National Digital Library of India

Development of National Digital Library of India – Towards Building a National Asset

WINNER $_{m}$Billionth South Asia Award 2017: in Learning and Education Category for Android Mobile App

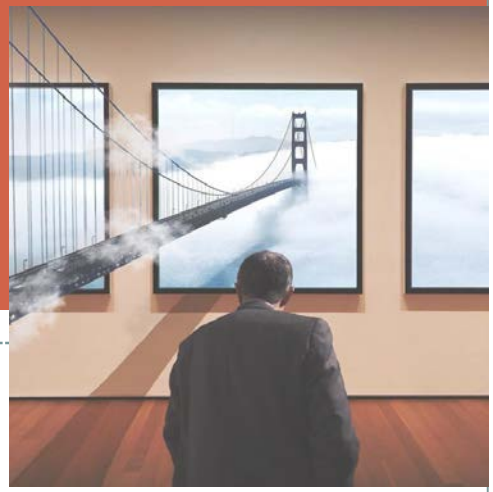
NDLI: VISION & MISSION

NMEICT
National Mission on Education Through ICT

NMEICT: National Mission on Education Through Information and Communication Technology

MHRD Government of India Ministry of Human Resource Development

NDL Vision



BUILD UP

NATIONAL DIGITAL LIBRARY OF INDIA

AS A NATIONAL KNOWLEDGE ASSET –

THE KEY DRIVING FORCE FOR EDUCATION, RESEARCH, INNOVATION, AND KNOWLEDGE ECONOMY IN INDIA

NDL Mission

TO CREATE A 24X7-ENABLED INTEGRATED NDL AS A UBIQUITOUS DIGITAL KNOWLEDGE SOURCE OF THE NATION – CATERING TO IMMERSIVE E-LEARNING FOR ALL LEANERS AT ALL LEVELS IN ALL AREAS

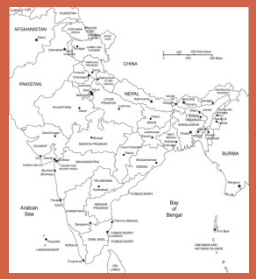
TO INITIATE A MOVEMENT FOR INTEGRATED DIGITAL LEARNING ACROSS INDIA

NDL Motto

INCLUSIVE

&

OPEN



National Digital Library of India

Issues, Architecture And Use Models

Libraries are more important to the education system than the institutions such as schools, colleges and universities

– Rabindranath Tagore

National Digital Library: Issues

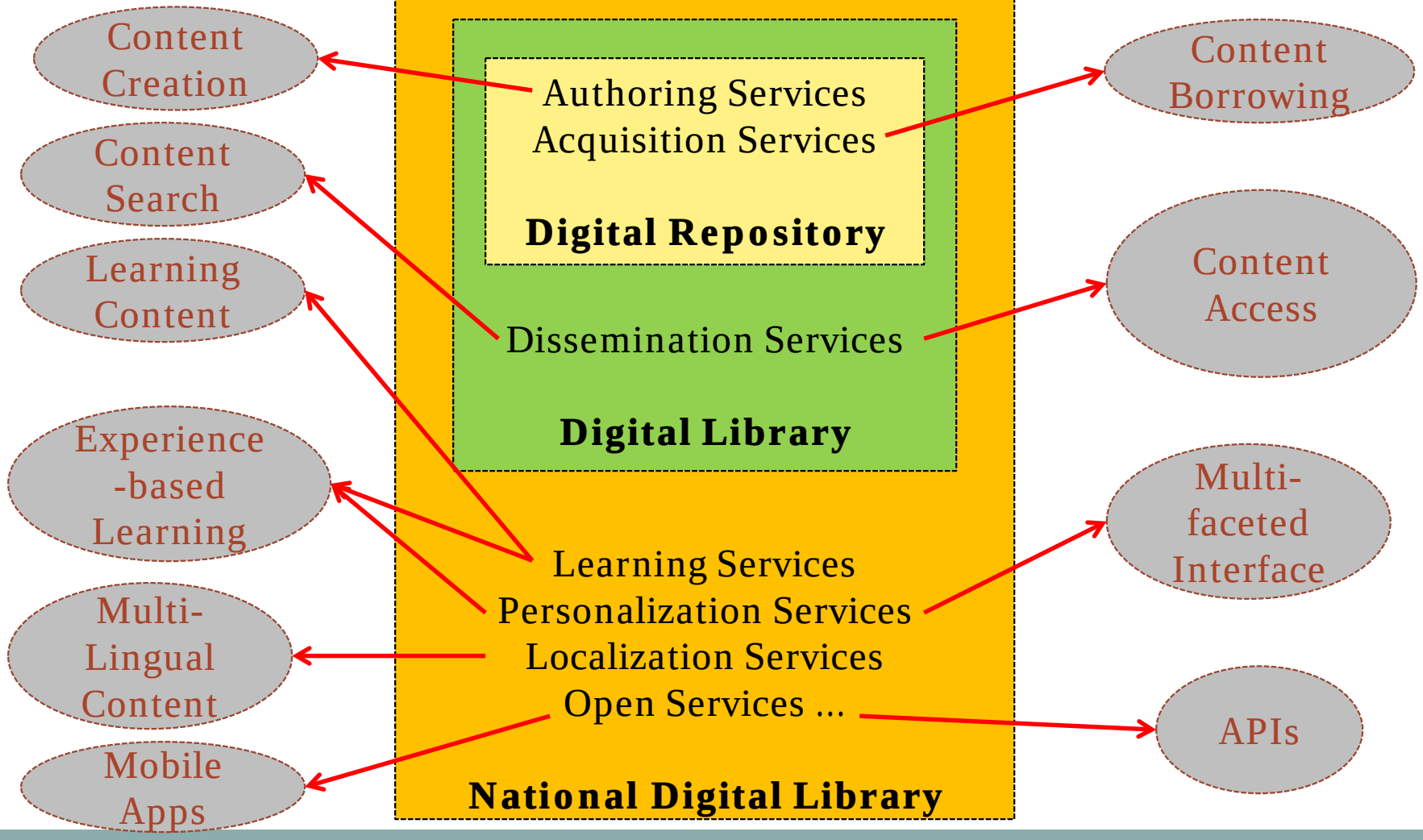
User-side

- Wide geographic expanse & Large population
- Huge number of students
- Large number of institutions
- Varied linguistic diversity
- Severe lack of Teachers

Provider-side

- Wealth of digital content
  - Books and Articles
  - ETD
  - Question Papers and Solutions
  - Video Lectures - MOOCs
  - Simulations & Animations
  - NMEICT Projects
  - Data
  - ...
- No single-window search
- Google search uses keyword – no metadata search
- Widely varied DL technology
- Lack of Interactivity, Vernacular support
- Low integration between content and learning system
- Weak ecosystem between learners and teachers

National Digital Library: Service Architecture



Use Models

Physically Challenged

Researchers

Learners

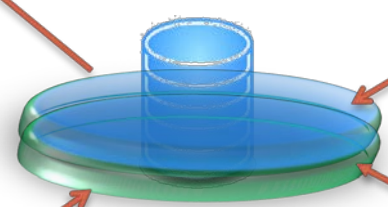
Professionals

Content Access

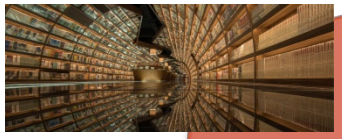
Institutional Digital Repositories

Web Content Harvesting

Web Content



NDL Repository



Content Contribution

Contributing Institutions

Learning Management System

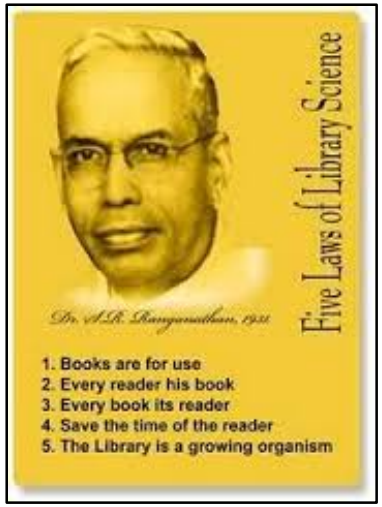
Educators

Presentation Model

- Not a new library – an umbrella
- Collects and ingests metadata only
- Presents full-text from source view
- Provides:
  - Search
  - Browse

Objective and Scope

TARGETS
CONTENTS,
STAKEHOLDERS,
CONTRIBUTORS,
USERS,
ARCHITECTURE, AND
THE BIG PICTURE



S R Ranganathan Laws

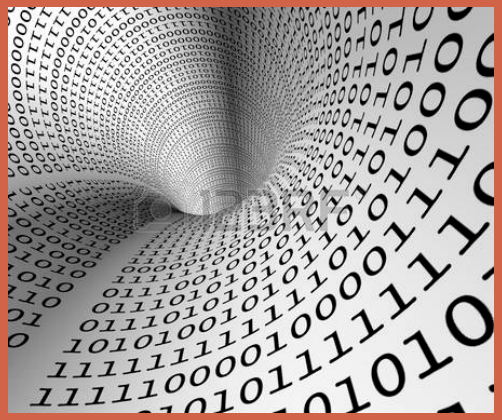
- ***Books are for use***
- ***Every reader his [or her] book***
- ***Every book its reader***
- ***Save the time of the reader***
- ***The library is a growing organism***

Objectives

- **A 24X7-enabled Infrastructure for NDLI with single window search facility – To include h/w systems, n/w, s/w tools, applications and interoperability**
- **Harvest IDRs across institutions of the nation to provide integrated access**
- **Facilitate select institutes to disseminate existing content and create new digital content**
- **Immersive E-learning environments at multiple levels spanning across**
  - **All academic levels – school to life-long learning**
  - **All disciplines – Science, Arts, Engineering, Medical, Law, and**
  - **All languages – used as medium of instruction.**
- **Interfaces in Indian Languages & for DA**

Digital Contents

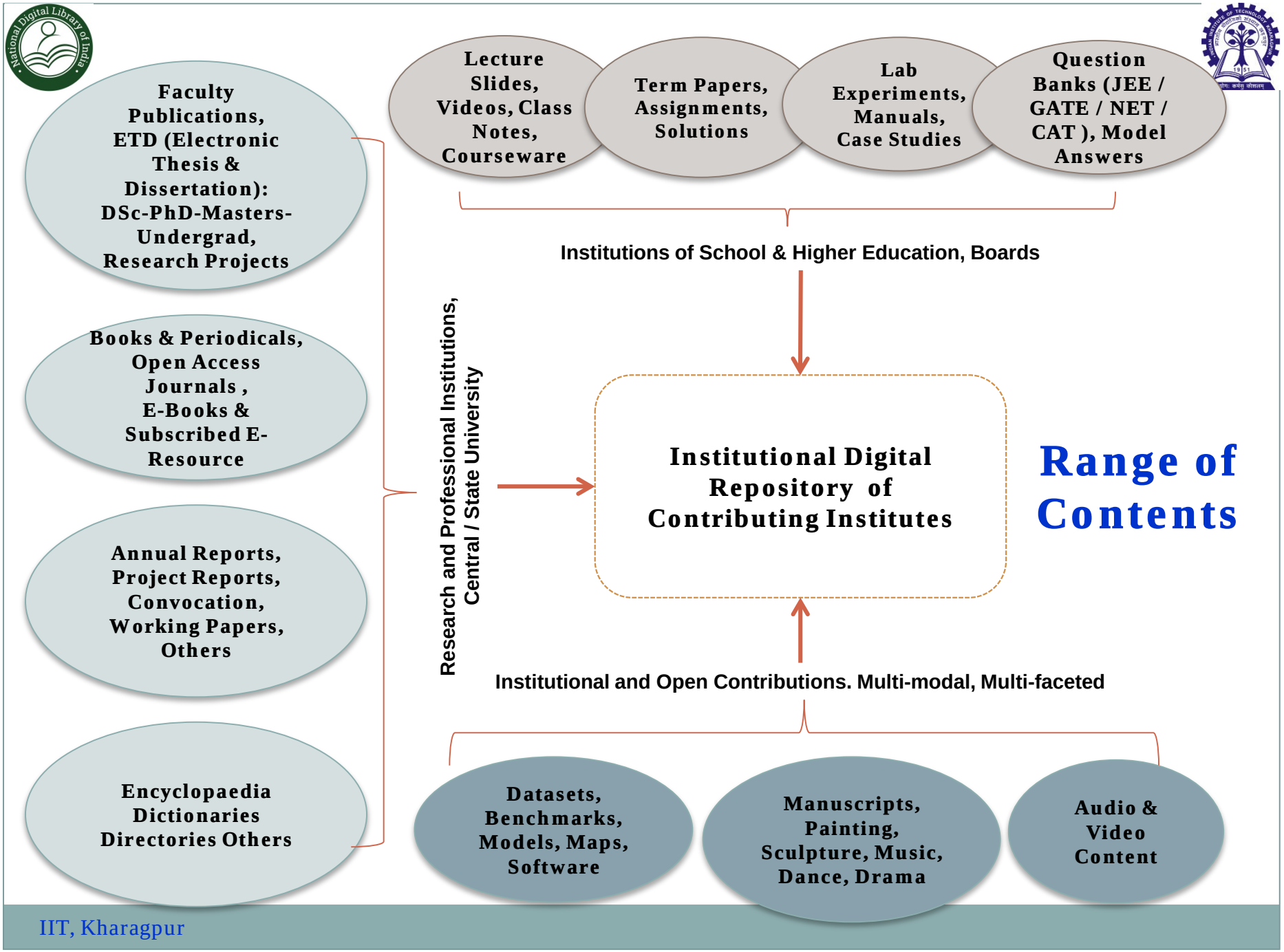
Digital, Surrogate Digital, Metadata Digital, etc.



