ್ತು ಪ್ರಗತಿಪರ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.	03 ಗಂಟೆ
• ದಲಿತ ಸಾಹಿತ್ಯ, ಮಹಿಳಾ ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ ಮತ್ತು ಇತ್ತೀಚಿನ ಪ್ರಚಲಿತ ಕನ್ನಡ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.	03 ಗಂಟೆ
3. ವೈಚಾರಿಕತೆ ಕುರಿತಾದ ಲೇಖನ - **ಜಿ ಎಸ್. ಶಿವರುದ್ರಪ್ಪ**	01 ಗಂಟೆ
4. ಕಥೆ - **ನೇಮಿಚಂದ್ರ**	01 ಗಂಟೆ
5. ಪ್ರವಾಸ ಕಥನ - ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯರವರ (ಕುಪ್ಪಳ್ಳಿ ಡೈರಿ ಪುಸ್ತಕದಿಂದ)	01 ಗಂಟೆ
6. ಪರಿಸರ, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಕುರಿತಾದ ಲೇಖನಗಳು	01 ಗಂಟೆ
7. ಪ್ರಬಂಧ - **ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ**	01 ಗಂಟೆ
8. ಪ್ರಚಲಿತ ವಿದ್ಯಮಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನ - "ಷೇರು ಮಾರುಕಟ್ಟೆ ಮತ್ತು ಹಣಕಾಸು ನಿರ್ವಹಣೆ" ಕುರಿತಂತೆ	01 ಗಂಟೆ
9. ಕರ್ನಾಟಕ ಏಕೀಕರಣ ಚಳುವಳಿ - **ಪ್ರೊ. ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ**	01 ಗಂಟೆ
10. ಕನ್ನಡ ಸಿನಿಮಾರಂಗ ಬೆಳೆದು ಬಂದ ದಾರಿ ಮತ್ತು ನಾಡು-ನುಡಿ ಹಾಗೂ ನಾಡಿನ ಸಂಸ್ಕೃತಿಯ ಮೇಲೆ ಬೀರಿದ ಪ್ರಭಾವಗಳು	01 ಗಂಟೆ
11. ಕನ್ನಡದ ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು (ಭಾಷಾ ಪ್ರಭೇದಗಳು)	01 ಗಂಟೆ
12. ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಒಂದು ಅವಲೋಕನ	02 ಗಂಟೆ
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ 26 ಗಂಟೆಗಳು	26 ಗಂಟೆ

<p style="text-align:center; color:red; font-weight:bold;">ಕನ್ನಡ ಬಾರದ / ಕನ್ನಡೇತರ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ಕಲಿಸಲು
ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ</p>

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	ಬಳಕೆ ಕನ್ನಡ – 2	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	2 Hrs Per Week 26Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

<p style="text-align:center; color:red; font-weight:bold;">ಬಳಕೆ ಕನ್ನಡ – 2 ಪಠ್ಯಕ್ರಮ - 20KA31T</p>

Table of Contents (ಪರಿವಿಡಿ)   26 ಗಂಟೆಗಳು

		Teaching Hour
Part – 1		
	Necessity of learning a local language (Continuation). Tips to learn the language with easy methods (Continuation). Easy learning of a Kannada Language: A few tips (Continuation). Hints for correct and polite conversation (Continuation). Instructions to Teachers for Listening and Speaking Activities (Continuation). Instructions to Teachers for Reading and Writing Activities (Continuation).	**01 Hour**
Part – II		
	Key to Transcription for Correct Pronunciation of Kannada Language (Continuation). Instructions to Teachers to teach Kannada Language (Continuation).	**02 Hour**
Part – III Lessons to teach Kannada Language		
(Speaking, Listening, Reading and Writing Activities with Explanation)		
Lesson – 1	Personal Pronouns, Possessive Forms, Interrogative words – Part II	**02 Hour**
Lesson – 2	Permission, Commands, encouraging and Urging words (Imperative words and sentences) – Part II	**02 Hour**
Lesson – 3	Comparative, Relationship, Identification and Negation Words – Part II	**02 Hour**
Lesson – 4	Different types of forms of Tense (Use and Usage of Tense in Kannada) – Part II	**02 Hour**
Lesson – 5	Kannada Helping Verbs in Conversation (Use and Usage of Verbs) – Part II	**02 Hour**
Lesson – 6	Formation of Past, Future and Present Tense Sentences with Changing Verb Forms	**02 Hour**
Lesson – 7	Karnataka State and General Information about the State	**02 Hour**
Lesson – 8	Kannada Language and Literature	**02 Hour**
Lesson – 9	Do's and Don'ts in Learning a Language	**02 Hour**
PART - IV Reading and writing Practice of Kannada Language		
Lesson – 10	Kannada Language Script Part – 1	**02 Hour**
Lesson – 11	Kannada Language Script Part – II (Continuation)	**02 Hour**
Lesson – 12	Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation (Continuation).	**01 Hour**
	Total Teaching Hours	**26 Hour**

ಸಾಹಿತ್ಯ ಸಿಂಚನ ಭಾಗ - II ಮತ್ತು **ಬಳಕೆ ಕನ್ನಡ ಭಾಗ - II** ಈ ಎರಡು ಪಠ್ಯಕ್ರಮಗಳಿಗೆ
CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಮಾರ್ಗಸೂಚಿಗಳು :

(Course Assessment and Evaluation Chart - CIE only)

