KLS Vishwanathrao Deshpande Institute of Technology

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

University / Model Question Paper
Scheme & Solution

Faculty Name	:	Nikhil A. Kulkarni
Course Name	:	E-Waste Management
Course Code	:	21EC755
Year of Question Paper	:	DEC 24 / JAN 25
Date of Submission	:	08/02/2025

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CBCS SCHEME

USN | | | | | | | | | | **21EC755**

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
E-Waste Management

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain essentials of cohesive e-waste management thinking in India. (10 Marks)
   b. Describe life cycle of an e-product. (10 Marks)

OR

2 a. Illustrate e-waste flow and recycling scenarios in India. (10 Marks)
   b. Explain e-waste generation, collection, recycling process. (10 Marks)

Module-2

3 a. Mention goals, implementation and challenges for e-waste management. (10 Marks)
   b. Explain the experiences of EPR and take back compaign by Nokia in 2009 and 2012. (10 Marks)

OR

4 a. Explain considerations for successful implementation of EPR. (10 Marks)
   b. Describe challenges in implementation of EPR for e-waste management. (10 Marks)

Module-3

5 a. With a neat diagram, explain linear economy model versus circular economy model. (10 Marks)
   b. Illustrate recycling and resource efficiency related challenges to the circular economy. (10 Marks)

OR

6 a. Explain e-waste management rules 2016 and e-waste amendment rules 2018. (10 Marks)
   b. Describe analysis performance of EPR and CPCB regulatory mechanisms. (10 Marks)

Module-4

7 a. Describe policy issues for e-waste management before 2010. (10 Marks)
   b. Explain awareness related efforts on e-waste. (10 Marks)

OR

8 a. Mention gap analysis in e-waste management representing multi-stakeholder views. (10 Marks)
   b. Explain Pan-Indian initiatives for dealing with e-waste during 2000 and 2020. (10 Marks)

Module-5

9 a. Describe four domains of the e-waste management. (10 Marks)
   b. Explain environment concerns indicating potentials for safe environment and human health. (10 Marks)

OR

10 a. Describe recycling culture with respect to e-waste. (10 Marks)
    b. Explain economic concerns opportunities. (10 Marks)

* * * * *

Challenge – Dominant presence of informal sector – collection to recycling, resale of recovered materials

⇨ Demand growth
⇨ Awareness about environment
⇨ User's behaviour towards 6Rs

EEE users

⇨ Innovation, advancement – Design materials, design product
⇨ Sector based growth

Technology

⇨ Production, Consumption, Disposal – resource use
⇨ Design and marketability
⇨ Linear vs circular model
⇨ Formal-informal partnership

Business

E-waste management thinking

Management (linked to all components)

⇨ EPR, inventorisation
⇨ Fee and taxation
⇨ Circular Economy
⇨ Achieving SDGs
⇨ Environment concerns

Policy / regulation

⇨ Generation, target collection, treatment (domestic, imported)
⇨ Role of actors in value chain, logistics, its cost
⇨ EoL, MFA assessment based on inventory
⇨ Recycling activities, infrastructure
⇨ Resource recovery, losses
⇨ Proactive pathways
⇨ Informal trade chain to be addressed