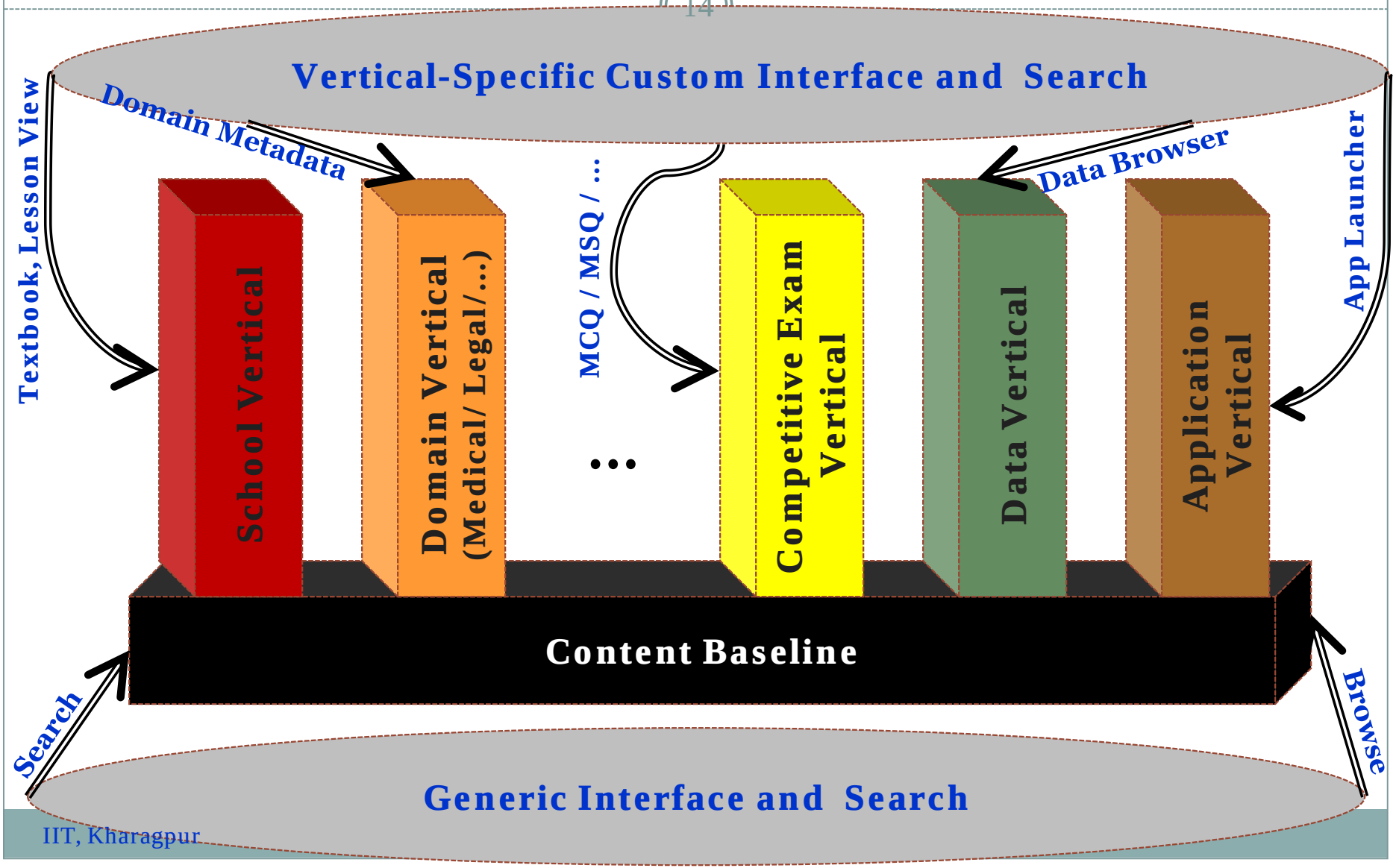
- **7679334-abstract-image-of-tunnel-with-binary-language.jpg**
- **https://www.123rf.com/profile_carloscastilla**
- **450 pixels X 376 pixels**
- **72 dpi**
- **Royalty Free**

- Content at NDL
  - Born-digital object
  - Digital surrogate of a physical object
  - Digital metadata of physical object
- Metadata at NDL
  - NDL does not store contents
  - NDL only ingests metadata for Search & Browse
  - Content (Full-text) is delivered from Source

A content is included (metadata ingested) in NDL if it is expected to have educational value


Lecture Slides, Videos, Class Notes, Courseware
Term Papers, Assignments, Solutions
Lab Experiments, Manuals, Case Studies
Question Banks (JEE / GATE / NET / CAT), Model Answers
Institutions of School & Higher Education, Boards
Faculty Publications, ETD (Electronic Thesis & Dissertation): DSc-PhD-Masters-Undergrad, Research Projects
Books & Periodicals, Open Access Journals , E-Books & Subscribed E-Resource
Annual Reports, Project Reports, Convocation, Working Papers, Others
Encyclopaedia Dictionaries Directories Others
Research and Professional Institutions, Central / State University
Institutional Digital Repository of Contributing Institutes
Range of Contents
Institutional and Open Contributions. Multi-modal, Multi-faceted
Datasets, Benchmarks, Models, Maps, Software
Manuscripts, Painting, Sculpture, Music, Dance, Drama
Audio & Video Content

Content View Architecture



Stakeholders

Roles and Responsibilities

Stakeholder	Roles and Responsibility
Government	1. Sponsor and facilitator 2. Content Contributor • Ministries / Departments • R & D Labs
Institutions • Public / Private • Academic / R & D / Educational	1. Host Institution – IIT Kharagpur 2. Contributing Institution – Supporting IDRs 3. Participating Institution – Providing Users & Feedback
Public • NGOs • Individuals	1. Use and Feedback 2. Metadata by Crowd Sourcing 3. Content by Crowd Sourcing
Industry	1. Technology Providers
Publishers	1. Metadata Provider 2. Content Provider (under various licensing schemes)

Contributors

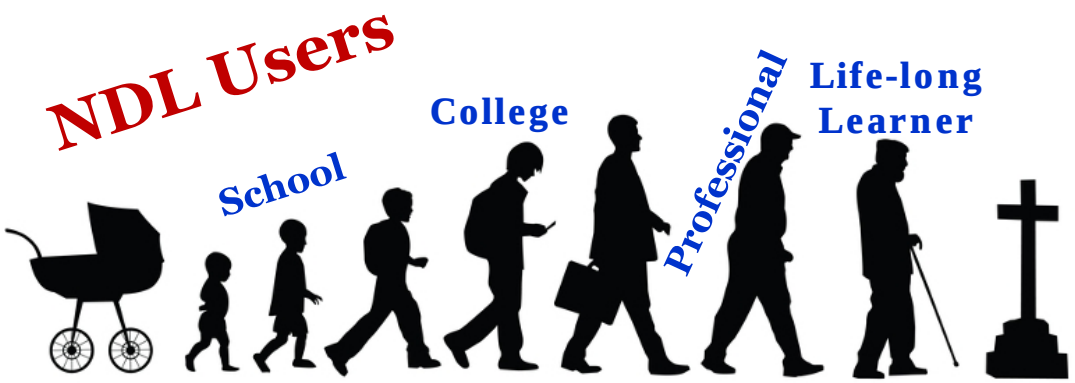
CFTI, State and Central Universities, R & D Labs, Govt. Depts, Free Portals, Publishers, etc.

Users & Access

Individual

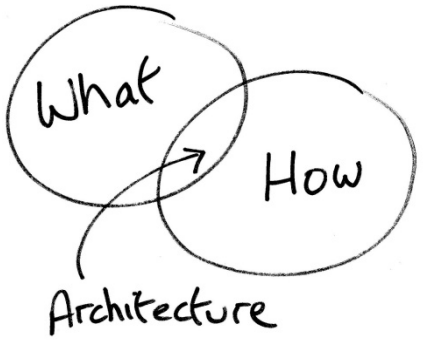
Institutional

- Registration is Open to *all*
- Registration Types:
  - Individual
    - Registers directly
  - Institutional
    - By request from Institution
    - Managed by authenticated Nodal Person
    - Convenient for bulk upload of users

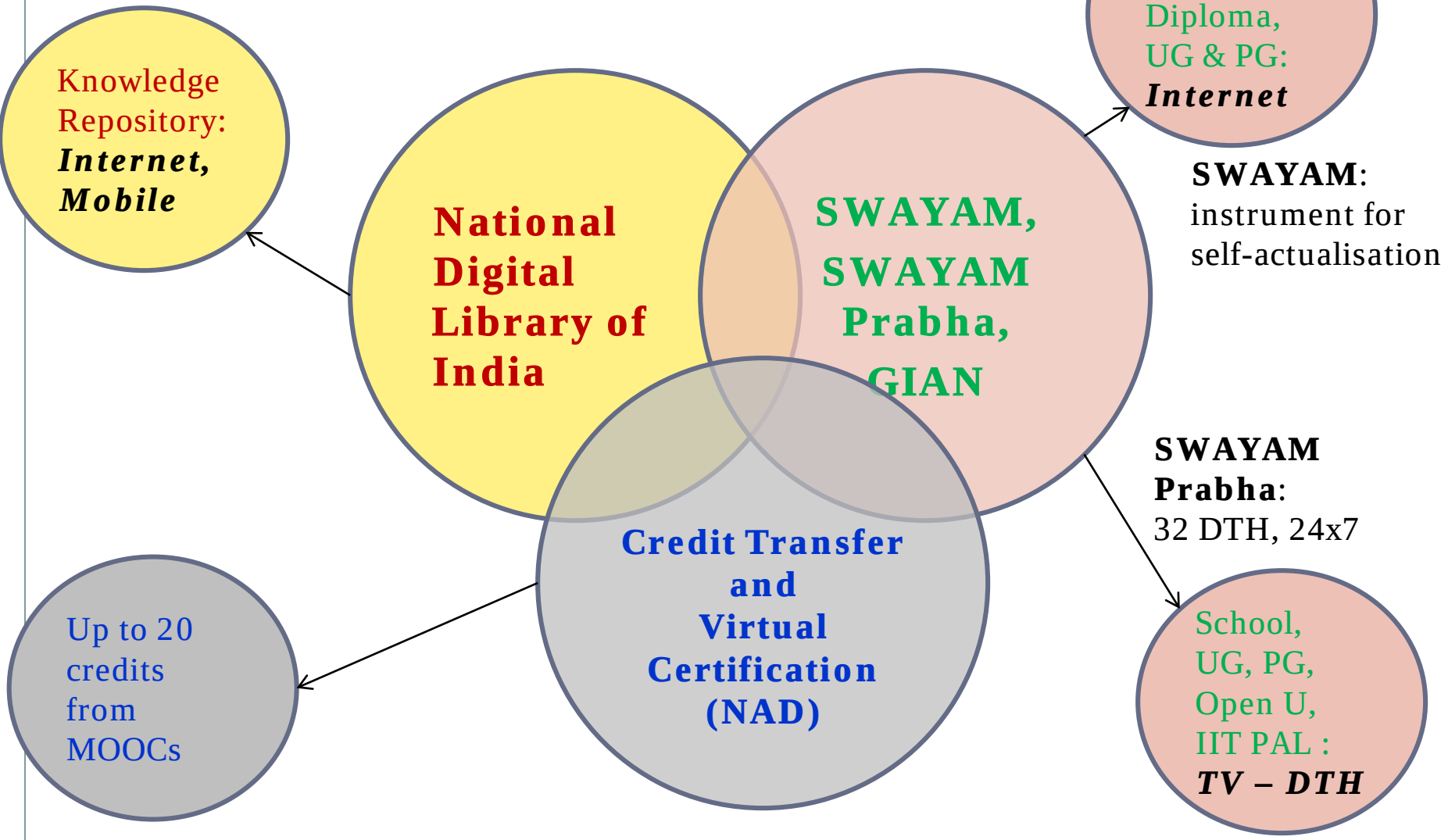


Architecture

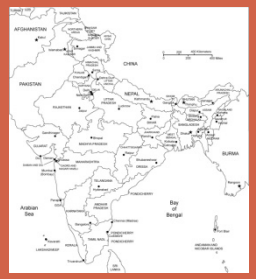
- Index Management
  - Ingestion of Metadata
  - Indexing of Metadata for Search
- Content Management
  - Dissemination of local contents
- Learning Management
  - Creation of Content
  - Handling learning interactions