Sl. No	Assessment	Type	Time frame in semester	Duration In minutes	Max marks	Conversion
1.	CIE- Assessment - 1	Written Test - 1	At the end of 3rd week	80	30	Average of three written tests : 1, 2 & 3 for 30 Marks
2.	CIE- Assessment - 2	Written Test - 2	At the end of 7th week	80	30	
3	CIE- Assessment - 3	Written Test - 3	At the end of 13th week	80	30	
4.	CIE- Assessment - 4	MCQ/Quiz	At the end of 5th week	60	20	Average of three Assessment tests : 4, 5 & 6 for 20 Marks
5	CIE- Assessment - 5	Open Book Test	At the end of 9th week	60	20	
6	CIE- Assessment - 6	Work book Consolidation & Activities	At the end of 11th week	60 (Work book Submission)	20	
	Total CIE – Continuous Internal Evaluation Assessment Marks					50
	Total Marks					50

ಸೂಚನೆ : 1.CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ 1, 2 ಮತ್ತು 3 ರ ಕಿರು ಪರೀಕ್ಷೆಗಳನ್ನು ಮತ್ತು ಮೌಲ್ಯಮಾಪನದ 4, 5 ಮತ್ತು 6 ರ ಪರೀಕ್ಷೆಗಳನ್ನು ಪ್ರತ್ಯೇಕ ಬ್ಲೂಬುಕ್ ಪುಸ್ತಕದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಬರೆಯಬೇಕು.

2.ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು, ತರಗತಿ ಕನ್ನಡ ಭಾಷಾ ಶಿಕ್ಷಕರಿಂದ ಮತ್ತು ವಿಭಾಗಾಧಿಕಾರಿ ಗಳಿಂದ ದೃಢೀಕರಣಗೊಂಡ ಕಾರ್ಯಪಠ್ಯಪುಸ್ತಕವನ್ನು (Work Book) ಮೌಲ್ಯಮಾಪನ ಭಾಗ- **CIE- Assessment – 6** ರ ಪರೀಕ್ಷೆಯ ನಂತರ ಆಯಾ ವಿಭಾಗಕ್ಕೆ ಸಲ್ಲಿಸಬೇಕು.

4 ᵀᴴ SEMESTER

Programme	Information Science and Engineering	Semester	IV
Course Code	**20IS41P**	Type of Course	Programme Core
Course Name	Data Structures with Python	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale

Data structures are the techniques organizing data and of designing the algorithms for real-life projects. Knowledge of data structures is essential for software design and development. Learning data structures with Python offer flexibility and ease of programming with many built in data structures and libraries.

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Explain data structures types, list their applications.
CO-02	Apply the right Algorithm design strategies to solve a given problem.
CO-03	Choose the right data structure to develop solution to a given computing problem.
CO-04	Analyse space and time complexities of the algorithm used and plot a graph.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week(2 hours/batch twice in a week)
1	01	1, 2, 3	Introduction to Data Structures, operations, classification, Characteristics. Primitive types – primitive data structures, python examples. Non primitive types - Non primitive data structures, python examples. Linear and nonlinear data structures – with python examples. Introduction, Abstractions, Abstract Data Types, An Example of Abstract Data Type (Student, Date, Employee), Defining the ADT, Using the ADT, Implementing the ADT.		1. Python program to Use and demonstrate basic data structures. 2. Implement an ADT with all its operations.
2	01, 02, 04	1, 2, 3, 4, 7	Algorithm Analysis – Space Complexity, Time Complexity. Run time analysis. Asymptomatic notations, Big-O Notation, Omega Notation, Theta Notation.	Refer Table 1	1. Implement an ADT and Compute space and time complexities. 2. Implement above solution using array and Compute space and time complexities and compare two solutions.

3	01, 02, 04	1, 2, 3, 4, 7	Algorithm design strategies: Brute force – Bubble sort, Selection Sort, Linear Search. Decrease and conquer - Insertion Sort.		1. Implement Linear Search compute space and time complexities, plot graph using asymptomatic notations. 2. Implement Bubble, Selection, insertion sorting algorithms compute space and time complexities, plot graph using asymptomatic notations.
4	01, 02, 04	1, 2, 3, 4, 7	Divide and conquer - Merge Sort, Quick Sort, Binary search. Dynamic programming - Fibonacci sequence Backtracking – Concepts only (Implementation examples with recursion in week 9). Greedy – Concepts only.		1. Implement Binary Search using recursion Compute space and time complexities, plot graph using asymptomatic notations and compare two. 2. Implement Merge and quick sorting algorithms compute space and time complexities, plot graph using asymptomatic notations and compare all solutions. 3. Implement Fibonacci sequence with dynamic programing.
5	01, 02, 03, 04	1, 2, 3, 4,	Linear(arrays) vs nonlinear (pointer) structures – Run time and space requirements, when to use what? Introduction to linked list, Examples: Image viewer, music player list etc. (to be used to explain concept of list), applications.		1. Implement Singly linked list (Traversing the Nodes, searching for a Node, Prepending Nodes, Removing Nodes)
6	01, 02, 03, 04	1, 2, 3, 4,	The Singly Linked List- Creating Nodes, Traversing the Nodes, searching for a Node, Prepending Nodes, Removing Nodes. Linked List Iterators.		1. Implement linked list Iterators.
7	01, 02, 03, 04	1, 2, 3, 4,	The Doubly Linked List, Examples: Image viewer, music player list etc. (to be used to explain concept of list). DLL node, List Operations – Create, appending nodes, delete, search.		1. Implement DLL. 2. Implement CDLL

