CHAPTER 7 – INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN SCHOOL EDUCATION

7.1 Introduction

Information and Communication Technology (ICT) has become one of the basic building blocks of modern society. Many countries now regard understanding of ICT and mastering the basic ICT skills (Communication, Collaboration, Creativity, Critical Thinking and Problem Solving) as part of the core of education, along with reading, writing and arithmetic.

The Government of India seeks to strengthen the use of ICT in almost every sphere. To promote the use of ICT in school education the Government of India had introduced ICT@ Schools scheme in the year 2004 {by merging the scheme of Educational Technology -1972 and Computer Literacy and Studies in Secondary Schools (CLASS)-1984}. The scheme was revised in the year 2010 and 2011 and a component to develop quality digital contents and incentives for teachers (National ICT Award for School Teachers) was introduced. Till date, 88993 (60.8%) secondary and senior secondary schools of both government and government aided have been covered under ICT@ Schools scheme out of total 146303 schools. Besides, Computer Aided Learning (CAL) program under SSA provided ICT infrastructure in Upper Primary schools, through provision of Rs.50 Lakh per annum per district. The CAL scheme had a coverage of 92,886 out of 4,20,221 schools (22%) approximately. Under the Teacher Education plan, ICT infrastructure are also being provided to the TEIs i.e. SCERTs/SIEs, DIETs, BITEs, etc.

Now the Digital India Campaign (2015) strives to transform India into a digitally empowered society and knowledge economy by focusing on the three vision areas: i. Digital Infrastructure as Core Utility to Every Citizen, ii. e-Governance and Services on Demand and iii. Digital literacy and empowerment of citizen. The three cardinal principles of access, equity and quality could be served well by harnessing the immense potential of ICT. Anytime anywhere delivery of quality education employing ICT is one such implication of Technology in Education. Development in India depends on the extent to which we are able to provide quality education and skill training to all our citizens. Relevant use of technology will help to effectively solve India's problem of providing quality education and development of skilled human resources. ICT needs to be used to provide high quality education, as well as, holistic education to each child including children and youth with special needs and marginalized sections of the society.

ICT in any system and situation includes ICT infrastructure, creation, storage and retrieval of digital resources, use of inter-operable software, technical support, networking using telecommunication and satellite-based communication to enhance learning. The schools and TEIs require a robust, reliable ICT infrastructure in order to effectively integrate ICT into all aspects of school life and that of TEIs including teaching, learning and evaluation.

Education system in any country aims at preparing youth to participate creatively in the establishment, sustenance and the growth of a knowledge society leading to all round Socio-Economic Development of the nation and the global competitiveness. Therefore, this integrated ICT guideline for schools and Teacher Education Institutions subsumes all previous guidelines to promote the following thrust areas:

- Universal equitable, open and free access to a state of art ICT and IT enabled learning environment, tools and digital resources to all students, teachers and teacher educators (BITEs, DIETs, SCERTs, etc.)
- Development of local, localised and vernacular quality digital contents in regional languages and to enable students, teachers and teacher educators to partner in the development and critical use of shared digital resources.
- Enable sharing of ICT infrastructure for skill development of youth and digital literacy of the community.
- ICT enabled assessment & evaluation of the learning outcomes of students in a cumulative manner, tracking of the performance of the teachers, teacher educators, managers etc.
- Development of professional networks of teachers, teacher educators, resource persons in schools and TEIs to catalyse and support resource sharing, up-gradation and continuing education of teachers and educators; guidance, counselling, academic support of students, resource sharing, management and networking of school managers/administrators etc., resulting in improved efficiencies in the schooling process and TEIs.
- Promote research, evaluation and experimentation using ICT tools and ICT enabled practices in order to inform, guide and utilise the potentials of ICT in school and teacher education.
- Appropriate ICT interventions will be adopted to bridge the digital divide with regard to education of girls, and other disadvantaged social groups, including SCs/STs, minorities, CWSN, and other marginalized communities.
- A critical understanding of ICT is core to its success, hence, its benefits, risks and limitations- safe, secure and ethical use of ICT needs to be infused in schools and teacher education curriculum.
- Sensitization of all the stakeholders on the disposal of e-waste and contribute in sustainable development.