The Big Picture



National Digital Initiative in Education



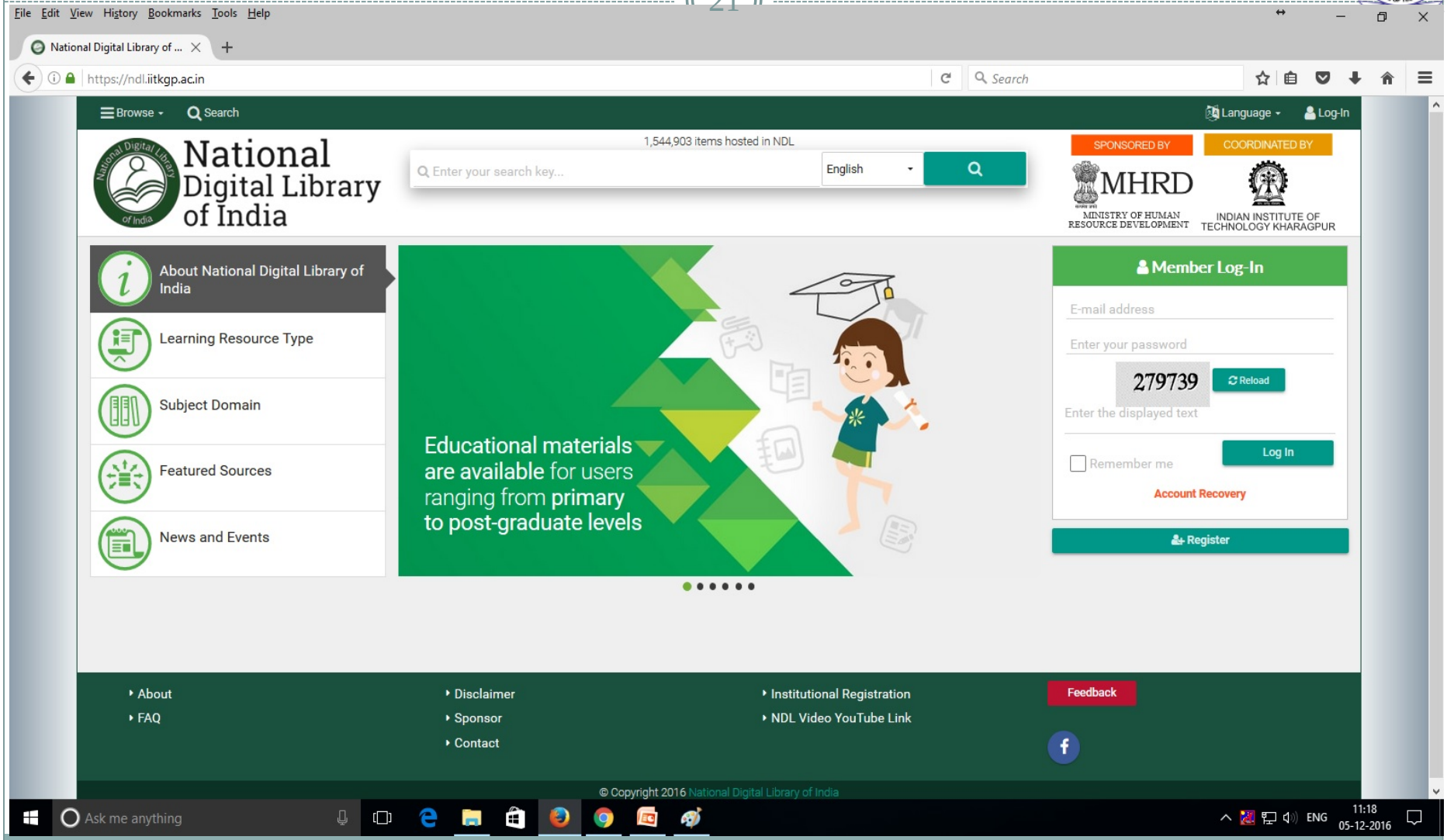
NDLI Portal

Walkthrough

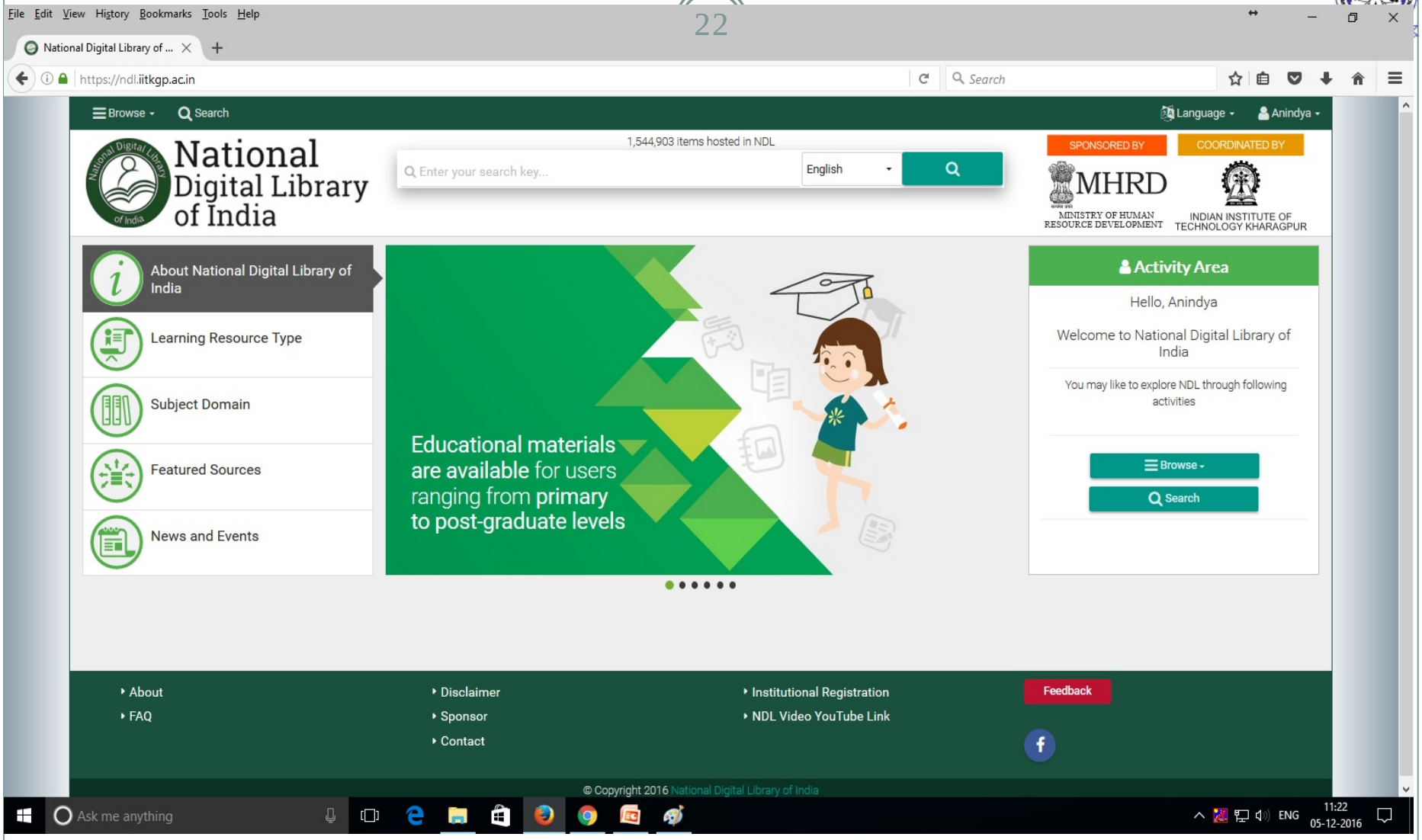
Where the mind is without fear and the head is held high
Where knowledge is free
Where the world has not been broken up into fragments
By narrow domestic walls
Where words come out from the depth of truth
Where tireless striving stretches its arms towards perfection
Where the clear stream of reason has not lost its way
Into the dreary desert sand of dead habit
Where the mind is led forward by thee
Into ever-widening thought and action
Into that heaven of freedom, my Father, let my country awake.

– Rabindranath Tagore

Landing Page



Home Page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Learning Resource Type
Subject Domain
Featured Sources
News and Events
Educational materials are available for users ranging from primary to post-graduate levels
Activity Area
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Welcome to National Digital Library of India
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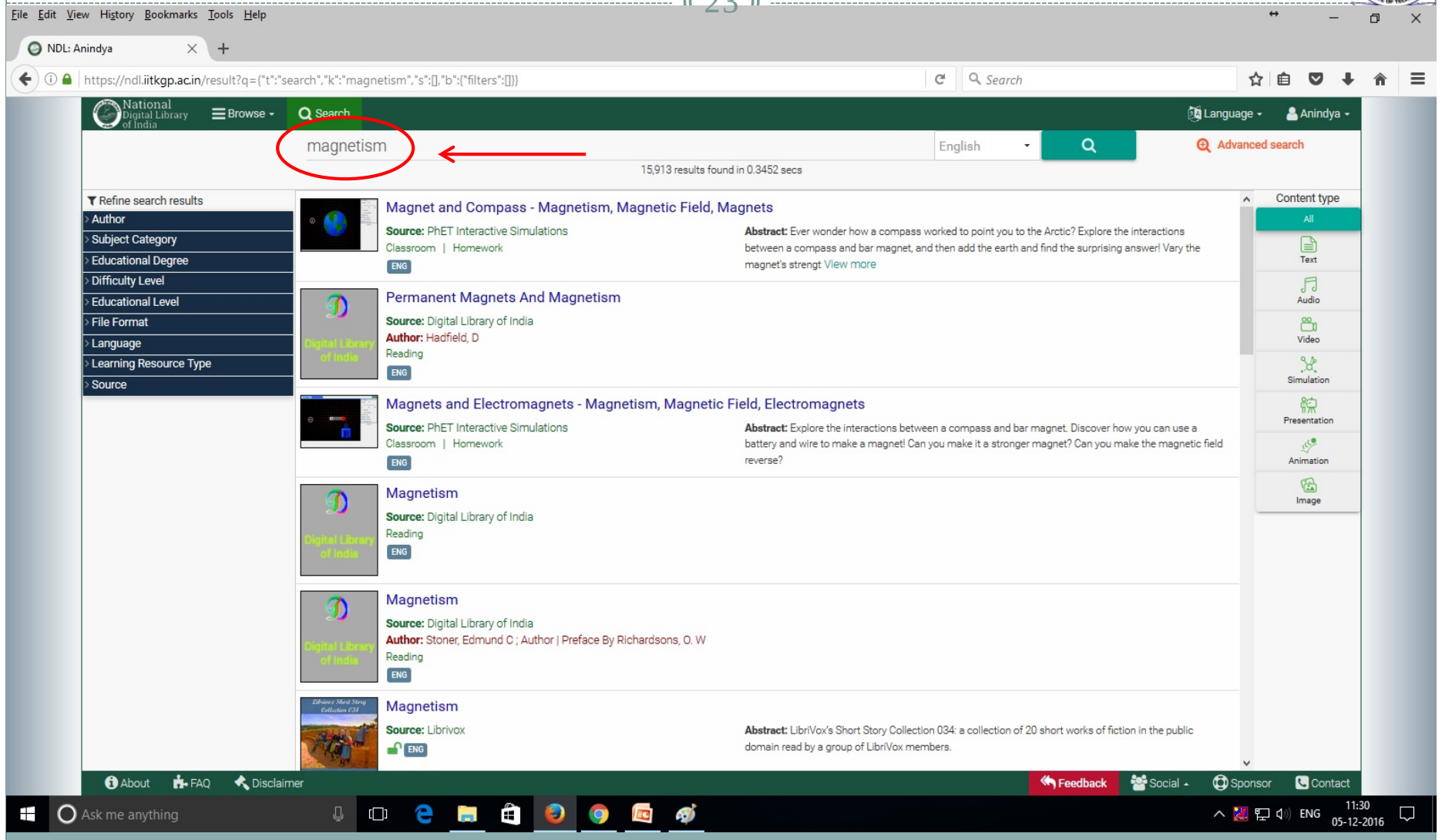
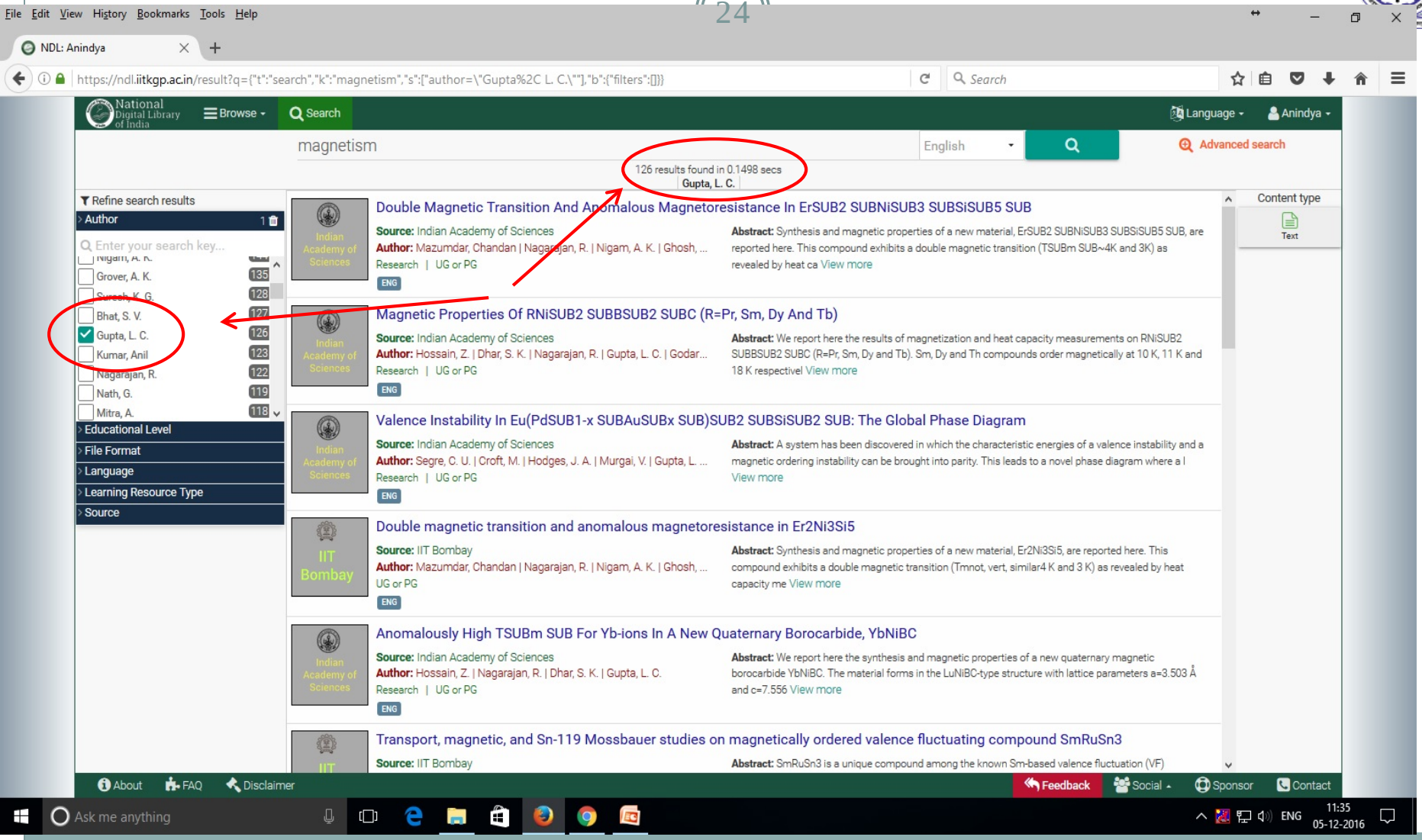
05-12-2016