			The Circular Linked List-Organization, List Operations – Appending nodes, delete, iterating circular list.		
8	01, 02, 03, 04	1, 2, 3, 4	Last In First Out (Stack) Data structures – Example: Reversing a word, evaluating an expression, message box etc. (to be used to explain concept of LIFO). The Stack implementation – push, pop, display. Stack Applications- Balanced Delimiters, Evaluating Postfix Expressions.		1. Implement Stack Data Structure. 2. Implement bracket matching using stack.
9	01, 02, 03, 04	1, 2, 3, 4,	Recursion. Properties of Recursion. Recursive functions: Factorials, Recursive Call stack, The Fibonacci Sequence. How Recursion Works- The Run Time Stack. Recursive Applications- Recursive Binary Search, Towers of Hanoi.		1. Program to demonstrate recursive operations (factorial/ Fibonacci) 2. Implement solution for Towers of Hanoi.
10	01, 02, 03, 04	1, 2, 3, 4,	The First In First Out (Queue) Data structure – Example: Media player list, keyboard buffer queue, printer queue etc. (to be used to explain concept of FIFO). Implementing the Queue and its operations using Python List. Priority Queues, Implementation.		1. Implement Queue. 2. Implement priority queue
11	01, 02, 03, 04	1, 2, 3, 4,	The Tree data structure – Example: File explorer/Folder structure, Domain name server. Tree Terminologies, Tree node representation. Binary trees, Binary search trees, Properties, Implementation of tree operations – insertion, deletion, search, Tree traversals (in order, pre order and post order).		1. Implement Binary search tree and its operations using list.
12	01, 02, 04	1, 2, 3, 4,	Depth-first traversal Breadth-first traversal Tree applications: Expression evaluation.		1. Implementations of BFS. 2. Implementation of DFS.
13	01, 03, 04	1, 2, 3, 4,	Introduction to Hashing. Hashing - Perfect hashing functions. Hash table Hash Functions, Operations, Hash collision, Application.		1. Implement Hash functions.
Total in hours			**39**	**13**	**52**

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

Sl. No	Activity
1	Design a Data structure for handling Student Records- Designing a Solution, Implementation (Using Basic DS).

2	Design a Data structure for handling Student Records- Designing a Solution, Implementation (Using ADT).
3	Optimize your solution (Bubble sort, selection sort and Insertion sort)
4	Implement Radix sort.
5	Prepare report on nonlinear data structures.
6	Design and implement sparse matrix representation using linked list.
7	Design and implement simple application that require DLL data structure.
8	Implement and demonstrate evaluating postfix expression.
9	Presentation on run time stack.
10	Design and implement priority queue data structure.
11	Prepare a Report on balanced trees.
12	Implement expression evaluation tree.
13	Prepare a report on hashing and analyze time complexity.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2Written Test	9	80	30	
3	CIE-3Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
				Total Marks	100

5. Format for CIE written Test

Course Name	**Data Structures with Python**	Test	I/II/III	Sem	III/IV
Course Code	**20IS41P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

	Dimension	Beginner	Intermediate	Good	Advanced	Expert	

Sl. No.		2	4	6	8	10	Students Score
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
						Average Marks=(8+6+2+2)/4=4.5	**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Data Structures and Algorithms using Python by Rance D. Necaise
2	Python Data Structures and Algorithms by Benjamin Baka
3	www.geeksforgeeks.com

8. CIE Skill Test and SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Select appropriate Algorithm design strategy to solve the given problem statement, and design Algorithmic solution.	25
2	Develop the solution choosing appropriate data structure, test and debug the solution.	30
3	Analyse time and space complexity and plot the graph.	15
4	Demonstrate the solution and its operation, justify your selection of Algorithm /Data structure using above graphs. In the event of, a student fails to get the desired result (with no syntactical and least semantic errors), the examiner shall use viva voce to assess the student's understanding of different data structures and algorithm design strategies.	20
5	Portfolio evaluation based on aggregate of all practice sessions	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers		20
2	Python 3.6		20
3	Editor such as iPython, Jupyter, spider, PyCharm		20

Programme	Information Science and Engineering	Semester	IV
Course Code	**20IS42P**	**Type of Course**	Programme Core
Course Name	Operating System and Administration	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1.Rationale

The Operating System knowledge and skill is an integral part in the study of computer science. It provides the platform for all other application to run on the machine, thus knowledge of operating system and administration becomes indispensable for understanding computing environment. It is essential to have knowledge of operating system's services and utilities to develop, deploy and maintain the software and hardware. The students will also be skilled in operating system virtualization, to create and manage virtual computing environment.

2. Course Outcomes: At the end of the course, the student will be able to:

CO-01	Explain functions and services of an operating system.
CO-02	Create a virtual environment and configure it to meet a specific application requirement.
CO-03	Identify and use Linux commands to create and manage simple file processing operations, organize directory structures, and develop shell script to automate given simple task.
CO-04	Demonstrate the role and responsibilities of a Linux system administrator and analyse problems using suitable diagnostic tools and resolve issues.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,7	Overview of Operating System, Need for OS, Structure, OS Types, Examples of OS (desktop and mobile) Dual mode operation, Kernel and microkernel, Functions of OS User interfaces; Corporate Vs Personal needs; Types of OS installation	Refer Table 1	1. Types of OS installation 2. Boot methods 3 . File System and formatting 4. Post installation tasks
2	1, 2	1, 7	Virtualization technology, working, types		1. Install and configure