Impacts

⇨ LCIA based
⇨ MFA based
⇨ Human health
⇨ Resource use, recovery
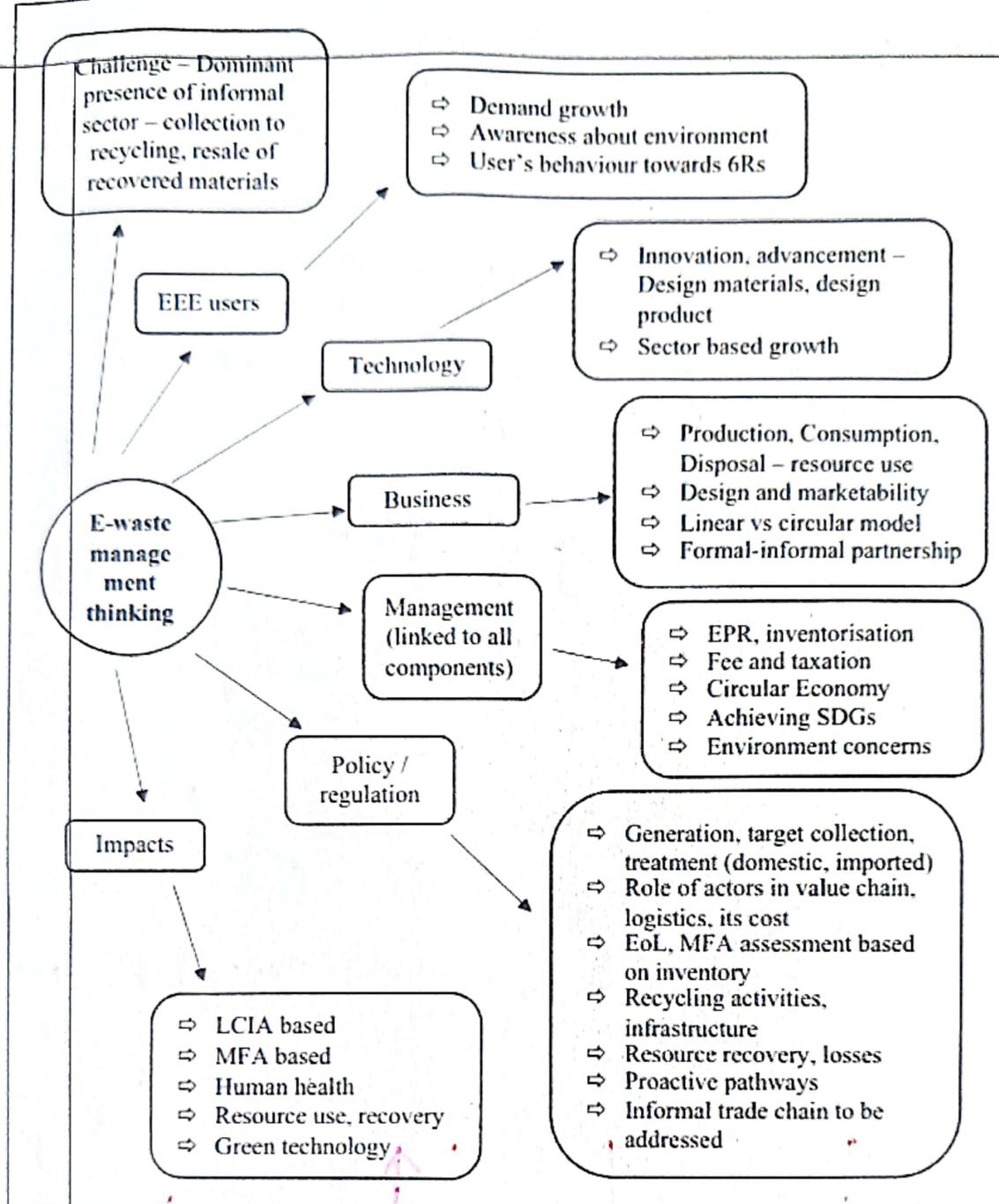⇨ Green technology

Diagram – 5M , Explanation – 5M

- Regulatory framework, employing EPR as management and enforcement strategy
- Increasing RE and RC
- PRO is expected to establish collection channel, segregation, safe transportation and ensure recycling of e-waste.
- The Meity and NITI Aayog, GoI has launched a document titled strategy on REs in EEE sector in 2019
- make in india, Digital india, and Clean india
- focus on EEE users, Technology, Business, Policy Impacts.

Q1b> Life cycle of an e-product

Raw material → Production → Sales → Consumption

EoL/Generation → Treatment Disposal Landfill

Repair ←

Treatment → Resale/Reuse

- It involves above steps
- Collection of Raw material, production, Sale consumption
- EoL is End of Life which indicates the up to what time it can be used without affecting the environment
- In case of EoL product disposal, it will be checked for possible treatment to resue the parts of the product, otherwise it will be disposed

Q2a) e-waste flow and recycling scenarios in India.