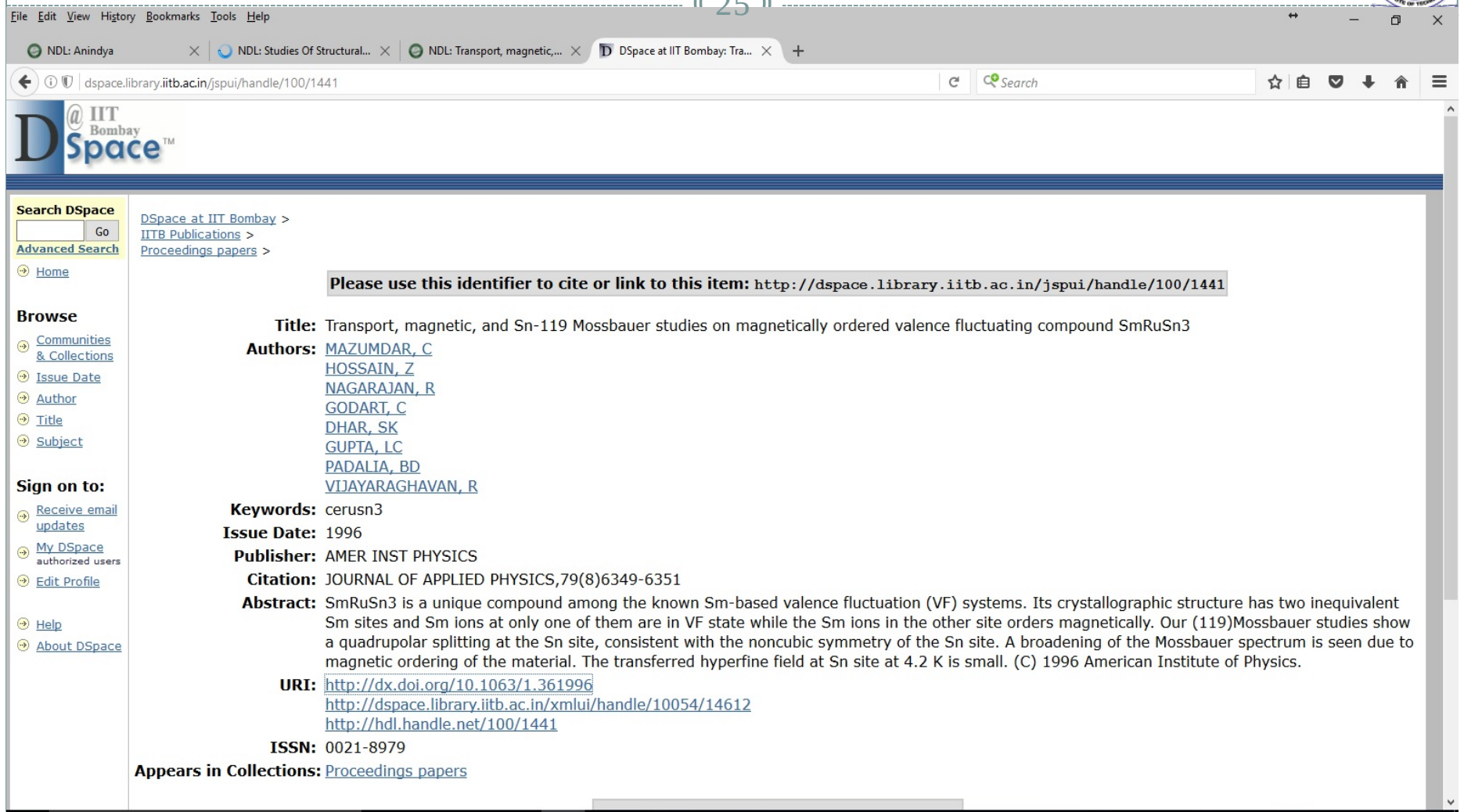
Search Result Page



Refine Search (Author) Page



Full Text (Contents) Page



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Title: Transport, magnetic, and Sn-119 Mossbauer studies on magnetically ordered valence fluctuating compound SmRuSn3

Authors: MAZUMDAR, C
HOSSAIN, Z
NAGARAJAN, R
GODART, C
DHAR, SK
GUPTA, LC
PADALIA, BD
VIJAYARAGHAVAN, R

Keywords: cerusn3

Issue Date: 1996

Publisher: AMER INST PHYSICS

Citation: JOURNAL OF APPLIED PHYSICS,79(8)6349-6351

Abstract: SmRuSn3 is a unique compound among the known Sm-based valence fluctuation (VF) systems. Its crystallographic structure has two inequivalent Sm sites and Sm ions at only one of them are in VF state while the Sm ions in the other site orders magnetically. Our (119)Mossbauer studies show a quadrupolar splitting at the Sn site, consistent with the noncubic symmetry of the Sn site. A broadening of the Mossbauer spectrum is seen due to magnetic ordering of the material. The transferred hyperfine field at Sn site at 4.2 K is small. (C) 1996 American Institute of Physics.

URI: http://dx.doi.org/10.1063/1.361996
http://dspace.library.iitb.ac.in/xmlui/handle/10054/14612
http://hdl.handle.net/100/1441

ISSN: 0021-8979

Appears in Collections: Proceedings papers

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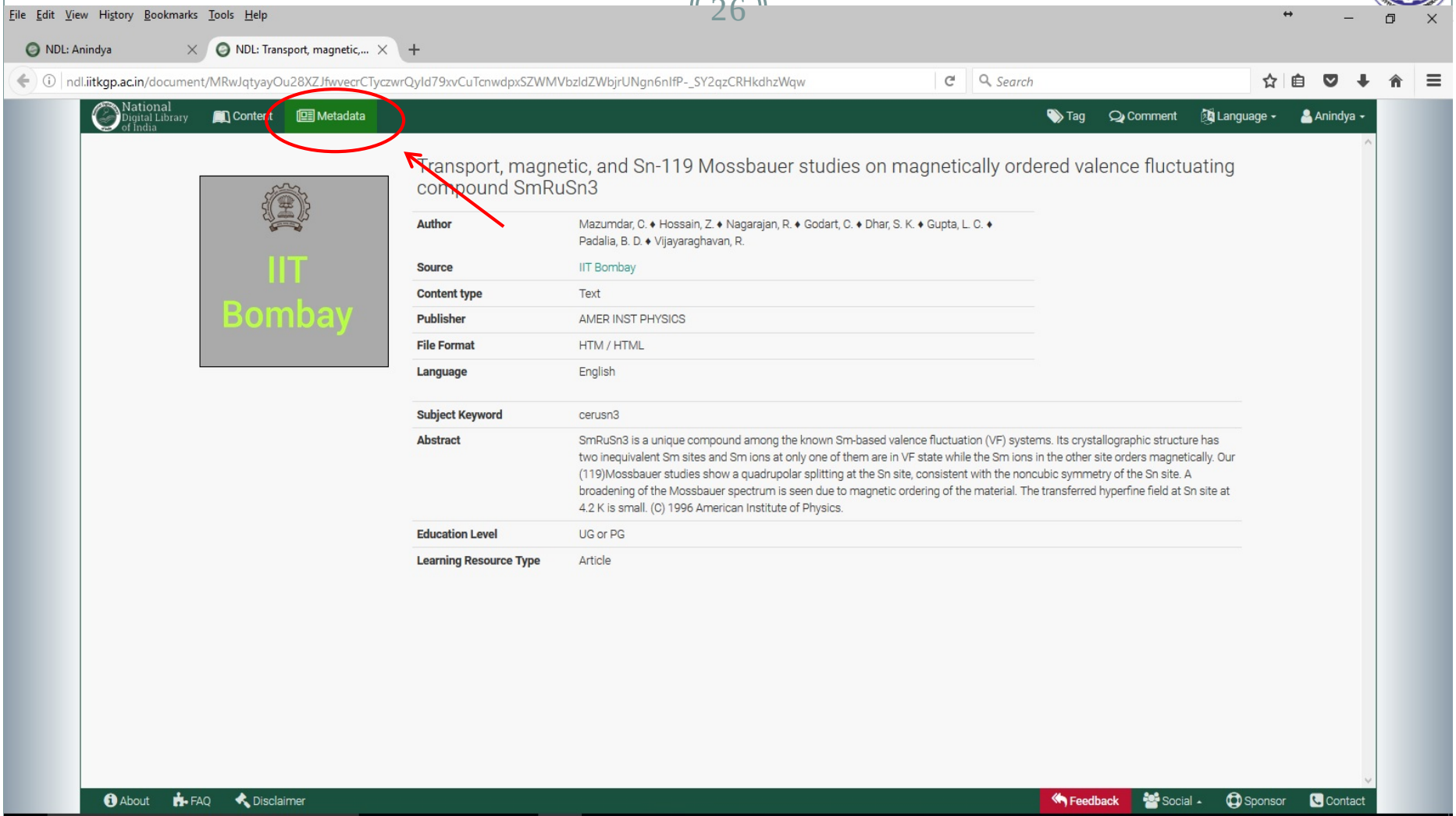

Full Text Page

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NDL: Transport, magnetic,...
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Tag
Comment
Language
Anindya
Page: 1 of 4
Automatic Zoom

AIP | Journal of Applied Physics

Transport, magnetic, and 119Sn Mössbauer studies on magnetically ordered valence fluctuating compound SmRuSn3

Chandan Mazumdar, Z. Hossain, R. Nagarajan, C. Godart, S. K. Dhar et al.

Citation: J. Appl. Phys. **79**, 6349 (1996); doi: 10.1063/1.361996
View online: http://dx.doi.org/10.1063/1.361996
View Table of Contents: http://jap.aip.org/resource/1/JAPIAU/v79/i8
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Related Articles

Valence fluctuation and electron–phonon coupling in La68−xCexAl10Cu20Co2 (x = 0, 34, and 68) metallic glasses
J. Appl. Phys. 108, 033525 (2010)

Intermediate valency of Eu in a cubic intermetallic compound Ce0.5Eu0.5Pd3
Appl. Phys. Lett. 94, 182503 (2009)

Interface and Mn valence effects in ferromagnetic insulating multilayers based on Mn and tin oxide
J. Appl. Phys. 103, 07D129 (2008)

Charge states of strongly correlated 3d oxides: from typical insulator to unconventional electron–hole Bose liquid
Low Temp. Phys. 33, 234 (2007)

The effect of mixed Mn valences on Li migration in LiMn2O4 spinel: A molecular dynamics study
Appl. Phys. Lett. 84, 529 (2004)

Additional information on J. Appl. Phys.

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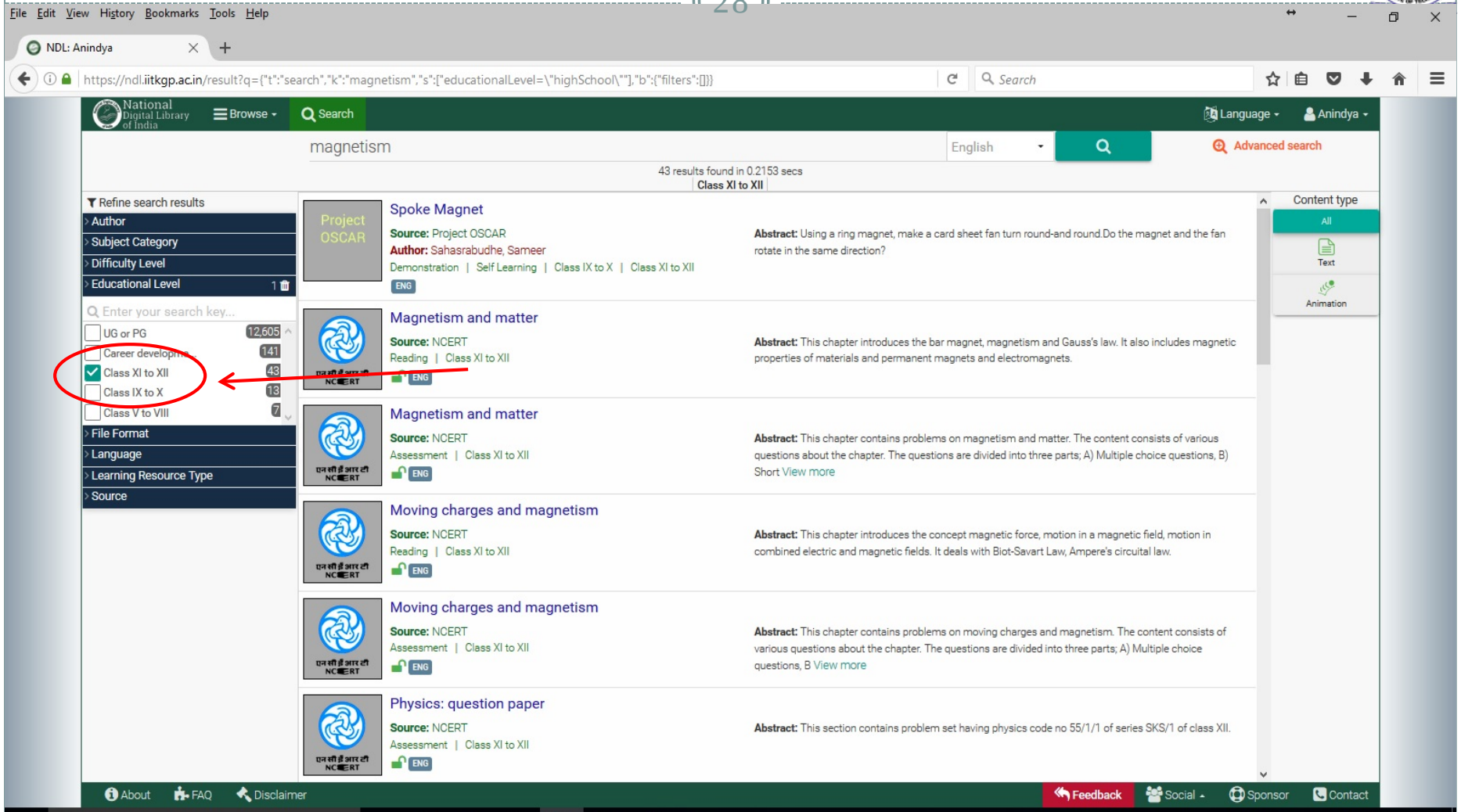