			Potentials and challenges of Virtualization, Virtual Machines, Containers. Linux Boot process. Linux command line - Interpreter, shell, CLI over GUI, Types of users- super and normal, Linux user manual.		virtual machine- Virtual box/VMware, VMware player station. 2. Download and install a terminal emulator and connect Linux VM via TE(optional). Significance of man command.
3	1,3	1, 7	File system - Pathnames, File system structure and its description, navigating the file system. File types, attributes, Access Control List (ACL), Adding text to file. Pipes, File Comparison, Filters / Text Processing Commands.	**Refer Table 1**	File and Directory commands: 1. Create and delete directories and files, File movement, copy commands, Pipes (named & unnamed) 2. Commands for viewing File, File comparison, File manipulation, Altering file permission, File compression and decompression. 3. Text processing commands.
4	1,	1,2,3,7	**Process Management** – Process, daemon, process states, PCB; Process scheduling Queue Operations on Processes - Process creation, Process termination, Interprocess communication. Scheduling - Long term, short term, and medium term; Context switch; Different types of CPU schedulers (Basic concept), Process priority; debugging (system hang)		1. Linux commands related to process creation and management- system calls fork() and exec(); bg, fg, nohup, pkill, nice, top, ps; 2. cron and at commands to schedule tasks.
5	1,3	1,2,3 4, 7	**Process synchronization-** critical section problem, Semaphores; Deadlock- System model, methods for handling deadlocks, deadlock prevention, avoidance, detection, recovery from deadlocks. Threads - Multithreading models, Threads, and processes. Types of threads - Kernel level and User level	**Refer Table 1**	1. Demonstration through videos. 2. Commands to exhibit thread concepts.
6	1	1,2,3 4, 7	**Memory management** - Process address space, static vs dynamic linking and loading.		1. Demonstration through videos. 2. Commands to view memory consumption

			Swapping, Memory allocation, Fragmentation, Paging, Segmentation; Virtual memory, Demand paging, Page replacement algorithm (concept only)		
7	1	2, 3 4, 7	**Shell Programming**: Basics of shell programming, types of shell in Linux, Basic Shell scripts- Shebang or Hashbang, Input & Output, decision making and iterative scripts.		1. Write shell scripts to illustrate decision making and different types of iterations; Ex- to perform string operations; to perform file operations;
8	1	2, 3 4, 7	**Automation of system tasks**: Writing scripts to automate common tasks.	Refer Table 1	1. Illustrate automation of basic tasks like monitoring memory consumption, check remote servers' connectivity, etc., at different frequencies.
9	1	2, 3,4	**Network Management** Network components- IP address, subnet mask, gateway. Network Interface management; Communication. Data transfer facilitation. Diagnosis and troubleshooting; Resource analysis.	Refer Table 1	1. Enable internet on Linux VM. 2. Test and manage network using following commands ifconfig, iwconfig, ethtool, arpwatch, bmon ,telnet, ssh, sendmail, mailstats, w cURL, wget, ftp, rcp, scp, rsync, sftp. netstat, ping, traceroute, iftop, nload, ss. tcpdump, dstat.
10	2,4 / 2,4,7		**User authentication** User and Group account management. Working on interface. Linux Directory Service - Account Authentication, what is LDAP and Active Directory? LDAP structure, working.	Refer Table 1	1. Work on user accounts useradd, passwd, userdel, usermod, groupadd, groupmod, gpasswd, groupdel; system-config. 2. OpenLDAP Installation 3. LDAP server and client configuration.
11	4	2, 3 4, 7	System monitoring, Log monitoring System maintenance, System information. System architecture, Linux Boot process and System run levels, System updates and repositories.		1. System monitoring commands top, df, dmesg, iostat 1, free, cat /proc/cpuinfo, cat/proc/meminfo; 2. Work on log directory - /var/log; 3. System maintenance commands- shutdown, reboot,

					halt, init. 4. System update & repositories- yum & rpm.
12	2,4	2, 3, 4, 7	Server setup: DNS- Introduction, Configuration, creating DNS zone, using DNS tools; FTP- Installation process, configuration and securing; setting up an Apache Web Server*(http)*	**Refer Table 1**	**Install and configure:** 1. DNS server with a domain name of your choice. 2. FTP server on LINUX and transfer files to demonstrate it's working. 3. Apache web server and create virtual hosts.
13	2,4	2, 3 4, 7	**Storage management:** Disk partition, formatting, mounting; Logical Volume Management (LVM)- Use of LVM, creating Volume groups, logical volume and disk mirroring, Extend Disk using LVM, Adding Swap Space Introduction to RAID – Hardware & Software, RAID levels.	**Refer Table 1**	1. Basic commands for storage partitions. 2. Install and configure LVM. 3. Add Disk and CreateStandard & LVM Partition. 4. Add virtual disk and create a new LVM partition(pvcreate, vgcreate, lvcreate) 5. Extend disk using LVM
Total in hours		**39**		**13**	**52**

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

1	1. Compare features of different OS(windows, Linux, RTOS- Vxworks/android) 2 Study the evolution of OS to recognize the importance of current OS trends. 3. Explain the different flavors of LINUX.
2	1. Explain OS level virtualization and state its benefits. 2. Compare VMs and Containers 3. Identify the difference between hypervisors and Linux containers. 4. Comprehend the benefits of virtualization.
3	1. Compare ex2/ex3 filesystem attributes. 2. Discuss the file- mount and unmount system calls.
4	**1.** Compare Linux fork () and Windows createprocess () functions.
5	1. Study probable conditions for deadlock occurrence and how to overcome it. 2. Identify relationship between threads and processes. 3. Comprehend the differences between types of threads
6	1. Compare the features of swapping and paging.
7	**1.** Compare different Linux shells.
8	1. Write a cron job that runs all essential apps. on an hourly/ daily/weekly/monthly basis. (for ex. Executing Antivirus)
9	1. Compare static and DHCP IP addresses and check whether these can be switched over. 2. Study different options offered by Linux for package management.
10	1. Identify few alternatives to openLDAP and make a comparison.
11	1. Explore other network commands required for a sysadmin and interpret their functions and usage.

