Programme Name/s	**: Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Industrial Electronics/ Electronics & Computer Engg.**
Programme Code	**: DE/ EJ/ ET/ EX/ IE/ TE**
Semester	**: Fourth**
Course Title	**: CONSUMER ELECTRONIC SYSTEMS**
Course Code	**: 314327**

I. RATIONALE

The usage and demand for consumer electronic appliances is increasing in both domestic as well as industries. This increases the demand for trained man power in the relevant industries. This course will provide working principle of various consumer appliances/gadgets /equipments and skills to troubleshoot and maintain them in scientific way. The knowledge gained will help the students in the manufacturing units of these consumer gadgets or help the students to start their own enterprise.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain the following industry/employer expected outcome through various teaching learning experiences.

Maintain various consumer electronic appliances/equipments.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Maintain the given type of audio system.
- CO2 - Test different types of video systems.
- CO3 - Troubleshoot various consumer electronic appliances.
- CO4 - Use various smart appliances.
- CO5 - Maintain various office automation appliances.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314327	CONSUMER ELECTRONIC SYSTEMS	CEL	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare mono, stereophonic and quadraphonic amplifier. TLO 1.2 Explain the controls available on Hi-Fi Amplifier. TLO 1.3 Describe the operating principle and working of the given type of microphone. TLO 1.4 Explain with sketch the construction and working principle of the given type of speaker. TLO 1.5 Draw the block diagram of Public Address System with explanation.	**Unit - I Audio Fundamentals** 1.1 Basic characteristics of sound signal : Intensity and loudness, pitch, frequency response, fidelity, sensitivity and selectivity 1.2 Audio Amplifiers: Mono, stereo, quadraphonic, block diagram of Hi- Fi amplifier and its working, use of bass, treble tone controls 1.3 Microphone: Working principle and Types - condenser, crystal, electret, laser 1.4 Speakers: Working principle and types- electrostatic, dynamic, plasma arc, Bluetooth 1.5 Multi-speaker system: Definition, Crossover Networks, Impedance matching 1.6 Public Address System (PA system) and Home theatre : Block diagram and working principle	Lecture Using Chalk-Board Video Demonstrations Model Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe working of CCTV system with functional block diagram. TLO 2.2 Describe with block diagram the working of LCD TV. TLO 2.3 Explain the working of LED TV. TLO 2.4 Explain with sketch the functions of given blocks of DTH. TLO 2.5 Write features and applications of Smart interactive TV.	**Unit - II Video Systems** 2.1 Closed circuit television (CCTV): functional block diagram, working ,installation of CCTV 2.2 Liquid crystal display (LCD) television: Principle, Block diagram and working 2.3 Block diagram and working principle: Light emitting diode(LED) TV, Organic light emitting diode(OLED) TV, Quantum dot light emitting diode (QLED) television 2.4 Direct to Home (DTH) television : Block diagram and working principle 2.5 Smart interactive TV : Features and applications	Demonstration Lecture Using Chalk-Board
3	TLO 3.1 Explain with sketch the working of photocopier machine. TLO 3.2 Prepare specifications of a Microwave oven and describe its working. TLO 3.3 State function of each block of washing machine. TLO 3.4 Describe features of camcorder. TLO 3.5 Explain the working of scanner. TLO 3.6 Describe the working of bar code reader.	**Unit - III Consumer Electronic Appliances** 3.1 Photocopier: Block diagram and working principle 3.2 Microwave Oven: Block diagram, single chip controllers, types, wiring diagram, safety instructions, electrical specifications 3.3 Washing Machine: Block diagram, electrical specifications, types and features of (Automatic, Semi-automatic and Fuzzy Logic) washing machine 3.4 Digital Camera and Camcorder: Working principle, picture processing, picture storage, electrical specification 3.5 Scanner: Working principle, Specifications, types of scanners (Handheld ,Flatbed, Sheet fed ,Portable Scanners), interface cables, ports and connectors 3.6 Bar code reader: Working principle , applications	Lecture Using Chalk-Board Demonstration Site/Industry Visit
4	TLO 4.1 Explain constructional features with applications of wearable antennas. TLO 4.2 Describe with functional block diagram working of smart wristband. TLO 4.3 Describe with functional block diagram working of VR headset. TLO 4.4 List the augmented reality devices used in classroom. TLO 4.5 State regulations related to recycling of E-waste.	**Unit - IV Smart appliances.** 4.1 Wearable antenna: Construction, Working principle and applications 4.2 Smart Wrist bands :Construction, applications and functional units (sensors ,signal conditioning, microcontrollers, wireless connectivity , power management, firmware, storage) 4.3 Virtual Reality (VR) Headset: Functional block diagram and functional units (tracking unit, processing unit, display unit, sensors, pixel resolution, field of view),virtual reality supported platforms such as Windows Mixed Reality(WMR) 4.4 Augmented Reality(AR) devices: Functional block diagram, working principle, examples 4.5 Recycling of electronic appliances :Regulations and procedures	Lecture Using Chalk-Board Video Demonstrations Flipped Classroom