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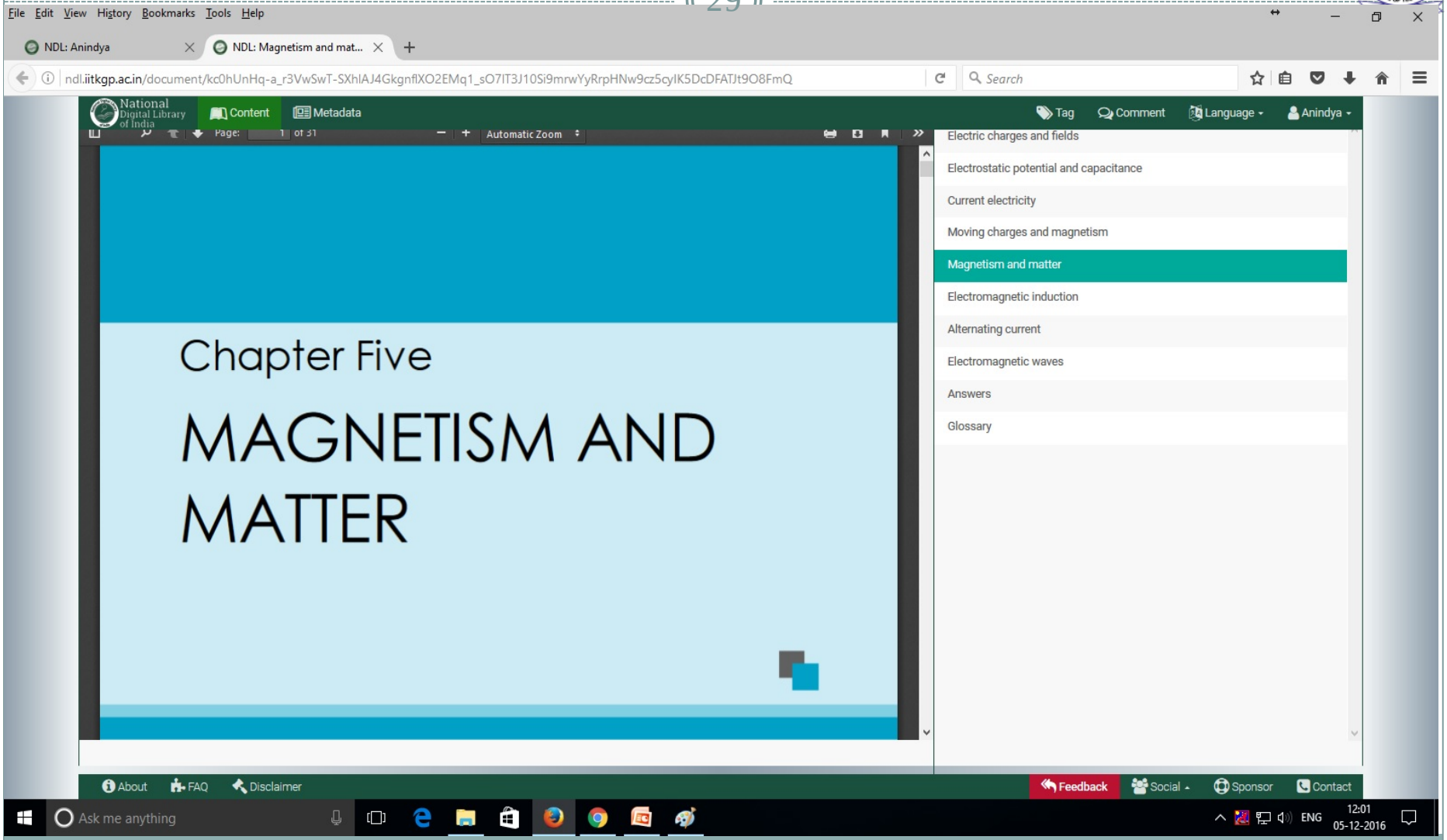
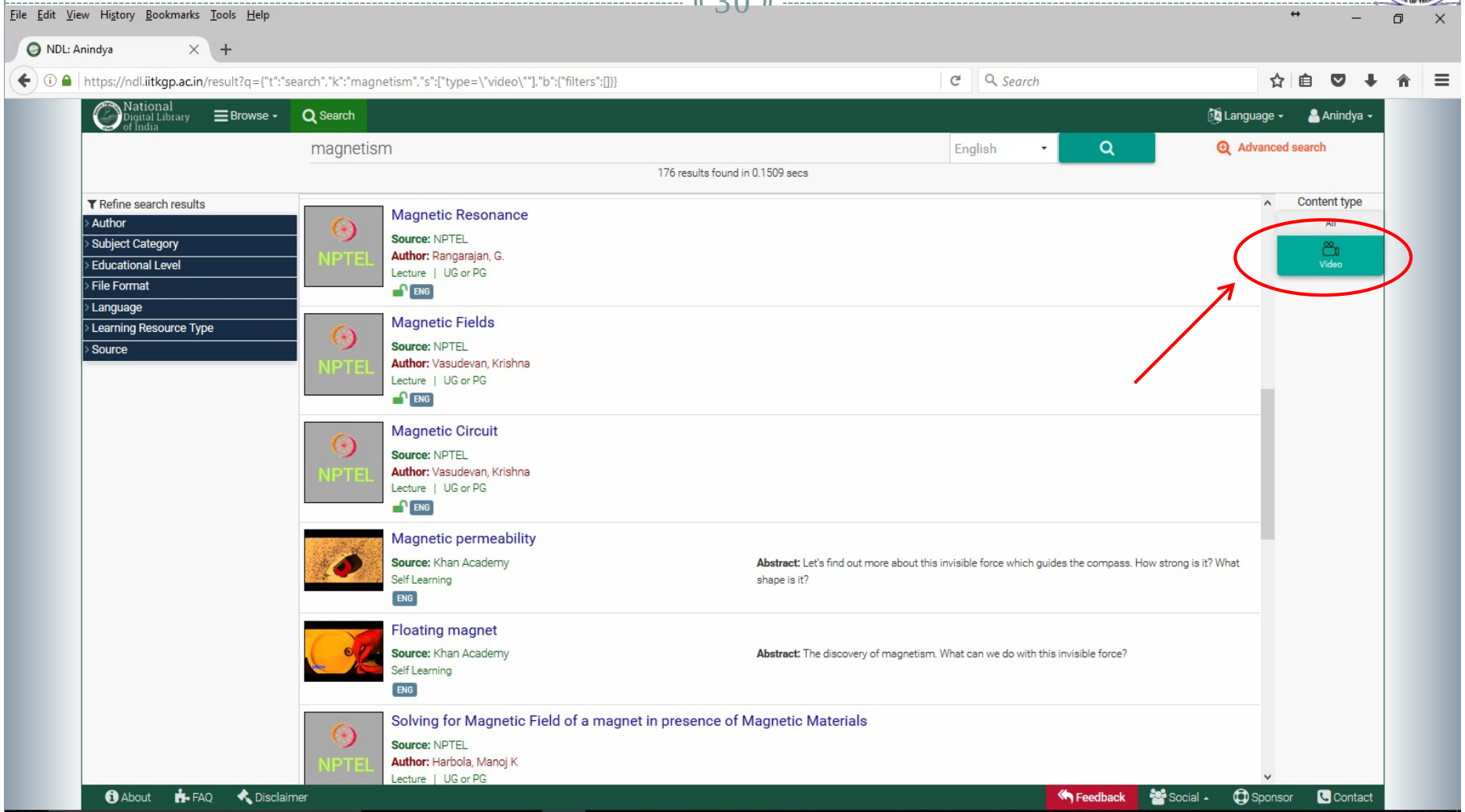
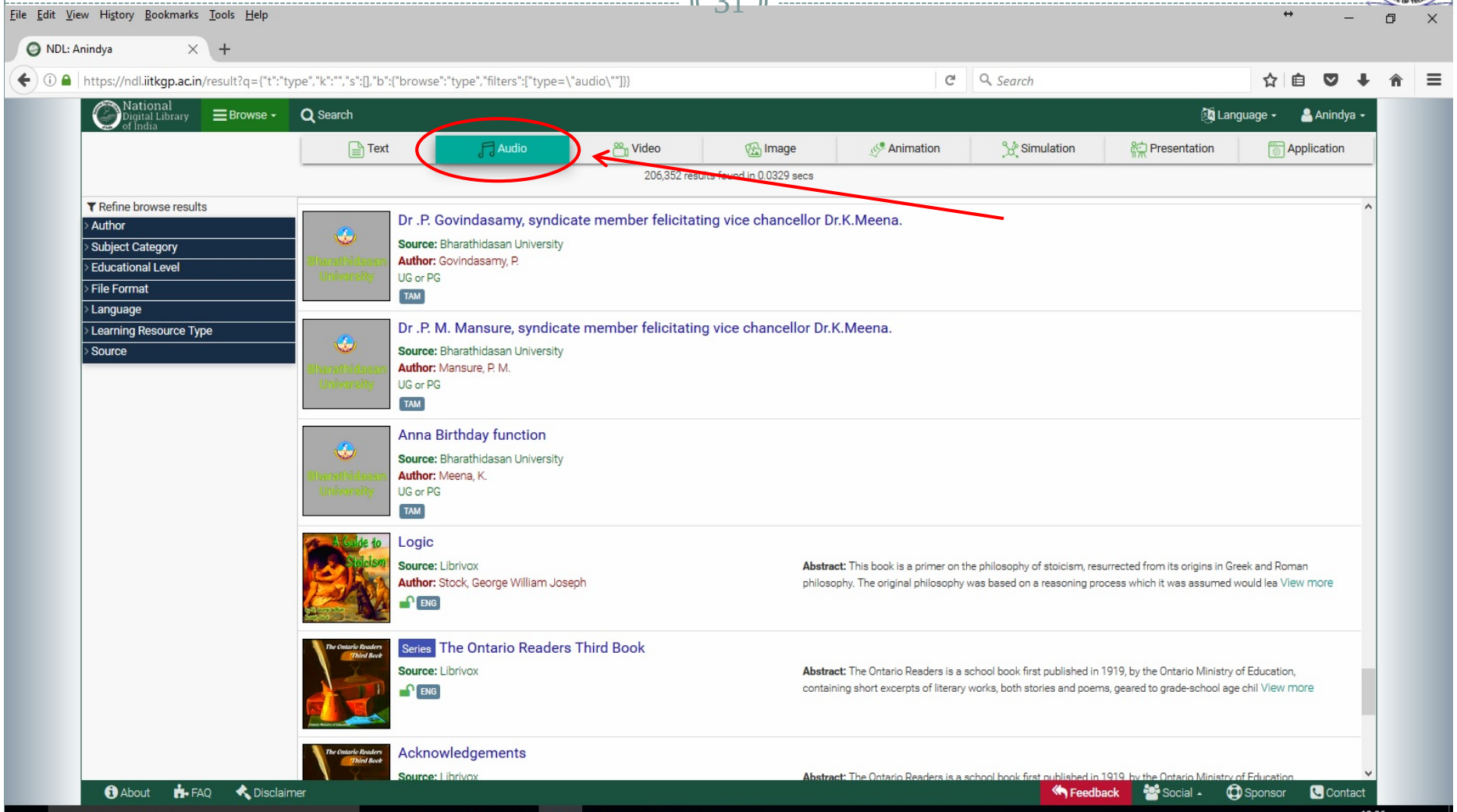


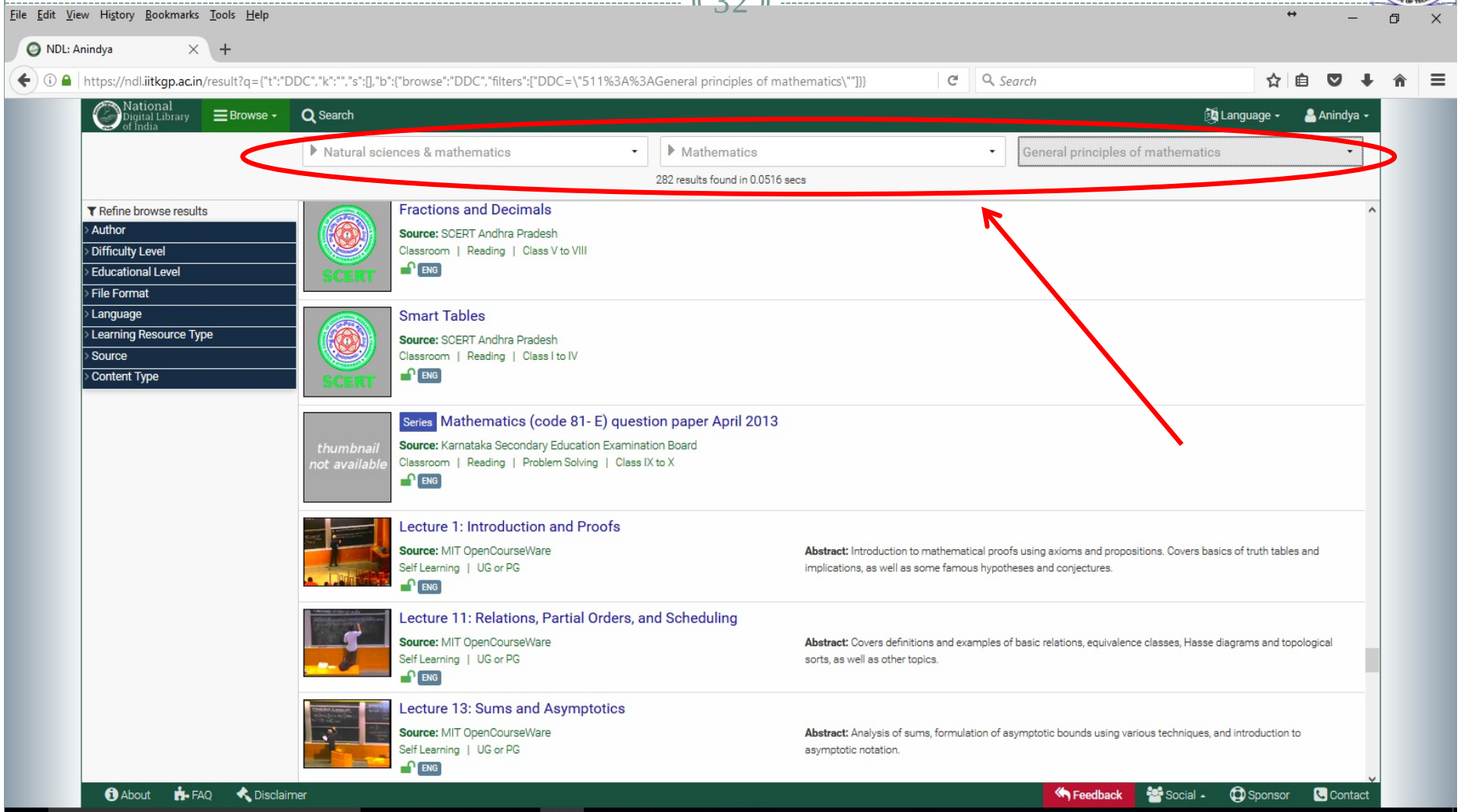
Search Filter Page (Video)