12	1. Study the difference between application server and web server.
	2. Identify the role of virtual host.
	3. Explain different types of Apache virtual hosts and how they are set up.
13	1. Compare the features between RAID and SSD.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
			Total Marks		**100**

5. Format for CIE written Test

Course Name	**Operating System and Administration**	Test	I/II/III	Sem	III/IV
Course Code	**20IS42P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
				Average Marks= (8+6+2+2)/4=4.5			**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Operating System internal and Design Principles, William Stallings
2	Operating System, Garry Nut
3	https://www.redhat.com/en/topics/virtualization
4	Virtual Machine - an overview	ScienceDirect Topics
5	DNS: https://www.youtube.com/watch?v=TiWs9n4fhys&list=RDCMUCQSpnDG3YsFNf5-qHocF-WQ&index
6	Linux system admin requirements: https://www.temok.com/blog/linux-system-administration/
7	Linux commands for modern sysadmins- N/W related - https://www.ubuntupit.com/useful-linux-network-commands-for-modern-sysadmins/
8	DNS Technology: https://www.digitalocean.com/community/tutorials/an-introduction-to-dns-terminology-components-and-concepts
9	Commands for Disk Management: https://www.programmersought.com/article/55913754022/

8. CIE SKILL Test or SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Create virtual environment and configure it to meet given application requirement.	20
2	Write and execute a shell script to automate a given task using appropriate Linux commands.	30
3	Demonstrate Linux administration skills in configuring and maintaining a server.	20
4	Explain the working above written shell script and procedure to configure the server, In the event of student failing to explain the working of shell script and procedure to configure the server, examiner shall use viva-voce to check the knowledge of student on operating system services and responsibilities of operating system administrator.	20
5	Portfolio evaluation of practice sessions.	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers		20
2	VirtualBox, Ubuntu or any other Linux OS image.		

Programme	Information Science and Engineering	Semester	IV
Course Code	**20IS43P**	**Type of Course**	Programme Core
Course Name	Object Oriented Programming and Design with Java	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1.Rationale

Object oriented programming paradigm with object-oriented design principles are vital in design and development of today's complex computing solutions. OOD principles provide valuable standards and guidelines to create clean and modular design and avoid code smells. Java being the popular object-oriented programming language that empowers the innovation in this digital world, students will have sound knowledge of object-oriented programming concepts and design principles with java.

2. Course Outcomes: At the end of the course, the student will be able to:

CO-01	Design a solution for a given problem using object-oriented programming concepts and apply all appropriate object-oriented design principles
CO-02	Write and test the code for a designed solution using java OOP concepts.
CO-03	Identify exceptions in the designed or given solution and explain how to resolve them.
CO-04	Demonstrate with an example a java application's connection with a database.

3. Course Content

Week	CO	PO *	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1,2	1, 4	Introduction to Java Brief history; features; java architecture; components: JVM, JRE, JDK; Applications; Java environment setup; Structure of java program; Compilation and execution of java program; Clean coding in java.	Refer Table 1	1. Install and Setup java environment 2. Install java editor (Eclipse for Enterprise Java) and configure workspace 3. Execution of first java program 4. Java code execution process
2	1,2	1, 2, 3, 4, 7	Introduction to OOP: Building blocks: class, object, attributes, methods; Class and objects in java;		1. **Code, execute and debug programs** that uses different types of variables and datatypes;

			Variable: Types (local, instance, static); declaration, initialization; comments; 'Data types;		2. Identify and resolve issues in the given code snippet
3	1,2	1, 2, 3, 4	Constructors: rules for defining constructor; types; Destructor; Access modifiers; **this'** keyword; Autoboxing and unboxing; Operators; Expressions; Evaluation of expressions;		**1. Code, execute and debug programs** a. that uses different types of constructors b. for expression evaluation c. to perform autoboxing and unboxing 2. Identify and resolve issues in the given code snippet
4	1,2	1, 2, 3, 4, 7	**Memory allocation in java**; garbage collection: concept, working, types, advantages finalize () method;		1. Install memory monitoring tool and observe how JVM allocates memory 2. Memory allocation explanation through the programs
5	1,2	1, 2, 3, 4	**Conditional and Iterative statements** Decision making: if, if..else, switch Iterative: need of iterative statements; types of loops in java; how to use them; Break and continue statements;		1. Code, execute and debug programs that uses different control statements. 2. Identify and resolve issues in the given code snippet
6	1,2,3	1, 2, 3, 4, 7	**OOP concepts**: **Encapsulation** Concept; What is encapsulation? How to achieve encapsulation in java; Packages; **Single Responsibility Principle**: Intent; Rules; Benefits; example		1. Code, execute and debug programs 2. that uses encapsulation concept. 3. Define class & implement like simple calculator or text processing and check compliance with SRP.
7	1,2	1, 2, 3, 4	**Arrays**: Why arrays? Features, types, Declaration, array creation with new operator, working with arrays; Strings: creation, string methods;		1. Code, execute and debug programs that uses array concept 2. Code, execute and debug programs to perform string manipulation.
8	1,2	1, 2, 3, 4, 7	**OOP concepts**: **Inheritance** Inheritance concept; types; Inheritance in java; Examples; **Open Closed principle:** Intent; Rules; Benefits; example	**Refer Table 1**	1. Code, execute and debug programs that uses inheritance concept 2. Design a class & implement like file parser and check compliance with OCP.