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe the working of a laser printer. TLO 5.2 Explain the function of various controls of LED projector. TLO 5.3 State the features of smart interactive board. TLO 5.4 Describe the working of given component in biometric attendance system. TLO 5.5 Explain functional blocks of video conferencing system with suitable sketch. TLO 5.6 Describe the working of paper shredding machine.	**Unit - V Office Automation appliances** 5.1 Laser Printer: Working principle, features, specifications, functional block diagram, control unit and troubleshooting procedure 5.2 Smart Interactive Board: Working procedure, features and specifications 5.3 LED Projector: Working principle, features, specifications, functional block diagram, control unit and troubleshooting procedure 5.4 Biometric Attendance system: Hardware and software components , working procedure 5.5 Video conferencing system: Components and working procedure 5.6 Paper shredding machine : Components and working procedure	Lecture Using Chalk-Board Presentations Model Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Test and measure the various parameters of a microphone.	1	Performance of given type of microphone	2	CO1
LLO 2.1 Test the given speaker and plot its frequency response.	2	*Performance of given speaker	2	CO1
LLO 3.1 Measure voltages at different sections of Hi-Fi amplifier.	3	*Performance of given Hi-Fi amplifier	2	CO1
LLO 4.1 Locate any three different faults by voltage analysis method in a Hi-Fi Audio amplifier.	4	*Fault identification in Hi-Fi amplifier	2	CO1
LLO 5.1 Measure the voltages for various components of CCTV unit.	5	*Test the CCTV unit	2	CO2
LLO 6.1 Connect CCTV Cameras to DVR/IVR, record and replay.	6	Connection of CCTV cameras to DVR/IVR	2	CO2
LLO 7.1 Measure voltage of Power supply , Audio section and Video section of LCD TV. LLO 7.2 Compare the above measured voltage with standard voltage.	7	Voltage analysis of power supply section,audio section and video section of LCD TV	2	CO2
LLO 8.1 Troubleshoot the faults in a LCD TV- a) No picture, No Audio b) No Audio but proper picture. c) Complete dead TV.	8	Fault analysis of LCD TV	2	CO2
LLO 9.1 Test the performance of various sections of given LED TV - a) Power supply b) Driver LED section c) Audio section d) Video section.	9	*Voltage analysis of given sections of LED TV	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Locate and rectify faults in a LED TV - a) No picture, No Audio b) No Audio but proper picture.c) Complete dead TV .	10	*Fault analysis in LED TV	2	CO2
LLO 11.1 Test the components and operation of the paper feed mechanism in a photocopier machine through dismantling and reassembly.	11	*Dismantling and assembling of paper feed mechanism in photocopier machine	2	CO3
LLO 12.1 Identify and test various front panel controls of microwave oven.	12	*Identification of front panel controls of microwave oven	2	CO3
LLO 13.1 Detect and rectify faults in microwave oven - a) Oven not starting b) Oven not heating c) Error display.	13	*Fault analysis in microwave oven	2	CO3