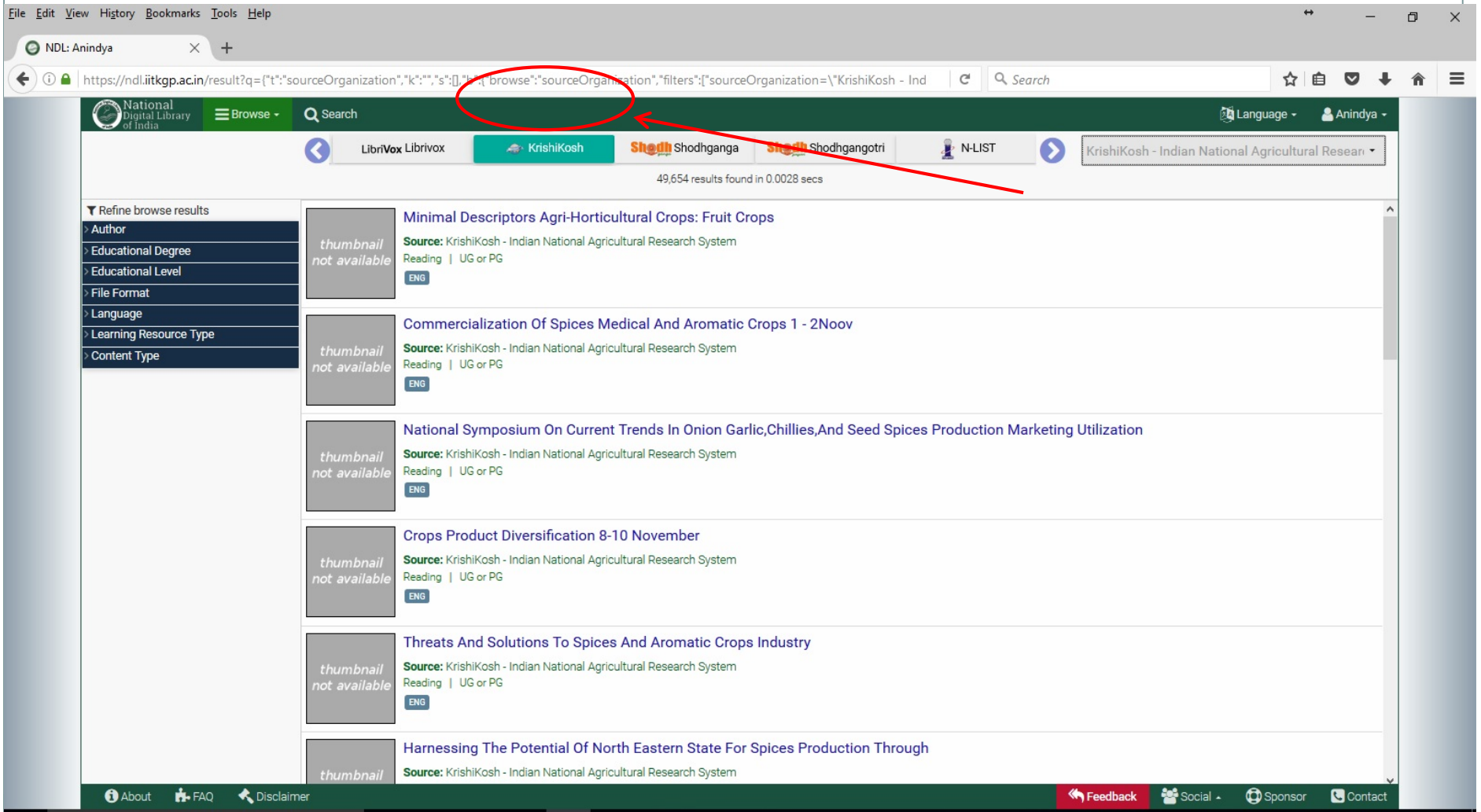
Browse (by Type) Page



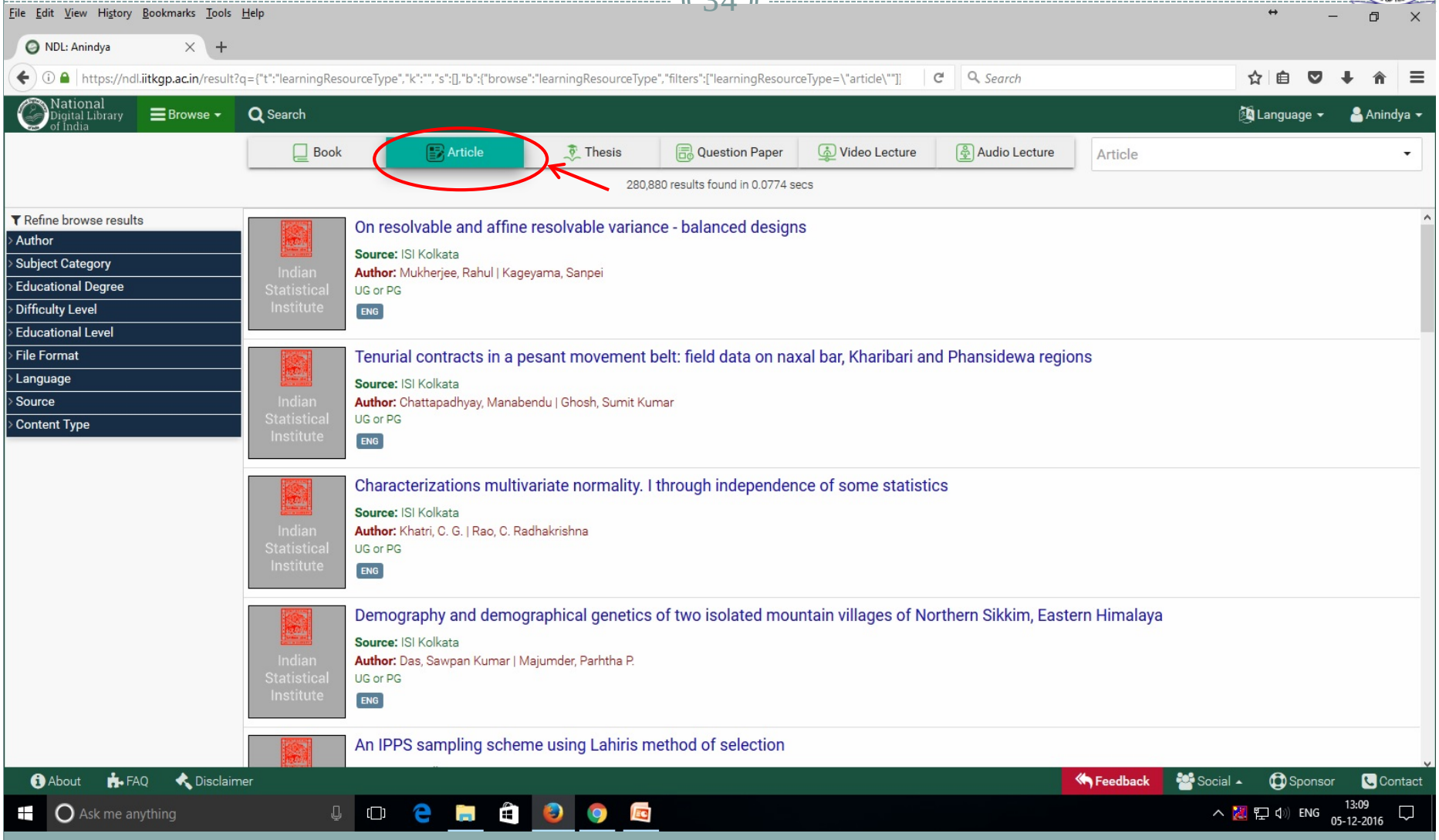
Browse (by Subject) Page



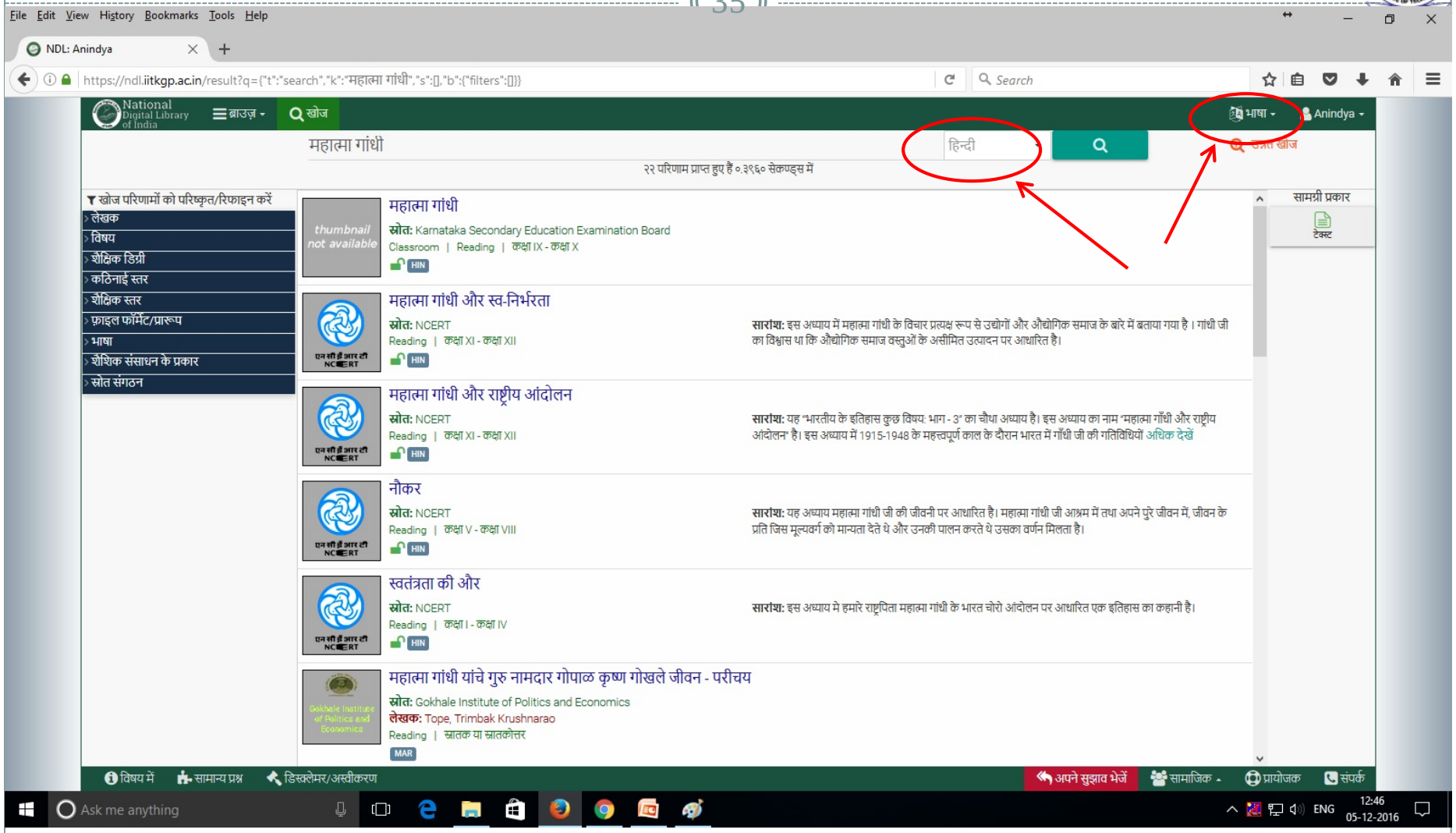
Browse (by Source) Page



Browse by (Learning Resource Type) Page



Indian Language (Hindi) Interface Page



NDL Mobile App

Available on

Android

And

iOS

Institutional Roles and Responsibilities

TERMS OF REFERENCE TO CONTRIBUTE TO NDL

The *worth of a librarian should* be gauged by his power of attracting and looking after such circles by acting as the intermediary of an intimacy of relationship between *reader and the library*. – *Rabindranath Tagore*

Roles and Responsibilities

Host Institution

- IDR
  - Support for Setting up IDR
  - Installation CD
  - Manual
  - Training
  - IDR Service, if needed
- Metadata
  - NDL Metadata Standard
  - Creation, Curation Workflow
- User
  - Institutional Registration for Nodal Person
  - Bulk Addition of Users
- Ongoing Support
  - Over email, phone
  - Hands-on at NDL, if needed

Contributing or Participating Institution

- IDR (CI only)
  - Setup IDR in Institutional LAN
  - Register with OPENDOAR / ROADMAP
  - OAI-PMH compliance for harvesting
  - OAI-ORE compliance for full-text access
  - Allow external access & Update regularly
- Content (CI only)
  - Add Content
  - Encourage faculty, students, staff to contribute
  - Create and Curate Metadata
- User
  - Register as an Institution
  - Add users in bulk or send to NDL
- Promote
  - Organize Workshop
  - Identify and Integrate Source

Technology of NDL

39

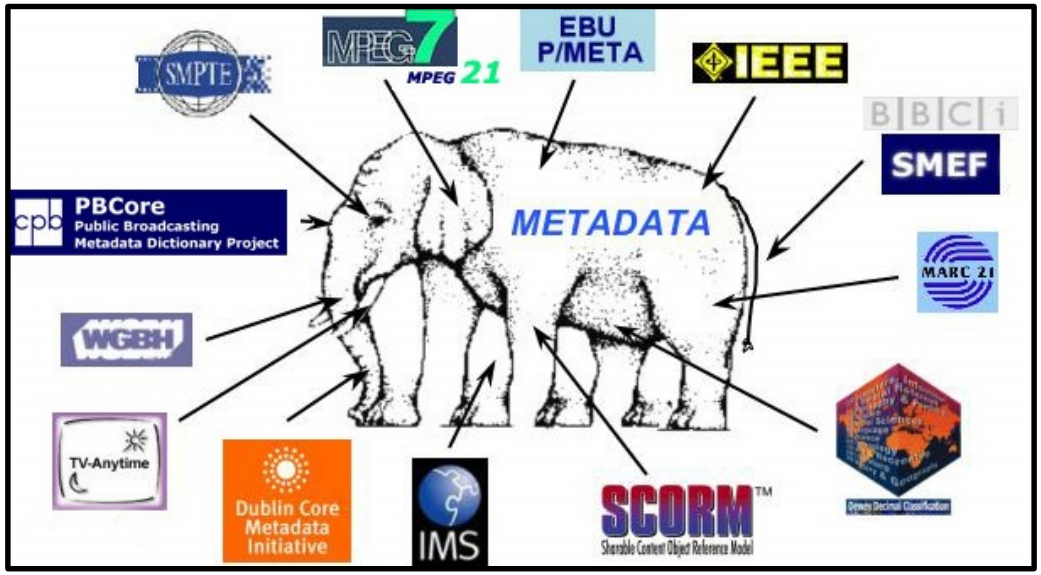
METADATA ENGINEERING

USER INTERFACE & EXPERIENCE TRACKING

Metadata Engineering

- Metadata Standard
- Metadata Acquisition

Metadata Standard



Source: http://courseweb.ischool.illinois.edu/~butler9/LIS501b/current.html

Metadata Standard

- **Metadata**
  - Is primarily textual information relating to Content
  - Includes information that enables users to identify, discover, search, browse, interpret, or manage Content
  - Includes hyperlinks that direct users to Content on the Source
  - May include an expressive description of the Content
- **Metadata Standard**
  - Defines common understanding of the semantics of the data
  - Ensures correct and proper use and interpretation of the data
  - Defined through a set of fields, vocabs (optional), and instructions for fill-up

NDL Metadata Design Challenges

- Wide category of resources
  - Generic metadata or domain specific?
- Openness of repository
  - Closed metadata standard may fail to describe a new resource
- Scale is enormous
  - Manual annotation is infeasible
  - Automatic annotation guided by crowd sourcing?