Large Scale waste aggregator

Formal/Informal recycles

Recovered materials Sold in market

→ Workingparts ←

Given away

Scrap

GivenToPRO

Given to friends

Donated to Institutes

F/IF Recycles.

Individual customer

Bulk consumer

Manufacture

Traders.

Imported e-waste.

Diagram - 5M

Explanation - 5M

Q.2B)   10M

generation: India ranks 3rd, with 3.2 Mt in
                2019, out of 10 countries – 3M

collection: India collected and recycled.
                30 kt in 2019, less than 2016-17
                which is increased 60% in 3 years
                b/w 2016-2019   – 3M

recycling: 95% of e-waste is managed by
            the informal sector in India in-
            -cluding collection, transportation
            dismantling   – 4M

Q3A) Goals: 10M
1) Create a sustainable production, consumption
    and waste management policy
2) incentives for eco.design
3) Reduce land filling and develop recovery
    channels
4) Internalisation of environmental cost.

    Implementation & challenges
1) an appropriate policy instrument that
    embodies the EPR principles is identified
    and a legislative frame work is developed.
2) Execution of the EPR programme in to a
    working system in practice

Q3B) In 2010, Brand Environmental Responsibility   10M
    (BER) adopted 'eco system approach'
    – take by program in 2009, 2012
    – one tree plantation for one mobile collected
    – Recycling of accessories collected
    – In a survey made in 13 countries, about-
        74% did not think about recycling, 84%
        of Indians did not considered the need
        for recycling

4a)
i) Stake holders involvement
ii) Clear allocation of responsibilities among all stake holder
iii) producers choice for IPR/CPR
iv) transperency of EPR
v) Govt. support in monitoring, evaluation and control needs
vi) Ambitious and clever policy targets are necessity
vii) compensation of resonable costs.

4b) Challanges in implementation of EPR (10M)

- A country must have institutional capacity to operate a supportive scheme, such as waste sorting scheme (UN ESCAP 2012)

- According to OECD countries, clear roles and responsibilities of stake holders is required

- Mutual trust b/w local authorities & industry owned EPR organisation is a must (EXPRA 2013:6).

- Legal provisions related challenges:
  o EM related

- Goverance/Enforcement-related challanges.

- Collection and recycling related challanges

-

Q.5a) Linear economy model vs Circular   10M
economy model

Linear model

Take → Make → Distribute → use → Dispose ___2M

In linear model EEE are taken from raw material and manufactured and distributed to all vendors, later once it is used after any minor damage / problem it can be disposed ___3M

Circular model


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      → Take ↘
     ↗        Make/Remake
  Consume        ↓
  Reuse
  Replace ← Distribute
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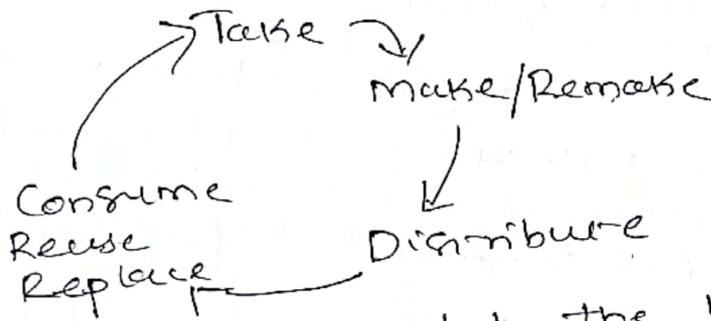
In circular model, the EEE iteam will be taken for verification, if any parts of that iteam is useful it will be distributed to various vendors, these vendors later use them in their products which are used as Replacable one, and same is taken back.