7.2 Components

ICT implementation has essentially four components:

The **first** one is the partnership with State Governments and Union Territories Administrations for providing ICT enabled education to Government and Government aided schools and TEIs (SCERTs/ SIEs, DIETs and BITEs).

The **second** component is teacher related interventions, such as, provision for engagement of an ICT teacher in schools, continuous capacity enhancement of all teachers in the use of ICT, and recognition of teachers and teacher educators for innovative use of ICT in education and learning, as a means of motivation. Every teacher is expected to innovatively use ICTs in teaching learning process by selecting and integrating a wide variety of ICT tools and Free and open-source software (FOSS) (including subject specific tools i.e. GeoGebra for

Math; Stellarium, PhET simulations, Kalzium etc. for Science; Open street map and Marble for Geography; concept mapping tools like Free Mind etc.)

Third one relates to the development of digital contents, curation and deployment of existing digital contents mainly through Central Institute of Educational Technology (CIET), National Institute of Education (NIE), NCERT, State Institutes of Educational Technology (SIETs), SCERTs/SIEs and RIEs, and through outsourcing from different relevant agencies. A variety of digital learning resources including audios, videos, interactive, multi-media digital charts, maps, timelines, digital books, on-line labs activities, **virtual and augmented learning resources** need to be developed and will be used to enhance teaching learning process in schools and TEIs and learning outcomes among students, teachers, pupil-teachers and teacher educators. These resources need to be disseminated through multiple modes (transmission and non-transmission)- web-portal, mobile apps, **DTH TV** channels etc. Further offline solutions need to be designed and used for delivery of digital contents through Local Area Networking **(LAN)/** Satellite connectivity. To augment the teaching learning process, continuous professional development of teachers, skill training and promote lifelong learning among all stakeholders in schools and TEIs. **DTH TV** channels should be used through designing of **virtual learning materials** including lectures by best available teachers from the State.

Fourth component is related to creation of Management Information System (MIS) of the schools and TEIs ecosystem to enable cumulative assessments, evaluation, monitoring, regular feedbacks and enhanced learning at various levels

7.3 Expansion of coverage of schools and TEIs in partnership with States/UTs

It shall be the endeavour to bring all Government schools from classes VI to XII, TEIs under the ambit of the scheme in a phased manner.

7.3.1. Infrastructure

(A) Hardware and software: The scheme suggests that each school, TEIs as per their requirement may choose to opt for the following: Tablets/Laptops/Notebooks/PCs with Integrated Teaching Learning Devices, Digital Boards with Content Management Systems and solutions (CMS)/Learning Management Systems (LMS), FOSS, Operating System (OS) and/or Servers with minimum 16 GB RAM, 1 TB Hard Disk, 1 Projector/LCD/LED/Plasma Screen, 1 Printer, 1 Scanner, 1 Web Camera, 1 Modem, Broadband/DTH-TV Antenna/Router, Receive only Terminal (RoT), Satellite Interactive Terminal (SIT), Generator/ Solar Package, UPS, Video Camera, Charging Racks, etc.

(B) Connectivity: It is suggested that the school, TEIs should have a broadband internet connection of at least 2 MBPS bandwidth with a plan to upgrade in future. The school and TEIs should also explore the Wireless links option to

ensure sustainability. Efforts should be made to bring all the schools and TEIs under the ambit of **National Knowledge Network (NKN)** or any other partners. This may be done in convergence with BHARATNET.

(C) Power Supply: Wherever the power supply is unreliable it is suggested to procure solar power panels and wherever they are not feasible a generator may be used on a temporary basis. In such cases where the school and TEI is using a generator facility; a recurring cost subject to a maximum of Rs.3000 per month will be applicable. For reliable power supply, it is advised to take into consideration the guidelines of Ministry of Power & Ministry of Renewable Energy, Government of India for convergence of plans and services.

(D) ICT Infrastructure: The Tablets/ Laptops/ Notebooks would be installed in charging rack(s)(portable) which can be kept in any of the classrooms/ Principal/Head Teacher room/ office room as per the availability in the school and TEIs. If any school has existing ICT labs, the same may be used for keeping charging racks.

