Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Computer Science and Engineering	Semester	III
Course Code	**20CS32P**	**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

5	01, 03	01, 04	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	**20CS32P**	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