LLO 14.1 Set the time duration of different wash cycles for a given washing machine.	14	*Performance of washing Machine	2	CO3
LLO 15.1 Sketch the wiring diagram of washing machine and locate its main components.	15	Sketch the wiring diagram of washing machine	2	CO3
LLO 16.1 Troubleshooting of washing machine - a) Excessive noise during operation b) Door lock problem. .	16	Fault analysis of washing machine	2	CO3
LLO 17.1 Test the various functions of Camcorder such as iris and shutter speed control, computer interface, recording rate and recording format.	17	Use the various functions of Camcorder	2	CO3
LLO 18.1 Interface the scanner to the desktop computer and test its various controls.	18	*Interfacing of scanner	2	CO3
LLO 19.1 Measure the signal strength of wearable antenna.	19	Performance of given wearable antenna	2	CO4
LLO 20.1 Display faults in smart wrist bands - a) display not working b) poor brightness .	20	*Display faults in smart wrist bands	2	CO4
LLO 21.1 Take Back-up of data from wearable device such as wrist band to given drive/ storage device.	21	Data back-up from wearable device	2	CO4
LLO 22.1 Test the VR headset problems - a) Bluetooth connectivity b) USB port connection .	22	Connection problems in VR headset	2	CO4
LLO 23.1 Use the controllers of VR headset to navigate within the virtual environment.	23	Performance of VR headset	2	CO4
LLO 24.1 Interface the laser printer to the desktop computer and identify various controls.	24	*Interfacing of laser printer	2	CO5
LLO 25.1 Detect and remove the faults in laser printer - a) The print quality is not very good. b) White Lines and Streaks. c) Cartridge leakage .	25	* Fault analysis for the cartridge related problems of laser printer	2	CO5
LLO 26.1 Measure the speed of given laser printer.	26	*Performance of laser printer	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 27.1 Interface and configure LED projector using various controls.	27	Interfacing of LED projector	2	CO5
LLO 28.1 Create new interactive whiteboard pages using Interactive whiteboard simulation software like Mimio Studio, SMART Learning Suite Online.	28	*Creating new interactive whiteboard pages	2	CO5
LLO 29.1 Test the audio and video settings for a video conferencing session.	29	Assess the quality of a video conferencing session	2	CO5
LLO 30.1 Determine the shredding capacity (number of sheets) and speed (sheets per minute) of a paper shredding machine.	30	Determination of capacity and speed of a shredding machine	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare a report on consumer product international standards.
- Do market survey of various models of Camcorder on the basis of different features through online/offline and make a report.
- Make presentation on functioning of biometric attendance system in institute.
- Develop a PA system for institute conference hall.
- Install and prepare annual maintenance report of SMPS/CCTV available in the institute.