9	1,2	1, 2, 3, 4,7	**OOP concepts**: **Polymorphism** Polymorphism concept; types: method overloading and overriding; application; polymorphism in java; sufficient examples;		1. Code, execute and debug programs that uses a. static binding b. dynamic binding
10	1,2	1, 2, 3, 4, 7	**OOP concepts: Abstraction** Overview; implementation of abstraction in java: abstract class and interface; Relationship between class and interface; inheritance in interface; Examples to substantiate the understanding of concepts; Eg. File parser; message logger		1. Code, execute and debug programs that uses 2. abstract class to achieve abstraction 3. interface to achieve abstraction 4. Verify whether the given code snippet is correct according to abstraction or not
11	1,2,3	1, 2, 3, 4, 7	**Files and Exception handling** Files and I/O streams: File reader and writer; Exception concept; exceptions in java; classification: checked and unchecked; exception handling in java;		1. **Code, execute and debug programs in java to** a. handles checked and unchecked exceptions b. read the content of the file and write the content to another file 2. Incorporate exception handling in programs/applications developed in previous sessions.
12	1,2,3	1, 2, 3, 4, 7	**Design principle:** **Interface Segregation principle:** Intent; Rules; Benefits; examples; Enums; Overview of java annotations;	Refer Table 1	1. Design an interface & implement it like one that builds different types of toys and check compliance with ISP.
13	1,2,3,4	1, 2, 3, 4, 7	**Database Connectivity** Introduction to JDBC; JDBC components; How JDBC works? JDBC connections; Connect java application to database using JDBC;		1. Code, execute and debug programs to connect to database through JDBC and perform basic DB operations
Total in hours		**39**		**13**	**52**

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

Sl. No	Activity

1	1. Identify various java IDEs and identify differences between them.
	2. Compare and contrast Java with Python
2	1. Study and present
	a. type casting in java
	b. what are command line arguments in java?
	c. java keywords and their usage
3	1. Compare and contrast
	a. method and constructor;
	b. constructor and destructor
4	1. Study and present how does bytecode work in java.
5	1. Present nesting of conditional and iterative statements considering a use case.
6	Identify advantages and disadvantages of
	a. Encapsulation.
	b. Inheritance
	c. Abstraction
	d. Polymorphism
7	Study and report
	a. java Arrays class their methods
	b. java String class their methods
8	Identify and document how these principles help to avoid code smells.
	a. SRP
	b. OCP
	c. ISP
9	Compare and contrast
	a. static and dynamic binding and identify usage of each
	b. abstract class and interface, identify usage of each
10	1. Differentiate error and exception
	2. Identify and document system exceptions
11	Study DRY principle, identify the benefits.
12	Identify how OOD principles violations impact the quality of code.
13	Identify java ORM frameworks and their features.
14	Study and find the inclusions in latest java versions.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
				Total Marks	100

5. Format for CIE written Test

Course Name	Object Oriented Programming and Design with Java	Test	I/II/III	Sem	III/IV
Course Code	**20IS43P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	https://docs.oracle.com/javase/tutorial/java/concepts/
2	www.edureka.co
3	Clean Code by Robert C Martin
4	https://www.javabrahman.com/programming-principles/
5	https://medium.com/

8. CIE Skill Test 1 Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Develop a solution for a given problem using object-oriented programming concepts	20
2	Write program for above given problem using appropriate java OOP concepts.	20
3	Code, execute, test and debug the above program	30
4	Demonstrate the how your program has solved the given problem. In the event of, a student fails to get the desired result (with no syntactical errors and least sematic errors), the examiner shall use viva voce to assess the student understanding of OOP concepts and java code execution process.	20
5	Portfolio evaluation based on aggregate of all practice sessions	10

	Total Marks	100

Note: For CIE skill test 2, SEE scheme of evaluation shall be used.

9. SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Develop a solution for a given problem using object-oriented programming concepts	20
2	Write program for above given problem using appropriate java OOP concepts.	20
3	Code, execute, test and debug the above program	30
4	Demonstrate how your program has solved the given problem and compliance of your solution with object-oriented design principles. In the event of, a student fails to get the desired result (with no syntactical errors and least sematic errors), the examiner shall use viva voce to assess the student understanding of OOP concepts and OOD principles	20
5	Portfolio evaluation based on aggregate of all practice sessions	10
	Total Marks	**100**

10. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers		20
2	Java 8.0 and above, eclipse		20

Programme	Information Science and Engineering	Semester	IV
Course Code	**20IS44P**	Type of Course	Programme Core
Course Name	Software Engineering principles and practices	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale

Digital reality has become an integral part of human life with software tools being used to deal with virtually every part of life. A process is key to develop a quality software successfully. Principles and practices of software engineering blends engineering, computing, project management and software development. It's essential to understand the life cycle of software development and the process followed to develop a quality software. Design thinking methodology encourages identifying alternative strategies and solutions to solve a problem in best possible way.

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Explain the typical software development life cycle (SDLC), list and differentiate the various SDLC models along with identifying where each model could be beneficial when applied.
CO-02	Demonstrate the application of design thinking as a process, explain how it helps in requirement engineering and mitigate risks.
CO-03	Study a given application requirement, create user stories, draw the appropriate UML diagram and validate to ensure user story/UML diagram meet with the given requirement.
CO-04	Document standard test procedures and test cases for a given requirement to ensure the software gives the desired results for which it is built.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1	**Overview** Software engineering; Need of software engineering; Software paradigms; Software product types: generic, customized; characteristics of good software; Challenges in software projects; Factors that influence software development; understanding success Software process; need of process, components of process, process	Refer Table 1	1. Discuss success and failure stories 2. Presentation of collected case studies 3. Enact the importance of ethical practices

			activities; Differentiate product, project and process; process assessment and improvement; Software engineering ethics.		