7.3.2 Mode of Implementation

It is suggested to the States, UTs and Autonomous bodies, that in-order to implement the program they may opt for any of the following models (uni/ multi model) as per their requirement which includes: Outright purchase through **Government e-Market (GeM)**/BOOT/BOO Model. For all the above-mentioned models, the Service Providers/Original Equipment Manufacturer (OEM) would make available the ICT infrastructure and learning services based on a signed agreement with the State, UTs and Autonomous bodies. The payments upfront and periodic to the service providers and OEMs will be subject to satisfactory deployment, maintenance and implementation of ICT Infrastructure & Services. The States/UTs Govt. and Autonomous bodies shall be free to partner with private organizations or integrate it with other similar schemes for implementation of the 'ICT in schools' scheme including a provision for annual maintenance. The Ministry of Human Resource Development shall consider the entry of the private sector in any of the above-mentioned models. The NCTE and NCERT shall be associated with the scheme in the context of teacher professional development through technology-enabled learning.

7.3.3 Inclusive Education

Assistive technologies such as JAWS and SAFTA, Audio Books etc. and other assistive technology-based solutions will be provided to students with special needs from classes VI to XII and to TEIs. The Rehabilitation Council of India (RCI) would play an important role in this area involving introduction and use of technology for the education of Divyang/ Children with Special Needs and addressing the concerns related to Universal Design of Learning (UDL).

7.3.4 Financial Parameters

The assistance of the Government of India would be for the following items and up to the limits indicated against each item:

a.	**Capital Expenditure (Non-recurring)**	**(Rs.in lakhs)**
1.	Tablets/ Laptops/Notebooks/PCs with Integrated Teaching Learning Devices, Digital Boards with Content Management Systems/solutions (CMS)/ Learning Management Systems (LMS), Free and Open Source Software (FOSS) and OS and/or Servers with minimum 16 GB RAM, 1 TB Hard Disk, 1 Projector/ LCD/ LED/ Plasma Screen, 1 Printer, 1 Scanner, 1 Web Camera, 1 Modem, Broadband/DTH-TV Antenna/ ROT/ SIT, Router, Generator/ Solar Package/Panel, UPS, Video Camera, Charging Racks, etc.	6.00
2.	Operating System & Application Software, Open Source Video Conferencing Software (FOSS may be preferred)	0.20
3.	Furniture	0.20
	Total	**6.40**

Note: The cost includes Annual Maintenance Contract for a minimum period of 5 years.

b.	**Recurring Expenditure**	**(Rs.in lakhs)**
1.	E Content and Digital Resources	0.24
2.	Charges for Electricity/Diesel/Kerosene @ Rs.2000/- p.m. The state may also use Solar Power-Hybrid solar instead, to ensure Sustainability in which case this amount may be utilised for providing additional e-resources.	0.24
3.	Internet connectivity (Tele communications/ satellite communication/ OFC) @ 1000 PM	0.12
4.	Financial Assistance for ICT Instructor @ upto Rs.15000/- p.m.	1.80
	Total	**2.40**

Note: *1. In order to enhance the learning capacities of the students, the schools, TEIs in states/ UTs and Autonomous bodies should optimise/maximise the numbers of Tablets/Laptops/PCs/Notebooks in the classroom situation. Content Access Management devices (Offline, Online, Satellite Based) should be used for effective classroom transaction.

2. The cost includes Annual Maintenance Contract (AMC) for a minimum period of 5 years. The state and UTs needs to commit to take ownership of the project after completion of five years.