Visit

- Visit to consumer product manufacturing unit.
- Visit to nearby electrical and hardware repair center of consumer appliances and make a report.

Assignment

- Prepare chart on CCTV components and specifications.
- Draw neat sketches of condenser and electret microphones.
- Draw neat sketches of electrostatic and dynamic speakers
- Compare washing machine types, features and electrical specifications

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Digital Multimeter: 31/2 digit display,9999 counts digital multimeter measures: Vac,Vdc(1000Vmax) Adc, Aac (10 amp max.) Resistance (0-100 M ohm), capacitance and temperature measurements .	1,2,3,4,7,5,8,9,10,12,13,20,22
2	Microwave oven – Supply voltage: 220 volts, 50Hz. single phase A.C. supply, Power Consumption: 1300W approx., Microwave Power: 700W - 850W,Oven Capacity: 20 litres - 25 litres ,Microwave Frequency: 2450 MHz, Control : Soft/one touch control, Timer : 60 minutes - 90 minutes. (any other equivalent) .	12,13
3	Cabinet/panel opener tool set / Telecommunication tool set, screwdriver dissemble tool, crowbar set, Hammer, Pliers, Wire cutter, LAN Crimping Tool, Aligner.	12,13,14,15,16,18,20,21,25
4	Washing machine unit (suitable unit) - 240 V ,50 Hz, Fully automatic control, Max. Spin Speed 780 RPM. (any other equivalent)	14,15,16
5	Camcorder - 4K HDR Video Recording.	17
6	Scanner-type-Flatbed color, Photoelectric device-Color CCD line sensor, effective pixels- 40,800 × 56,160 pixels at 4800 dpi,Scanning resolution-4800 dpi (main scan),9600 dpi with Micro Step (sub scan),Output resolution-50 to 6400, 9600, and 12800 dpi, Image data-16 bits per pixel per color internal,16 bits per pixel per color external (maximum),Interface-One USB port. (any other equivalent) .	18
7	Smart wristband , bluetooth synchronization, low power accelerometer sensor, vibration motor support, operating temp -10°C to 50° C ,system requirement –iOS 9.0 and above/Android 5.0 and above. (any other equivalent)	19,20,21
8	Audio level/dB meter - Functions : MAX / MIN / HOLD, Auto Power Off ,Range : 35 dB ~ 130 dB (31.5 Hz ~ 8 kHz),Accuracy : ±1.5 dB (under reference condition), Resolution : 0.1 dB,Power : 9 V Battery.	2,19
9	VR headset- Max Resolution 3664×1920 per eye, Screen Type Fast Twitch LCD, Max Refresh Rate-120Hz, Tracking 6DOF Inside Out Tracking (wireless). (any other equivalent) .	22,23
10	Laser Printer -600 x 600 dpi ,Input capacity-Up to 150 sheets, Output capacity-Up to 100sheets,Media type Paper (laser, plain, photo), Memory - standard 2 MB.(any other equivalent).	24,25,26

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
11	LED Projector- Built in 10 W speakers, 28dB low noise bright 4000 lumens, versatile connectivity, USB power, long lamp life upto to 15000 hours. (any other equivalent) .	27
12	Simulation Software : mimio studio/SMART Learning Suite Online .	28
13	Desktop PC or laptop with video conferencing platform such as Zoom, Microsoft Teams, Cisco Webex, or Google Meet, cameras, microphones, and speakers compatible with chosen video conferencing platform, stable and high-speed internet connection .	29
14	Hi Fi amplifier system trainer - Hi-Fi Audio Amplifier (Using Power Transistor)Trainer Kit- For Measure Power Transistor Voltages OfDifferent Stages. Demonstration model of Hi Fi amplifier with various test points for wave form tracing, 2 Channel, tone controls bass, treble, blend, master gain control,5+5 band graphic equalizer with fault creation facility.	3,4
15	Automatic/Semi automatic cross-cut shredder/shredding machine with shred Speed- 1.5 m/min and shred capacity of 20 sheets or any suitable configuration .	30
16	CCTV tool monitor- Build in battery: 3.7 volt 3000 mAH, Power Output: 12V DC, Resolution: 480x234, Screen Size: 3.5 Inch.	6,5
17	CAT 5/CAT 6 cable tester.	6,5
18	LCD TV trainer Kit -14” (or other equivalent) with Faults creating switches and test points at various sections.	7,8
19	Cathode Ray Oscillator: DC -30 Mhz dual channel, Rise time:12 ns approx. accuracy :±3 % input impedance:1 M ohm.	7,8,9,10
20	LED Color TV trainer Kit -18 “/21” (or other equivalent) with Faults creating switches and test points at various sections.	9,10

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Audio Fundamentals	CO1	6	2	2	4	8
2	II	Video Systems	CO2	7	4	4	4	12
3	III	Consumer Electronic Appliances	CO3	10	4	6	6	16
4	IV	Smart appliances.	CO4	10	4	6	6	16
5	V	Office Automation appliances	CO5	12	4	6	8	18
Grand Total				**45**	**18**	**24**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two-unit test marks will be considered for out of 30 marks.

For formative assessment of laboratory learning 25 marks.
Each practical will be assessed considering 60 % weightage to process, 40 % weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks.