Example! Parts of mobile

Q.5b) challanges in circular economy model


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    Circular Economy
         ↘
  WEEE Recycling
         ↓
  Improved Environment ←
```

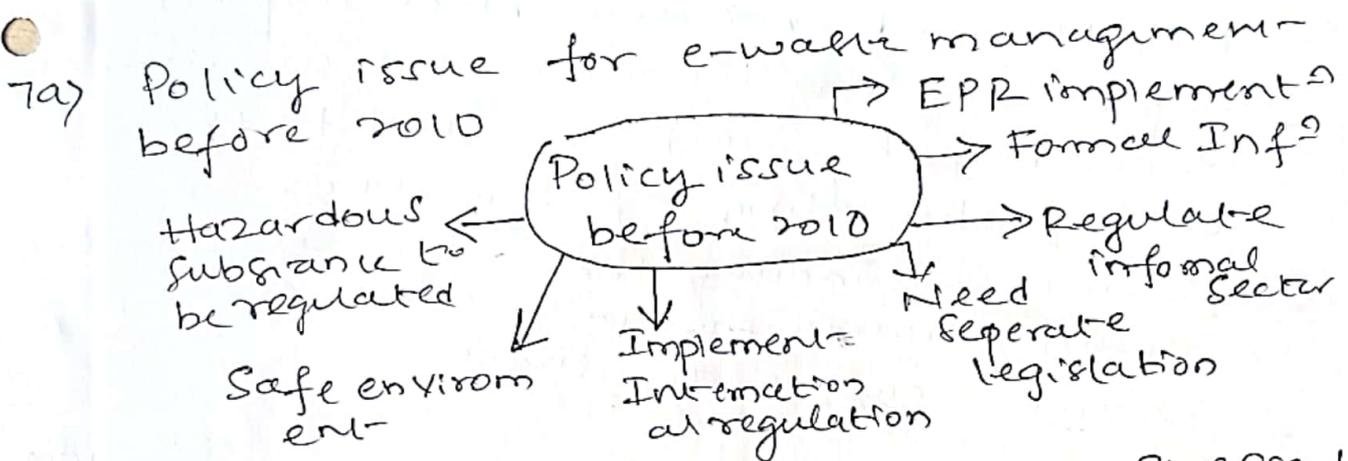| Collection |
| Pre-processing |
| Processing |
| Refining process |
| Lab vs industrial practice |

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5B) continues
- Recycling and RE are critical compo-
 -nent of CE.
- CE from collection to recycling te-
 -chniques
- lack of experence amoung companies
- cost of waste collection
- logistics. challenge
- The total recycling efficiency depends
 on recovery rate
- 50% metal, 70% preprocessing

6a) E-waste management rules 2016 & 2018 10M)
Amendments
2016 Rules! and 2018 Amendments
1) Manufacturer Rule 4! Collection and
channelisation of e-waste; seeking
authorisation from SPCB before June
2) Producer Rule 5: Authorisation of EPR,
- implementing EPR by finance
- Treatment, storage and disposal facility.
3) Amendment! Targets to be specified
EPR are applicable as per
schedule
4) Dealer, Rule 7! Collect e-waste, ensure
that the facilities are in accordance
with the standards DRS
5) Refurbisher Rule 8!: Collection e-waste
generated during the process of refur
- bish
6) Dismantler Rule 10! Ensure prescribed
standard for dismantling the EEE.

OR

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6b) Analysis performance of EPR and CPCB. Based on the 2016 rules and 2018 Amendment, 3 components are important.

i) PAN India EPR authorisation for all EEE products

ii) Producers preparation for EPR plan and target plan for e-waste collection and enhance re-cycling.

iii) ensure RoHS compliance

iv) Regulatory, enforcement and Awareness creation

7a) Policy issue for e-waste management before 2010

- Hazardous Substance to be regulated
- Safe environment
- Implement International regulation
- Need separate legislation
- EPR implementation
- Formal Info
- Regulate informal sector

Policy issue before 2010

— Initial workshops and meeting stressed on two policy issues
→ Production & consumption pattern with the need of inventorisation
→ Product-design improvement for increased life-span of an e-product