3. The state and UTs are provided flexibility in procuring suitable hardware and software under the budget ceiling. However, all efforts should be made to procure and use Free and Open Source Software **(FOSS).**

4. The ICT teacher in schools and TEIs shall provide assistance in implementation of the scheme through hardware, software and ICT pedagogy integration in classroom transaction. **Prioritization of schools for ICT implementation will be given to schools providing greater coverage across grades and number or students.**

Keeping in view the current trends in technology and its usage various options such as Tablets/ Laptops/Notebooks have already been suggested which requires minimum/no civil infrastructure. However if any school and TEIs has any constraints towards such mobile

solutions they may opt for preparation of labs for computers including civil repairs and cabling, etc. depending upon their needs and resources. A combination of static & mobile options may also be deployed. The hardware, software and mode of implementation should be determined by the usage of ICT for teaching learning, digital resources availability, delivery mechanisms & strategy rather than the other way round. Thus the teaching methodology, e-resources for digital literacy an ICT based subject teaching should be decided first and thereafter the planning for hardware and mode of implementation should be done.

7.3.5 Interventions for Teacher

Under the scheme, all Government schools and TEIs (SCERTs, DIETs and BITEs) will have a minimum level of ICT infrastructure. It should be the endeavour to make all students, teachers and teacher educators of these schools and TEIs, ICT literate. This would involve formulation and transaction of curriculum and syllabus on ICT for each of the classes from VI to XII and for TEIs at pre-service and in-service level

All Examination Boards in the country would be encouraged to offer ICT related subjects in an integrated way up to class X and as electives at the Senior Secondary stage.

This scheme would encourage individual schools to offer such electives, so that a large number of human resources with ICT skills/competencies can be built up in the country. Similarly all the SCERTs/SIEs/DIETs/BITEs would design and integrate ICT in Education and Learning components in the Pre-Service and In-Service professional development courses.

7.3.6 Teachers' Training

A. Pre-Service Training:

It will be necessary for all the TEIs to integrate ICT in teaching-learning in the pre-service training courses meant for student teachers. The ICT curriculum prescribed by National Council for Teacher Education needs to be implemented (**NCTE Curriculum Guidelines are at Annexure-VII**).

B. In-Service Training: ICT in Education curriculum should be linked with induction course developed by NCERT. (http://ictcurriculum.gov.in).

(I). Details of Induction training: First time induction training in ICT should be provided to all teachers in the sanctioned schools for a period of 10 days (8 hours per day). The details of training, curriculum and duration (80 hours- 40 hours face to face and 40 hours online through MOOCs platform) to be provided are as follows:

Sl. No.	Topics of Induction training	Hours
1.	Introduction Session	0.30
2.	Introduction to ICT and ICT in Education Initiative taken up at National level	8.00
3.	Exploring Educational Resources through Internet	9.00
4.	Communicating and collaborating with ICT	12.00
5.	Safe, Secure and ethical use of ICT	6.00
6.	Creating Educational Resources with ICT	24.00
7.	Introduction to Assistive technology	4.00
8.	Assessment and Evaluation using ICT	6.00
9.	e-MIS	4.00
10.	ICT - Pedagogy - Content Integration	6.00
11.	Feedback	0.30
	Total hours	80.00

(II). Details of Refresher Training: Refresher trainings in use of ICT in teaching learning should be provided to all teachers of the sanctioned schools. Refresher training is proposed to be provided for 5 days (8 hours per day). The details of training and duration (40 hours- Face to Face/Online mode- through MOOCs platform) to be provided are as follows:-

S. No	Topics of Refresher Training
1.	Internet as a learning resource
2.	Development of Digital Contents
3.	ICT for Teaching, Learning and Evaluation
4.	Safe, Secure and Ethical use of ICTs
5.	Building Communities and Collectivising

The trainings (induction and refresher) would be organized by the respective State Governments/UTs in convenient batches at the SCERTs, SIEs, DIETs, BITEs, CTEs, IASEs, etc. or such other training institutions as the State Governments/UTs find suitable. CIET-NCERT would create a State Resource Group (SRG) in states and UTs selecting faculty from TEIs and schools on ICT in Education and Learning at least 2 to 5 Master Resource Persons/Key Resource Persons who will be providing their support for scaling the teacher training in the respective states/UTs as Mentors.

7.3.7 National Award for the Teachers using ICT in Education

In order to motivate teachers and teacher educators to use ICT in school and teacher education in a big way, National Awards for the Teachers using ICT would be given to 90 teachers every year. An amount of Rs. 1 crore would be kept aside for instituting National Award for the Teachers using ICT for innovations in education. A selection process will be followed by NCERT for short-listing and recommendation of required number of awardees to MHRD-GoI.