End semester summative assessment of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	3	1	1	3			
CO2	2	1	2	3	1	1	3			
CO3	3	1	2	3	1	1	3			
CO4	2	1	2	3	3	1	3			
CO5	2	1	2	3	1	1	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Bali S.P.	Consumer Electronics	Pearson Education India, New Delhi,2007;ISBN:9788131717592
2	Bali R and Bali S.P.	Audio video systems: principle practices and troubleshooting	Khanna Book Publishing Co.(P) Ltd.,New Delhi,2014;ISBN:9780070067172
3	Gupta R.G.	Audio Video Systems: principle and practices and troubleshooting	Mc Graw Hill, New Delhi , 2010; ISBN:9780070699762
4	Whitaker Jerry and Benson Blair	Standard handbook of Audio engineering	McGraw-Hill Education; New Delhi 2010; ISBN -13:9780070067172
5	Glen Ballou	Handbook for Sound Engineering	ELSEVIER-British Library Cataloguing-in-Publication Data,2008; ISBN: 9780240809694
6	Whitaker Jerry and Benson Blair	Mastering Digital Television	McGraw-Hill Professional, New Delhi, 2010; ISBN-13:9780071411806
7	Haider Raad	The Wearable Technology handbook .	Ohio publishing and academic services, Metaverse Edition,2022: ISBN: 9781737233480
8	Murray Ramirez	Virtual Reality for Beginners! How to Understand, Use and Create with VR	Create Space Independent Publishing Platform,2016; ISBN-13 : 9781540532220
9	P Kaliraj, Devi Thirupathi	Innovating with Augmented Reality: Applications in Education and Industry	CRC Press, Taylor and Francis group,ISBN: 9781003175896
10	Jerry D. Gibson.	Multimedia Communications	ISBN:9780122821608

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://ed.iitm.ac.in/~raman/agcl/VR_Paper.pdf	VR Headset
2	https://www.nxp.com/assets/block-diagram/en/AugmentedReality andVirtualRealityHeadsets.pdf	V R Headset
3	https://www.nxp.com/assets/block-diagram/en/SmartWatch_SMART WATCH.pdf	Smart Watch
4	https://www.nxp.com/assets/block-diagram/en/SmartWatch_SMART WATCH.pdf	Smart Watch
5	https://www.nsdcindia.org/scmp/assets/image/1179656187-CCTV_ Installation_Technician__English.pdf	CCTV installation handbook
6	https://toshiba.semicon-storage.com/ap-en/semiconductor/appl ication/multi-function-printer.html	Multifunctional printer/ All-in-one printer
7	http://digimat.in/nptel/courses/video/117105133/L10.html	Perception of sound
8	https://www.coursera.org/learn/introduction-virtual-reality	Introduction to VR
9	https://www.youtube.com/watch?v=d1Lk7EL-XEo	LCD/OLED
10	https://www.youtube.com/watch?app=desktop&v=6-heUDnJaHQ	Simulation for wearable antenna
11	https://www.youtube.com/watch?v=S5n3APXOk_k	Wearable antenna
12	https://www.instructables.com/DIY-LED-Projector/	LED Projector
13	https://da-iitb.vlabs.ac.in/exp/washin-machine-control/simul ation.html	Washing machine simulation
14	https://ijrpr.com/uploads/V4ISSUE3/IJRPR10799.pdf	Paper shredder machine
15	https://core.ac.uk/download/pdf/12008168.pdf	Biometric attendance system.
16	https://www.indiafilings.com/learn/e-waste-management/	Recycling of electronic appliances
17	https://cpcb.nic.in/displaypdf.php?id=aHdtZC9HVUlERUxJTkVTX0 VXQVNURV9SVUxFU18yMDE2LnBkZg==	e waste management
18	http://slot-tech.com/interestingstuff/a%20collection%20of%20 technical%20stuff%20from%20a%20technician%20in%20Libya/Print er%20and%20Photocopier%20Troubleshooting%20and%20Repair%20Co llectio.pdf	Printer and Photocopier Troubleshooting and Repair
19	https://www.fau.edu/ehs/info/microwave-fire-safety.pdf	Microwave oven safety instructions.

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students