2	1	1, 5	**SDLC and Process Models**
			SDLC; Software process model; How to choose process model? Comparison between a defined process and an empirical process; Traditional process models: waterfall; Incremental;
			Agile process- manifesto; principles; practices; A paradigm shift from plan driven mentality.
					1. Case study to understand the SDLC
					2. Organize and play games to understand the agile process like, morning wake up game
					  ▪ the marshmallow challenges
					  ▪ White Elephant Sizing
					  ▪ Easter Egg Challenge
					3. Create JIRA (similar tool) account and learn interface
					  ●

3	1	1, 5	Agile frameworks; Ceremonies; Roles; Overview of XP – XP practices Scrum: Overview; framework; ceremonies and artifacts		1. Play and act agile ceremonies 2. Play different agile roles Eg. Product owner, business analyst
4	1,2	1	**Risk** Risk, characteristics, categories; why risk management is critical; risk management framework; Activities; Principles of risk management, Risk identification, Risk assessment – risk analysis; risk prioritization; Risk Mitigation; need and importance of risk mitigation; Risk Control – planning, resolution, monitoring; How to use tool to manage and mitigate risks in an organization.		1. case study to understand the importance of risk management and mitigation of risk 2. How to use tools to manage and mitigate risks [eg. Logicgate, AuditBoard etc]
5	2	1, 2	**Design Thinking** Introduction, 5 stages of design thinking Understand the process of design thinking using an example Case Study		1. Conduct warmup activities to Ignite Design Thinking 2.Organize and conduct design thinking exercises and games

6	1,3	1, 2	**Requirement Engineering & Modeling** Overview; what is requirement? Importance; Requirement types; Sources of requirements; Requirement engineering Process; Feasibility study; Typical Requirements Engineering Problems; Requirement modeling strategies; Overview of UML; types of diagrams; **Note: Take a case study to understand requirement engineering and prepare use cases or user stories**		1. Organize role play for requirement activities 2. Identify a problem and prepare requirement document or Epics and user stories 3. Configure JIRA for the managing the project to solve the identified problem 4. Draw UML diagram for given use case
7	1,3	1, 2, 4	**User stories** What are user stories? Why user story? Basic concepts; Characteristics; How to write/create user stories? Steps; 3C's in user stories; Life cycle of user story. User story map. **Estimation:** User story point: basics; components of story point estimation; Steps involved in estimation;		1. Create detailed user stories for the above identified problem 1. Organize and play planning poker to decide on user points.
8	1,2	1, 2, 3	**Design** Objectives; design Concepts; Levels of design; Architectural styles; Monolithic and Microservices; UI and UX: Overview of UI and UX, UI types, essential properties, elements of UI design; relationship between UI and UX; Importance of good UI/UX. Wireframes: overview, purpose, benefits;		1. Create sitemap and wireframe for above created user stories. (Tools such as sketch, Adobe XD, Figma, etc can be used)
9	1	1, 2, 3, 4	**Development** Overview of DevOps; working principle; Benefits; DevOps culture; DevOps practices: continuous integration, continuous delivery, version control, configuration management, Build process;		1. Create Git (similar tool) account and configure repository 2. Upload the artifacts created to Git Learn version control and configuration management with Git
10	1	1, 2, 3, 4	**Code quality and code security**: overview; importance; issues caused by poor code; tools to check code quality **Containerization**: Container, why container, containerization; working principle; benefits; Hello world example **Note: Docker or similar tool can be used to explain the containers.**		1. Install and configure Jenkins 2. Create a container image for Hello world project 3. Setup build for container image using Jenkins (Hello world application)

11	1,4	1, 4	**Testing** Principles of testing; Need of testing; stages; Testing process and activities; classification; Testing strategies; Levels of software testing; Software testing types; (Integration testing, functional testing, end-to-end testing need to be explained in detail)		1. Prepare Test plan for the user stories using JIRA 2. Prepare RTM for the user stories created using JIRA. Create test cases for the user stories created.
12	1,4	1	**Software Measurement and Metrics** Measurement; need of Measurement; types; Metrics: characteristics; classification; Agile metrics; Application monitoring.		1. Use JIRA or similar tool to capture agile metrics 2.Use SonarQube to capture code quality metrics
13	1,4	1	**Quality Control and Assurance** Concept of software quality, Compliance, Quality Standards, quality control, quality assurance; Difference between QC & QA. Need for auditing. Auditing fundamentals: auditing, elements of auditing; audit types; auditing methods, benefits of auditing. Quality and Process improvement tools and techniques– pareto chart, PDCA cycle, Six sigma and Lean process		1. Organize Roleplay to understand the roles and responsibilities of QA and QC team. 2.Audit the artifacts produced in previous sessions
Total in hours			39	13	52