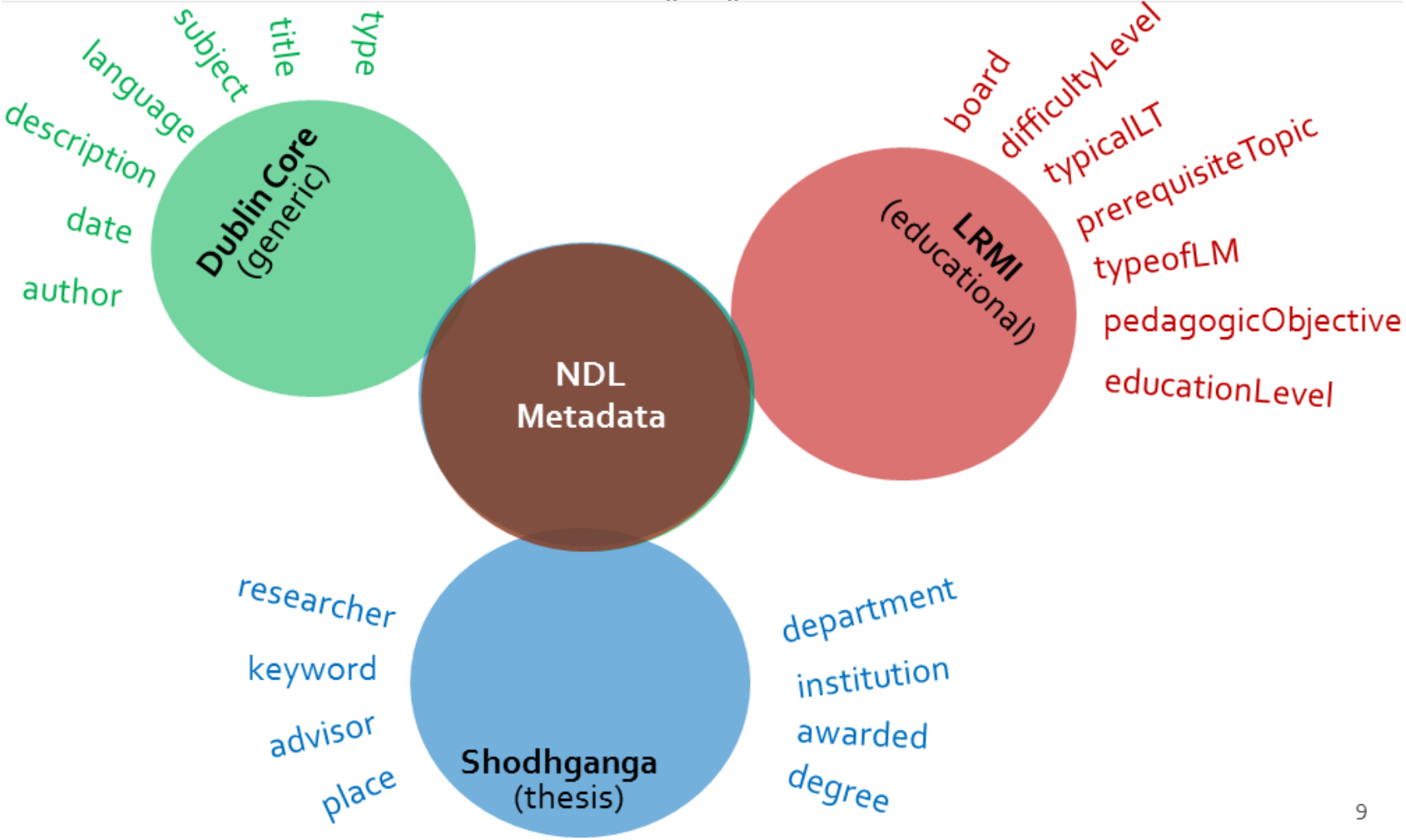
Metadata Requirements Specs

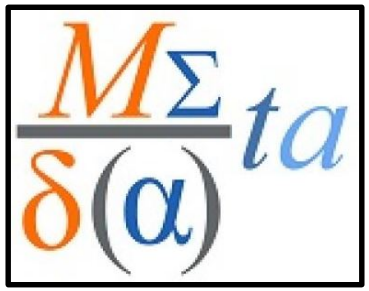
- To describe any digital resource
  - Generic content metadata
    - Contributor, Description, Language, Format etc.
- To describe domain specific resources
  - Educational content metadata
    - Educational level, ToC, Type of learning material etc.
  - Thesis metadata
    - Institution, advisor, degree, researcher

NDL Metadata Standard

- NDL Metadata Standard v 1.0 is an **Open Virtual Standard**
  - URL: http://www.ndlproject.iitkgp.ac.in/ndl/header.php?mname=Metadata%20Schema
- Schema is categorized into three profiles:
  - **Generic Metadata:**
    - Describes general attributes of the contents
    - Adopted from Dublin Core Metadata Standard
  - **Educational Metadata:**
    - Describes the educational attributes of the resources and helps in enumerating properties of the contents relevant to teaching-learning process
    - Adopted from Learning Resource Metadata Initiative (LRMI)
  - **Thesis Metadata:**
    - Describes dissertation or thesis related metadata fields
    - Adopted from Shodhganga Thesis Metadata Standard
  - More profiles may be added in future
- Uses the namespace of Dublin Core (dc.)

Metadata Envelop





Metadata Acquisition

Acquisition Scenarios

Locate Content

- Harvest Institutional IDRs
- Crawl Websites
- In Bulk – from Publishers
- Donated by Source
- Source-supported API
- …

Acquire Metadata

- Creation
  - Manual
  - Automated
- Translation
  - Format
  - Standard / Schema
- Curation
  - Manual
  - Assisted
- Ingestion

Challenges in Metadata Acquisition

- Different sources follow different norm in annotation
  - Automation of curation
- Errors in sourced data
  - Error listing
  - Manual curation
- Errors in manual annotation
  - Review step before actual submission in database
  - Manual curation
- Set up norm/guideline
  - Controlled vocabulary

Translation Issues

- Variation in Subject classification standards
  - Dewey Decimal Classification (DDC)
  - Library of Congress Classification (LCC)
  - Library of Congress Subject Headings (LCSH)
- Mapping terminology for different languages
  - Translate when equivalent terminology is present
  - Transliterate otherwise

NDL Metadata Extraction Toolkit

- Automated metadata extraction workflow
- Syntactic metadata extractor
  - Author name, ISBN, Publisher, dates etc.
- Table of content extractor
- Wikification for keyword extraction
- Learning resource metadata
- Toolchain for metadata extraction

Once completed and tested, the toolkit will be released to public and open-sourced

Experience Tracking and UI

- Experience Tracking
  - To offer customized search results
- Multi-lingual Support
  - Reduce cognitive load for native use
- Personalization
  - Customized UI to suit user grade

Source: http://www.brandquarterly.com/tracking-customer-experience-essential

Experience Tracking Technology

Record:

Partha searched 'tiger'

Partha navigated to Tiger Wiki

Partha studied Wiki (3 min)

Partha downloaded tiger image (4 images)

Partha checked tiger map (2 min)

Partha enlarged map at Sunderbans (twice)

Partha searched 'national animal of India'

Infer:

Partha learnt – tiger is the national animal (of India)

... possibly

- **Experience API (xAPI) / Tin Can API**
  - Connects learning content and learning systems to record and track all types of learning experiences
- **Learning Record Store (LRS)**
  - Stores learning experiences

Source: https://tincanapi.com/overview/

UI Technology: Web Interface

API End Points:

RestFul API endpoint

- **CMS API, Index API and LMS API**

Parameterized access to the index

API Sandbox

- Web interface is an app using NDL API
- Extended Search Features
  - Facet based search result refinement
  - DDC Topic tree based content browsing
  - Tag, comment on a content
  - Target group specific interface
  - Bookshelf
  - Rating and sharing
- NDL-Specific Features
  - Multi-lingual enablement
    - Multi-lingual query interface powered by Google transliteration
    - Cross-lingual search
  - Personalization

Copyright & License

HOW DOES NDL COPE WITH COPYRIGHT AND LICENSING ISSUES

Copyright Act, 1957 (Amendment 2012)

Is metadata copyrighted?

Yes / No / May be

Copyright of Metadata is contested

Source: http://lj.libraryjournal.com/2013/02/opinion/peer-to-peer-review/metadata-and-copyright-peer-to-peer-review/

- Copyright is a bundle of rights given by the law to
  - Creators of literary, dramatic, musical and artistic works and
  - Producers of cinematograph films and sound recordings
- Rights are:
  - reproduction of the work,
  - communication of the work to the public,
  - adaptation of the work and,
  - translation of the work
- Creator / Author is the first Owner
- Ownership (Title) can be transferred (assigned)

Copyright of Metadata

- NDL principles as follows:
  - Vast Majority of Metadata is Not Subject to Copyright Restrictions
  - NDL's Partners Share the NDL's Commitment
  - NDL Asserts No Rights Over its Database of Metadata and Dedicates its Contributions to the Public Domain
  - Free and Unencumbered Access to Metadata

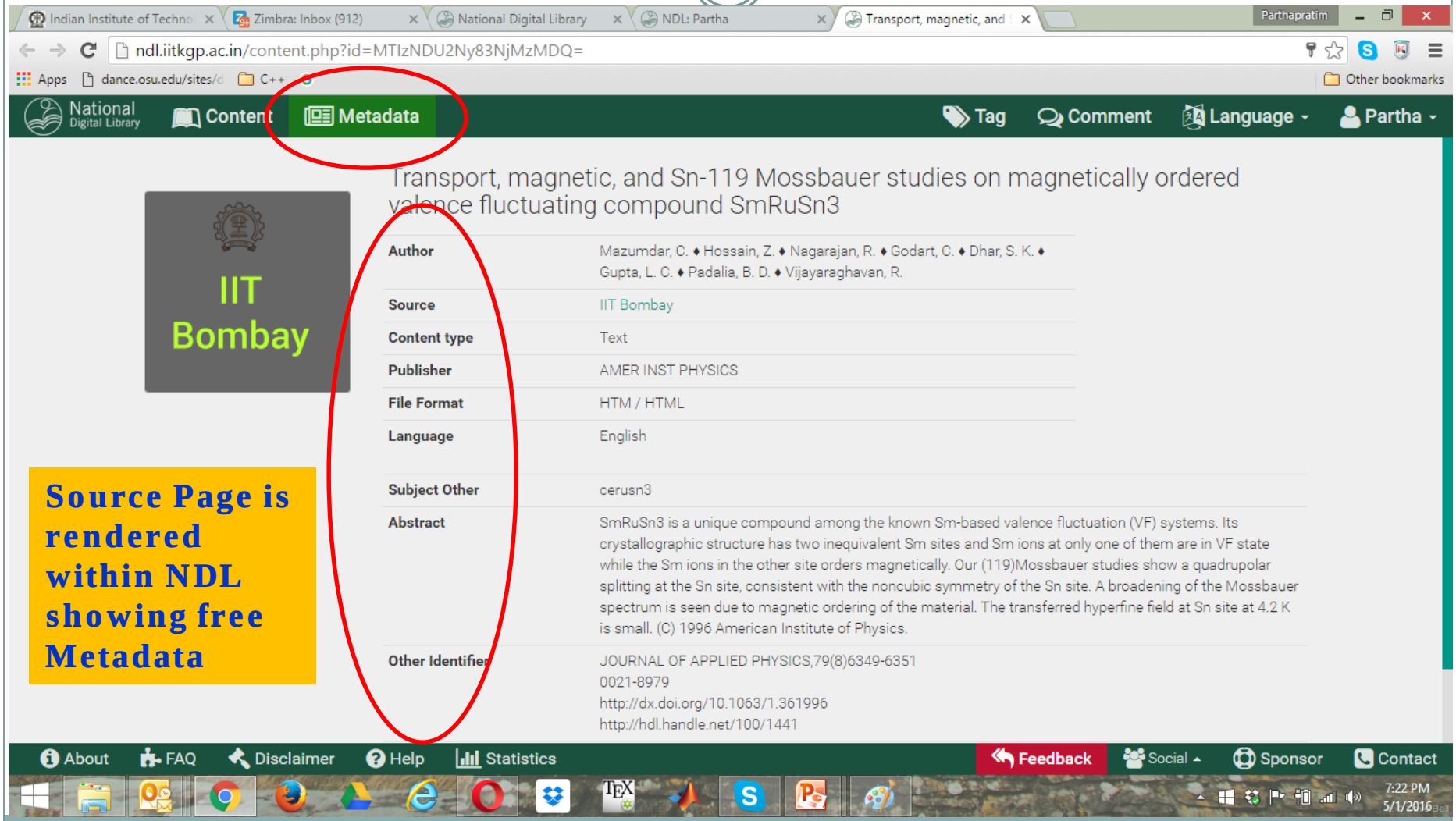
Adapted from: https://dp.la/info/wp-content/uploads/2013/04/DPLAMetadataPolicy.pdf