7.3.8 **Creation of Management Information System of the Schools and TEIs**

With the increase in the mandate and outreach of the scheme, an appropriate management structure is needed at the national, state and district levels. The States/UTs and Autonomous bodies are expected to develop an automated mechanism (eMIS), for the assets procured under Integrated ICT Scheme, which shall include: Tracking Inventory for hardware, software (including license compliance, vendors, POs, tenders etc.) to facilitate online redressal of issues related to routine operation and maintenance of the scheme and maintain transparency.

7.4. Digital Content Development

7.4.1 Development of appropriate digital content and its persistent and effective use constitutes the core of this scheme. This task would be shared by CIET, Regional Institutes of Education (RIEs), and Pandit Sundarlal Sharma Central Institute of Vocational Education (PSSCIVE) of the NCERT, State Institutes of Educational Technology (SIETs), ET units of SCERTs/SIEs, Institutes of repute having experience of education and development of digital content and other wings of central and State Governments as required. Outsourcing to private sector in a transparent manner may also be done.

Content creation/ acquisition being the critical factor for the success of the scheme, the CIET- NCERT shall work towards utilising the full range of capabilities of the Indian ICT sector. National level and State level committees should also be set up to assess the nature of digital contents to be developed to enhance the learning capabilities of the students, teachers, pupil teachers and teacher educators of schools and TEIs. Efforts should be made on development of digital contents and building of portal/repository/OER/Mobile apps for dissemination of best practices.

Digital contents developed by any of the stakeholders in the country are to be linked with the dissemination platforms. The digital content should be platform agnostic/neutral.

The content should cover the hard-spots for all the grades.

- The content should be essentially mapped to NCERT, SCERTs/SIEs and other state board curriculum. While development of digital contents, effort should be made to design these in local, localised and regional languages
- It should contain 3D/2D immersive Videos
- The modules are to be created in a way that it supports a Teacher-led delivery which requires continual teacher intervention to keep the focus on students learning.
- The modules are to be created in a way that the topics covered are creatively and pedagogically designed.

7.4.1.1. **Development of Infrastructure**

Existing course contents of various teacher training programmes and curriculum based digital contents offered across the country have little component of Educational Multimedia, virtual realities etc. It is proposed to fill this gap by developing and deploying the interactive multimedia, digital books, virtual labs etc. The content developed for various subjects should be translated into other languages and adapted to a regional context so as to avoid de novo efforts for each language. ICT based Science Lab, Math lab and Language Lab should be established with integration of hardware & software.

7.4.2 **Financial Parameters**

Financial assistance would be provided to CIET, SIETs, SCERTs/SIEs, RIEs, PSSCIVE and other institutes including outsourcing agencies for development of e-content, based on the project proposals submitted by them. The norms for development of digital contents shall be developed by CIET and disseminated among all the above mentioned institutes for its adherence.

A variety of digital learning resources including audios, videos, interactives, multi-media digital charts, maps, timelines, digital books, on-line labs activities, **virtual and augmented learning resources** need to be developed and will be used to enhance teaching learning process in schools and TEIs and learning outcomes among students, teachers, pupil-teachers and teacher educators. The content developed for various subjects at one laboratory/institute would be translated into other languages at other laboratories and adapted to a regional context so as to avoid de novo efforts for each language.

7.5 **Programme Management**

The proposal for using ICT should include the details of the infrastructure put in place in the previous year as well as utilization in imparting more effective classroom teaching. The states should share the POCs (Proof of Concepts) and Best practices and innovations for sharing with other States. Details of the provision made in the State budget, including that for the State share should be a mandatory requirement of ICT Plan. CIET, SIETs, RIEs and other institutes etc shall also have to submit their annual work plans for various components of the scheme for consideration by PAB.