→ ILO has articulated policy issues w.r.t informal sector, suggesting that the regulation and formalisation of the sector required to tackle negative employment indications.

→ Poor working conditions in informal units dealing with e-waste.
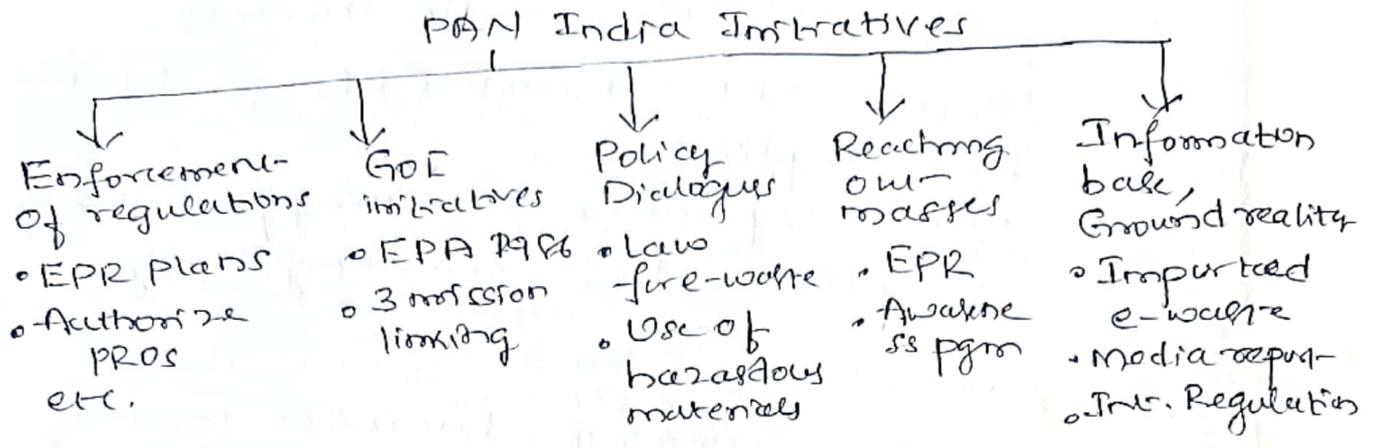
or

Q.7b) awareness related efforts on e-wm 10M

- By GoI is the Environmental Information System (ENVIS).
- Installing e-waste bins
- Increasing recycling and consequently reduction in hazards for environment as well as human health.
- Wipro has its take-back channel which reported 100% recycling the collection.
- PAN India Awareness Programme (PIAP). in 2015
- health and environmental aspects
- improving low literacy and awareness regarding hazards related to the unsafe handling of e-waste.
- awareness amoung the consumers regarding e-waste management
- MOOC coursus awareness.

Q.8a) Gap Analysis   10M

- A report was prepared by Verena R (2018), this report was based on survey of 20 stake holders. (producers, authorised PROs, recyclers, NGOs etc.).
- report on EoL management in India was also considered in 2017
- From 2008 to 2017, A synopsys was prepaid on e-waste disposals.
- SDGs and CSR requirements under companies act (ibid)
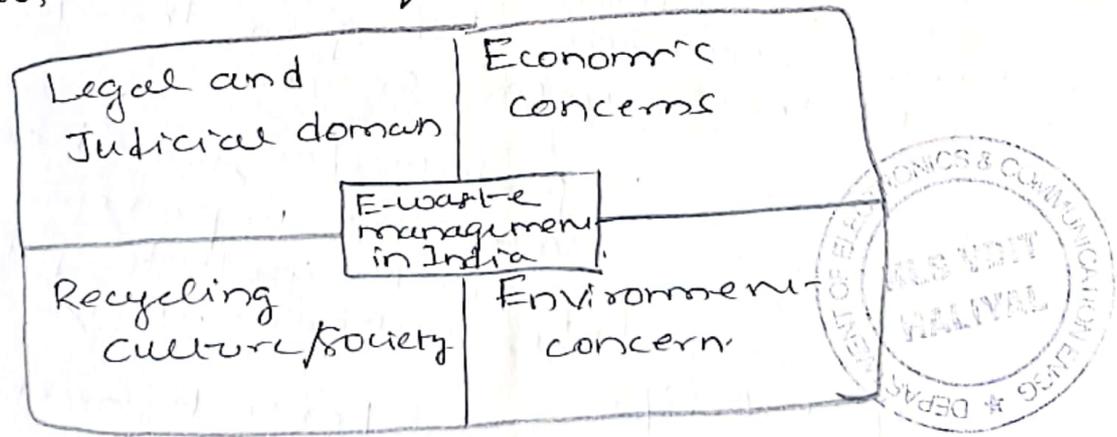- Audit for finance, Formal processing, small scale processing for current informal e-recyclers. etc

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8b>

PAN India Initiatives

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        ┌──────────────┬──────────────┬──────────────┬──────────────┐
        ↓              ↓              ↓              ↓              ↓
  Enforcement-    GOI          Policy        Reaching      Information
  of regulations  initiatives  Dialogues     out-          base,
                                             masses        Ground reality
  • EPR plans    • EPA 1986   • Law                        • Imported
  • Authorize    • 3 emission  -ire-waste    • EPR           e-waste
    PROs           limiting    • Use of      • Awarene      • Media report-
    etc.                         hazardous     ss pgm       • Int. Regulation
                                 materials
```