License Mechanisms

- Content Access Views in NDL
  - Metadata View
    - This shows the metadata of the item – as maintained in NDL
  - Full Text View
    - This shows the view and provides access to full text – offered by the content source

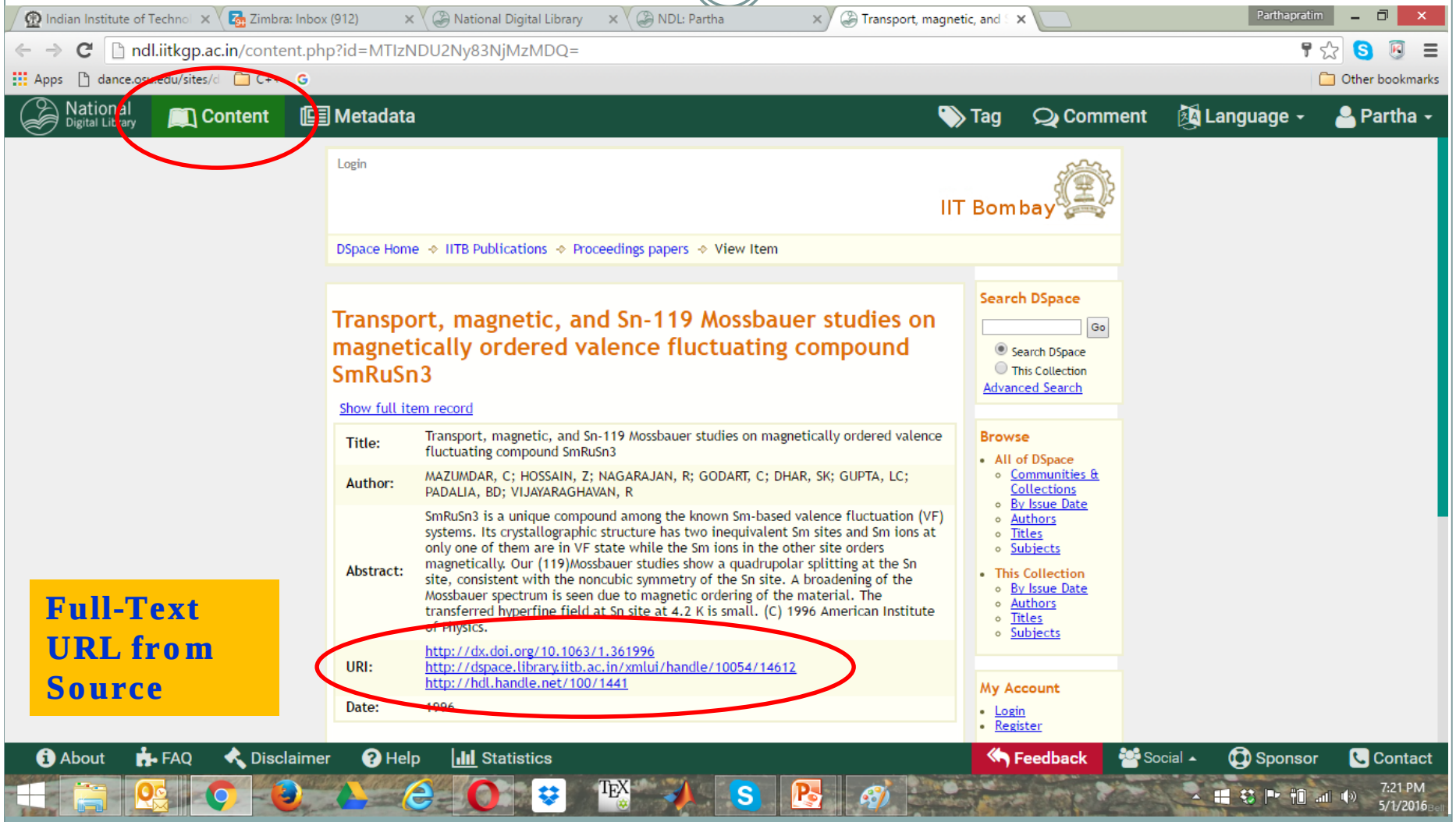
A license encapsulates the rights & privileges that a copyright holder grants to someone else vis–a–vis something they have created

Content Access View: Metadata



Source Page is rendered within NDL showing free Metadata

Content Access View: Full Text



Full-Text URL from Source

Access Options

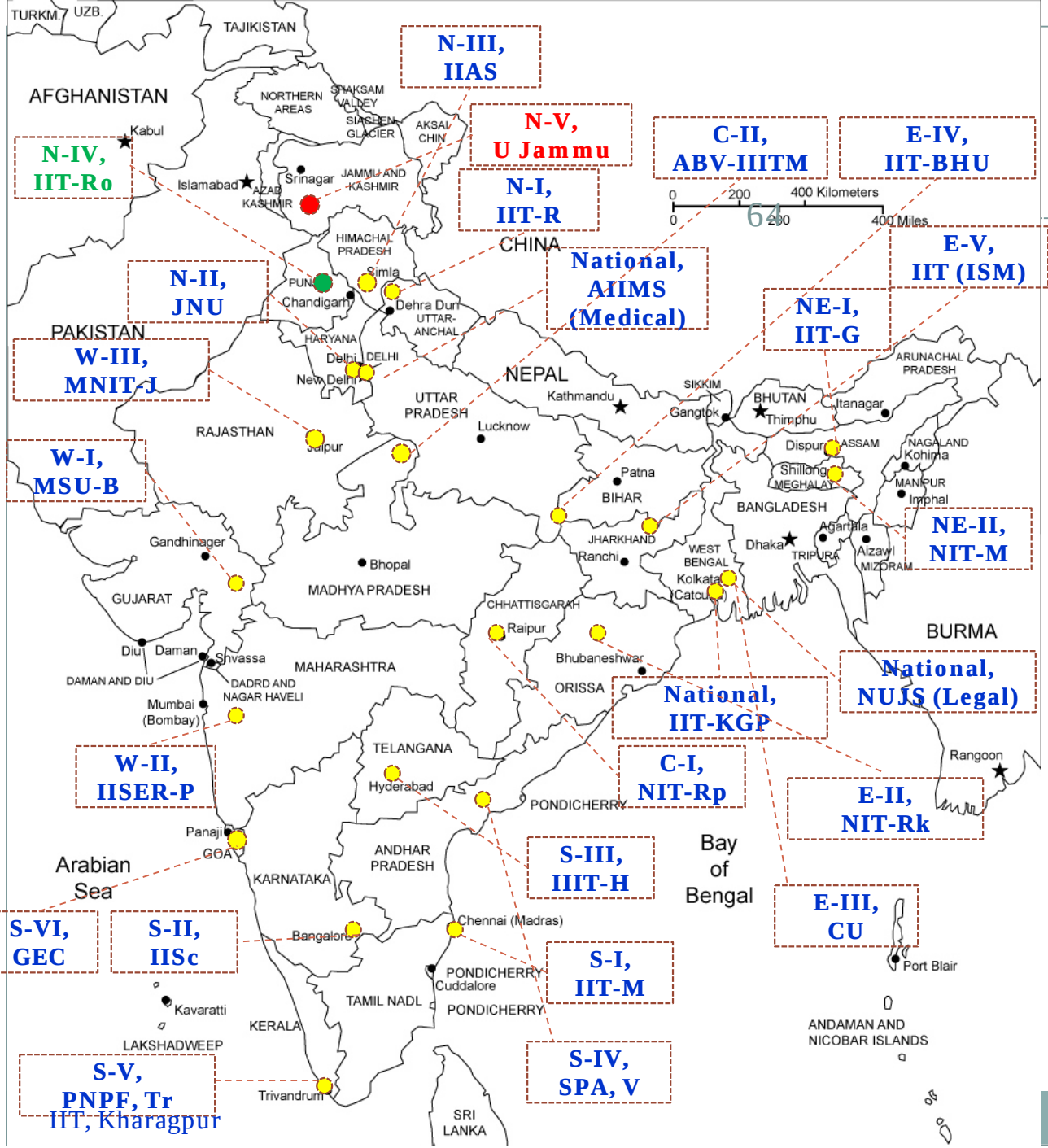
	Open Full-text available to all (Example: NCERT)
	NDL Users Full-text available through NDL, *not directly* from Source (Example: South Asia Archive)
	Limited Access Part of text available but full-text requires authorization by Source authority (Example: IISER, Bhopal)
	Subscribed Full-text available from institutions that have subscribed to the Source (Example: Springer)
	Restricted Full-text access requires authorization by Source authority and separate login to the Source (Example: IIT Jodhpur)

National Licensing

- An initiative by eSS:
  - e-ShodhSindhu: Consortium for Higher Education Electronic Resources

- Licensing being negotiated with Publishers
  - Institutional License:
    - Accessible from within designated institutional network: IP filtered
  - NDL Supported License:
    - Accessible if requested from NDL: Concurrent use-basis

Project Status



NDLI IDR Workshops

***Completed*:**

Events: 25

Institutes: 730

Individuals: 1340

***Scheduled*:**

Events: 2

Institutes: 60

Individuals: 140

NDLI Live:
https://ndl.iitkgp.ac.in/

NDLI on Facebook:
https://web.facebook.com/NDLIndia/

NDLI on YouTube:
https://www.youtube.com/watch?v=LEwAyHGKeLw
https://www.youtube.com/watch?v=qIZB-G9ywF0
https://www.youtube.com/watch?v=UCoJwfPrQFs&t=115s

NDLI Project:
http://www.ndlproject.iitkgp.ac.in/ndl/

Publications

1. Debarshi Kumar Sanyal, **Semantic Search in Digital Library**, Presented in International Seminar on Digital Humanities and Digital Societies in the Contemporary World, January 18-19, 2018
2. T. Y. S. S. Santosh, Debarshi Kumar Sanyal, and Plaban Kumar Bhowmick, **Surrogator: Enriching a Digital Library with Open Access Surrogate Resources**, Proceedings of ACM India Joint International on Data Sciences and Management of Data (C0DS-COMAD), January 11-13, 2018.
3. Samrat Guha Roy, B. Sutradhar, Partha Pratim Das, **Large-scale Metadata Harvesting – Tools, Techniques and Challenges: A Case Study of National Digital Library (NDL)**, Presented in *International Conference on Digital Library, TERI New Delhi, Dec. 13th – 16th, 2016.*
4. Subhayan Roy and Plaban Bhowmick, **Augmenting Online Video Lectures with Topically Relevant Assessment Items**, *The 24th International Conference on Computers in Education, IIT Bombay, Nov 28th - Dec 2nd, 2016*: **Best Technical Design Paper**
5. Poonam Anthony and Plaban Bhowmick, **Architecture for User Experience Tracking and Analytics in National Digital Library (NDL)**, *The 8th IEEE International Conference on Technology for Education, IIT Bombay, Dec. 2nd -4th, 2016.*
6. The NDL Team, **National Digital Library: A Platform for Paradigm Shift in Education & Research in India**, *Science and Culture (published by: Indian Science News Association)*, vol. 82, No. 1-2, pp. 4-11, Jan.–Feb. 2016.
7. The NDL Team, **National Digital Library: Building a National Asset**, *YOJANA*, vol. 60, pp 19-23, Jan. 2016. *Also in Hindi, Bangla, Marathi, Gujarati, Punjabi, Urdu, Telugu, Kanada, Malayalam, and Tamil.*

Status ...

- Items: 16M+
- Metadata: Version 1.0 of Standard Published
- Sources: 164 (IDRs: 100+)
- Registered Users: 3.0M+
- Daily Website Hits: ~12K
- Android App Download: 8L+
- Daily Android / iOS Hits: ~10K
- Registered User Institutions: ~9K
- Languages: 20+
- Learning Resource type: 15+
- Subject domain:
  - Most of the major educational areas (except medical and law)
- Educational Level: School Level (Class-I to XII) ,UG and PG

Status ...

- Nature of Sources: 154 (IDRs: 100+)
  - Featured: 7
    - Shodhganga, Shodhgangotri, Spoken Tutorial, SNLTR, OECD, Satyajit Ray Archives, JEE / GATE Questions & Solutions, South Asia Archives, WeL
  - Crawled Repositories: 5
    - NPTEL, Khan Academy, PhET, Project-OSCAR, LibriVox (audio books), PubMed
  - Manually-annotated sources: 6
    - NCERT, CBSE, Boards of WB, Tripura, AP, Karnataka, Kerala, Maharashtra
  - MARC data from Publishers: 2
    - CRC Press, Springer
  - Through API: 1
    - INFLIBNET N-LIST
- Upcoming
  - Integration Underway
    - Royal Society of Chemistry
    - American Society of Mechanical Engineers
  - Exploration
    - UNESCO, Gandhi Heritage Portal

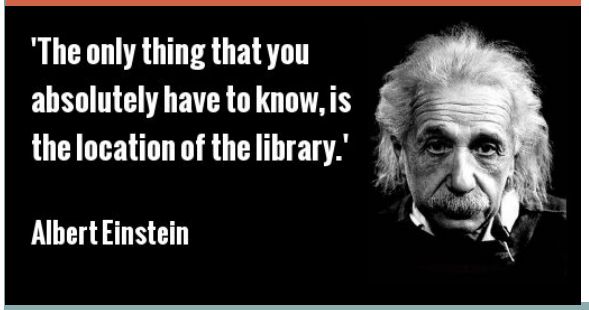
Summary

The only thing that you absolutely have to know (may use Google, though), is the URL of NDL:

ndl.iitkgp.ac.in

Rest you find in NDL

Why are you waiting?



- An umbrella over all IRs of India
- User-Centric Design
  - Multi-lingual Indic Interface
  - Multi-faceted Search
  - Multi-modal Filters
  - User Experience Tracking for Personalization
- Rich Set of Contents
  - National Licensing
  - Domain / Usage -focused Verticals
- Metadata Engineering
  - Metadata Standard
  - Open Source Toolkit
- NDLServices
  - Open APIs for 3rd party development
- Platform for Educational Ecosystem where all stakeholders participate, contribute and benefit
- Spearheads **NDL Movement**