The Recurring Grant will also be provided to the State/UTs for the period of 5 years only from the year of implementation. Once the implementation report/Status is received from the State, first instalment of the Recurring Grant will be released immediately on the basis of the implementation report/basis. However, the release of the second instalments recurring grant in the second and subsequent years would be based on receipt of utilization certificate along with the progress report and audited statement of accounts in respect of grants released till the end of the preceding year is furnished.

The recurring grant, for the schools that have already been approved and where implementation has been started, will be provided on the basis of the old ICT scheme. The recurring grant, for the schools have been approved but are yet to be implemented by the State, will be provided on the basis of the revised guidelines.

7.6 Management, Monitoring and Evaluation

The respective States would have an internal mechanism for overseeing the implementation of the programme through a monitoring committee constituted for the purpose. The main parameters for monitoring would include timely installation of requisite hardware, including power supply, suitable software, engagement of teaching and administrative staff, teacher training and extent of use of e-content developed at the multi-media labs by the teachers. The State Govt. shall undertake a monitoring mapping at each level i.e. school, district, and State level.

For effective monitoring and evaluation, a web portal will be developed to enable real time monitoring of the implementation of the project at various levels. The Management at State/National level could view the status of implementation and also provide timely mid-course interventions. Successful innovations, experiences shall also be uploaded on the portal so that all the stakeholders can make use of the best practices or innovations being carried out by various States and Schools.

The PAB at the Ministry of HRD would also function as the Monitoring Committee. In addition, the SIETs, CIET, RIEs and the State/UT Government submitting the proposal would be required to submit progress report every quarter.

ANNEXURE-VII

CURRICULUM FRAMEWORK: TWO-YEAR B.ED. PROGRAMME (BY NCTE)

Course EPC 3: Critical Understanding of ICT

Preparing teachers to use technology in a classroom is an important step for ICT enabled education in the country. This course will focus on moving beyond computer literacy and ICT-aided learning, to help student-teachers interpret and adapt ICTs in line with educational aims and principles. It will explore ICTs along three broad strands; teaching learning, administrative and academic support systems, and broader implications for society. ICTs have often been seen as a stand-alone subject, consisting of a finite set of proprietary applications, taught to children directly by technology experts, bypassing teachers, which has diluted possibilities of teacher's ownership, enhancement of expertise and engagement. Seeing ICTs as an important curricular resource and an integral part of education, according primacy to the role of the teacher, ensuring public ownership of digital resources created and used in education, taking a critical perspective on ICTs as well as promoting constructivist approaches that privilege participation and co-creation over mere access, are principles that the course will help teachers explore. Applying these principles can support Teacher Professional Development models that are self-directed, need-based, decentralized, collaborative and peer-learning based, and continuous, in line with the NCFTE, 2009 vision for teacher education.

Since ICTs are technologies, along with developing such understanding, the course will also help student-teachers to learn integrating technology tools for teaching learning, material development, developing collaborative networks for sharing and learning. This learning can help integrate pre-service and in-service teacher education, address traditional challenges of teacher isolation and need for adequate and appropriate learning resource materials (MHRD, 2012). The course will explore use of ICTs to simplify record keeping, information management in education administration.

Communication and information sharing/ storing are basic social processes; new digital Information and Communication Technologies (ICTs), by making these easier and cheaper, have significantly impacted and are impacting our socio-cultural, political and economic spheres (Castells, 2011). The course will help student-teachers to develop an understanding of the shift from an 'industrial society' to a 'post industrial information society', where the production and consumption of information is both easier/ simpler as well as important (DSERT Karnataka, 2012). This change has positive and negative implications and possibilities for democracy, equity and social justice, all core components of our educational aims. The course will help student-teachers reflect critically and act responsibly to prevent how ICTs are used to support centralisation and proprietization of larger knowledge structures; it will show student-teachers how ICTs can be adapted to support decentralized structures and processes, as well as build the 'digital public' to make education a participatory and emancipatory process (Benkler, 2006).

Curriculum Framework: D.Ed. Programme (by NCTE)
Course: Pedagogy across the Curriculum
Unit 4: Critical Study of ICTs and Developing Capacities

- Critical examination of the role of ICT in education and society
- Capacity development in the use of ICTs
- ICT – based teaching-learning approaches in schools and for teacher professional development.