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

Sl No	Activity
1	Study the traffic signal and the importance of rules and process.
2	Visit various consulting company web portals and collect case studies.
3	Document the roles and responsibilities of different agile ceremonies
4	Identify cost of risk; Identify commonly used risk management tools.
5	Identify a problem and explain how design thinking can be applied to solve it. Design a shopping cart to achieve ease of use, applying design thinking.
6	Prepare RPM requirement traceability matrix for shopping cart List the criteria to select the requirement management tools. Identify different requirement management tools and list their features. Identify frequently used UML diagrams and also identify tools used to draw them.
7	Explore agile estimation techniques and prepare a report.
8	Study boiler plate and present necessary characteristics of boiler plate for a large and small project
9	Identify different DevOps Tools and list their features Study and report OWASP coding guidelines Learn and report Twelve Factor App methodology Identify different version control and configuration management tools and report their market share

10	Compare and contrast containerization and virtualization and identify importance of these in software development Identify container providers
11	Study and prepare report on testing tools. Compare manual and automation testing
12	Study and prepare report on widely used software metrics.
13	Identify different quality tools and report their features and usage

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests
2.	CIE-2 Written Test	9	80	30	30
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
			Total CIE Marks		60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	Software Engineering principles and practices	Test	I/II/III	Sem	III/IV
Course Code	**20IS44P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2

	Average Marks= (8+6+2+2)/4=4.5	**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Agile Software Development, principles, patterns and practices by Robert Martin
2	Art of agile development by James Shore & Shane Warden
3	Extreme programming explained: embrace change
4	Software-Engineering-9th-Edition-by-Ian-Sommerville
5	RPL-7th_ed_software_engineering_a_practitioners_approach_by_roger_s._pressman_
6	Becoming Agile..in an imperfect world by Greg Smith, Ahmed Sidky
7	scaledagileframework.com
8	Continuous Delivery Principles	Atlassian
9	www.agilealliance.org/
10	www.udemy.com
11	www. tutorialride.com
12	www.interaction-design.org/
13	www.digite.com

8. SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Capturing the requirements of the client, documenting, reviewing and acceptance by the client of the documented requirement for given the problem statement.	30
2	Identify and document at least two associated risks for the above case.	20
3	Create user stories for the above requirements and draw a UML diagram using any of the modeling technique.	30
4	Document test suite for the above requirement. Viva-Voce, In the event of student unable to document a test suite, then student should be allowed to explain the test procedure.	20
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1.	Computers		20
2.	Git, Jira, SonarCube, Lucidchart or any other UML design tool		

Programme	Audit Course	Semester	IV
Course Code	**20IS45T**	Type of Course	Audit
Course Name	**Indian Constitution**	Contact Hours	2 hours/week 26 hours/semester
Teaching Scheme	L:T:P :: 2:0:0	Credits	2
CIE Marks	50	SEE Marks	Nil

1. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	**CO1**	Understand Preamble, salient features and importance of Indian Constitution.
CO-02	**CO2**	Understand Fundamental rights, duties and Directive principles of state policy.
CO-03	**CO3**	Understand Parliamentary system of governance, Structure, Functions, Power of Central, state governments (Legislative, Executive) and Judiciary.
CO-04	**CO4**	Understand Panchayat Raj Institutions and Local self-governments, UPSC, KPSC, NHRC, Status of women, RTE etc.

2. Course Content

Week	CO	Detailed Course Content	Contact Hours
1	1	Introduction to constitution of India-Formation and Composition of the Constituent Assembly-Salient features of the Constitution-Preamble to the Indian Constitution	2
2	1,2	Fundamental Rights- Definition, The right to equality, The right to freedom, The right against exploitation, The right to freedom of religion.	2
3	1,2	Cultural and educational rights and The right to constitutional remedies. Fundamental Duties, Directive principles of state policy.	2
4	1,3	Parliamentary system of governance- Structure of Parliament- Lok Sabha and Rajya Sabha. Functions of parliament- Legislative, Executive, Financial Function Powers of Lok Sabha and Rajya Sabha.	2
5	1,3	Procedure followed in parliament in making law, Annual financial statement (Budget) – procedure in parliament with respect to estimates, Appropriation bill, Supplementary, additional grants, Vote on account, votes on credit and exception grant, special provisions, rules of procedure.	2
6	1,3	Structure of union executive, Power and position of President. Vice President, Prime minister and council of ministers.	2
7	1,3	Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts.	2
8	1,3	Federalism in the Indian constitution- Division of Powers: Union list, State list and concurrent list. Structure of state legislation, Legislative assembly and Legislative council.	2

9	1,3	Functions of state legislature, Structure of state executive-Powers and positions of Governor, Speaker, Deputy Speaker, Chief Minister and council of minister.	2
10	4	Local self-government- meaning-Three tier system, Village Panchayat-Taluk panchayat Zilla panchayat, Local bodies-Municipalities and Corporations, Bruhath Mahanagara Palike, Functions of Election commission, UPSC, KPSC.	2
11	4	Amendment of the constitution, Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life,	2
12	4	Status of Women in India - Women in rural areas, Constitutional Safeguards - Dowry Prohibition act 1961- Domestic violence act 2005- Sexual harassment at work place bill 2006. Human Rights of Children- Who is a child- list the Rights of the Child- Right to education, Protection of Children from Sexual Offences Act (POCSO)-2012-	2
13	1,4	National Human Rights Commission Constitution- Powers and function of the Commission-Employee rights- Provisions made, Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trademark	2
Total in Hours			**26 Hrs**

REFERENCES

1. Introduction to the Constitution of India- Dr. Durga Das Basu
2. Empowerment of rural women in India-Hemalatha H.M and Rameshwari Varma, Hema Prakashana.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 MCQ	6	60	20	Average of two CIE = 20
5	CIE-5 Open Book Test	12	60	20	
Total CIE Marks					50
Semester End Examination (Practice)		-	-	-	-
Total Marks					**50**