— Above Fig shows the various PAN India Initiatives

— Enforcement of regulation includes, EPR plans and targets, Awareness related mandate (2017)

— GoI Initiatives: Rule 2008 on Hazardous e-waste management, Digital India, make in India, Swachh Bharat-

— Policy: Separate Law for e-waste, monito ring use of hazardous substances

— Reaching out-masses through training and conducting workshops with different actors, EPR - efforts

— Information base Creation

— Ground reality: based on research & media reports

Q9a> Four domains of e-waste management-

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┌──────────────────────┬──────────────────────┐
│ Legal and            │ Economic             │
│ Judicial domain      │ concerns             │
│          ┌───────────────────┐              │
│          │ E-waste           │              │
│          │ management        │              │
│          │ in India          │              │
│          └───────────────────┘              │
│ Recycling            │ Environment-         │
│ culture/society      │ concern              │
└──────────────────────┴──────────────────────┘
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→ Legal, Judicial Domain involves
   - Enforcement through EPR, facilitation for compliance
   - Non-compliance tracking/monitoring
   - compliance by regulatory body

→ Economic concerns
   - Circular economy - business model
   - Fund for infrastructure
   - Skill building
   - Formal - informal sector partem ship

→ Recycling culture
   - Adoption of culture of 6Rs - repair, reuse, refurbish, responsibly dispose, recyle, recover and its institutions
   -

→ Environment- Concerns.
   - Design modification, innovation folloing LCA, RoHS compliance.
   - Responsible disposal.

9b> Environment-al concerns
   - Adopting Green Technology:
      - minimication of energy and use of natural resources, orgin from the design stage to the recycling stage.

   - Improvement in product design unheeded:
      - to promote environment improvements
      - The area of products include factors such as product material, design and expected life
      - The E-waste from Toxic to Green initiative

   -

Q9b) continued:
Standardisation related are aligned with global practices, WEEE Labex, E-Stewards, R2, CENELEC etc.
- By Recycling and disposal of residues related issues partially addressed.

Q.10a> Recycling Culture w.r.t e-waste
- The recycling culture is a civil society centric concept and a requirement, beyond the regulatory frameworks, wherein all the stakeholders remain the same/ not distinctly categorised
- Academic courses started on SWAYAM and upscaling through many more education institutes
- CCRD model of project implementation
- The dust is yet to settle programme
- continuing enforcement of the Rules and innovative ideas
- A hub and spoke model for recycling (for solid waste)

Q10b> Economic concern opportunities   10M
These include
- Opportunities CE through the existing / new business model.
- Building up of infrastructure
- Business opportunities (PRO rule)
- Fostering formal - informal partnerships
- Employment and skill related funding
- Mudra loan etc

Ok