



सत्यमेव जयते



भारतीय पुनर्वास परिषद्

DIPLOMA IN HEARING AID AND EAR MOULD TECHNOLOGY

D.H.A.E.M.T.

May, 2023

(w.e.f. 2023-24)

REHABILITATION COUNCIL OF INDIA

(Statutory Body of the Ministry of Social Justice & Empowerment)

Department of Empowerment of Persons with Disabilities (Divyangjan)

Government of India

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New Delhi – 110 016

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Index

S No	Content	Page No
1	Preamble	2
2	Nomenclature and Objectives of Programme	2
3	Scope of Programme	2
4	Duration of the course:	2
5	Eligibility	3
6	Medium of instruction:	3
7	Criteria for passing:	3
8	Attendance	3
9	Theory and practical hours	3
10	Examination Pattern: Scheme of Examination	3
11	Question paper pattern	4
12	Declaration of results and award of Diploma	4
13	Guidelines for special assistance to examinees with disabilities.	5
14	Certification as Registered Personnel	5
15	Requirements of Physical Infrastructure and Materials	5
16	Course Content:	9
	DHAEMT 1: Hearing Aids & Assistive Listening Devices	10
	DHAEMT 2: Ear Mould Technology	13
	DHAEMT 3: Employability Skills	15
	DHAEMT 4: Practical 1: Hearing Aids & Assistive Listening Devices	16
	DHAEMT 5: Practicals2: Ear Mould Technology	17

1. Preamble

Aim of the program is to train a class of persons and equip them with skills for care, maintenance and repair of hearing aids, assistive devices and address the needs of our clientele relating to ears.

2. Nomenclature of Programme: Diploma in Hearing Aid and Ear Mould Technology i.e. D.H.A.E.M.T.

Objectives

The objectives of the diploma course are to increase the availability of manpower equipped with skills for maintenance and services of hearing aids as well as other listening devices services, with skills to make all kinds of ear mould for the hearing impaired, with skills to address the service needs of persons with hearing impairment in different set ups, and train manpower who will address all service-related issues of the hearing impaired relating to hearing aids, assistive listening devices and ear moulds and also to ensure that these devices are optimally utilized.

3. Scope of the programme

There are more than one million hearing aid users in the country and a 7% growth in hearing aid industry is predicted in the coming years. Poor after sales service has meant that a large number of hearing aids are either unutilized or underutilized by our clients. This is especially true with children in special schools, rural population and women with hearing impairment. There is a felt need for a class of semi-professionals or skilled persons who can address the basic maintenance - service issues relating to hearing aids and assistive listening devices felt by the different groups of hearing aid users referred to above. Therefore, a diploma program of this nature is warranted. Additionally, persons so trained under the diploma program can fill critical practical voids in the hearing aid industry.

4. Duration of the course

The duration of the programme will be of 1 year comprising of 1200 hours leading to 40 credits (30 hours = 1 credit). The weightage to the programme will be 60% practical and 40% theory. The course work will comprise of 720 hours of practical and 480 hours of theory. The theory hours will also include 60 hours of Employability skills. The resources for the module are freely downloadable at www.employabilityskills.net. This module will enable and empower the trainees with readiness skills for applying, preparing for interviews and developing soft skills for working

as professionals in supporting diverse clients across different setups. The module will be assessed formatively for internal marks and summatively with a final exam.

5. Eligibility

- a) A pass in 12th class with Physics or Electronics as one of the papers, or any recognized diploma in Electronics/ Electrical engineering, or any qualified dental technician course, or Certificate or Diploma from ITI in Electronics/Electrical Engineering area.

6. Medium of instruction:

English / Hindi or any other regional language

7. Criteria for passing:

As per NBER Scheme of Examination

8. Attendance

Minimum 80% attendance in theory and 90% in practical classes is required.

9. Theory and practical hours

Calculated on the basis of 7 hours / day, 5 days / week and 38 weeks / year

- a) 1200 hours per year

Paper Code	Theory/Practicum	Hours	Total Theory/Practicum	Credit
DHAEMT 1	Hearing Aids & Assistive Listening Devices	180 Hrs + 30 hr Library	480 Hrs	16
DHAEMT 2	Ear Mould Technology	180 Hrs + 30 hr Library		
DHAEMT 3	Employability Skills (Soft Skills)	60 Hrs		
DHAEMT 4 Practical	Hearing Aids & Assistive Listening Devices	360 Hrs	720 Hrs	24
DHAEMT 5 Practical	Ear Mould Technology	360 Hrs		
Total			1200 Hrs	40 Credit

10. Examination Pattern/Scheme of Examination

Paper	Title of the paper	Theory / Practicum	Marks		
			Final* Exam	IA	Total
DHAEMT 1	Hearing Aids & Assistive Listening Devices	Theory	80	20	100
DHAEMT 2	Ear Mould Technology	Theory	80	20	100

DHAEMT 3	Employability Skills (Soft Skills)	Theory	80	20	100
DHAEMT 4 Practical	Hearing Aids & Assistive Listening Devices	Practicum	80	70	150
DHAEMT 5 Practical	Ear Mould Technology	Practicum	80	70	150

There shall be one examination at the end of the course. In view of the technical nature of the course and the field, the medium of instruction shall be English. Duration of each examination shall be 3 hours.

11. Question paper pattern

The following is only an illustration. Important thing to note is that there has to be internal choice for each question except DHAEMT 3.

Unit No.	Question	Sub- Question	Marks
I	1 or 2	a.	8
		b.	8
II	3 or 4	a.	7
		b.	5
		C	4
III	5 or 6	A	10
		B	6
IV	7 or 8	A	8
		B	8
V	9 or 10	A	6
		B	4
		C	6

12. Declaration of results and award of Diploma

There will be a uniform pattern of declaration of results as under:

75% and above	-	Distinction First
60-74.9%	-	Division Second
50-59.9%	-	Division
40-49.9%	-	Pass Class

Diploma will be awarded to the successful candidates by the examining body nominated for this purpose by NBER-RCI.

13. Guidelines for special assistance to examinees with disabilities

Based on the medical certificate issued by the competent authority, and as provided for CBSE /State Governments / UGC and NIOS for students with disabilities, special provisions are to be given in terms of providing scribes, computers, extra time, separate room and readers to student-trainees.

14. Certification as Registered Personnel

It is mandatory for every rehabilitation professional / personnel to obtain a “Registered Personnel/ Professional Certificate” from the Rehabilitation Council of India to work in the field of disability rehabilitation and special education in India. A Student who has attended the training and completed the requirements for all modules successfully will be qualified as a **Hearing Aid and Ear Mould Technicians - Personnel** and be eligible to work in the field of Rehabilitation in India as a **Hearing Aid and Ear Mould Technician**. As continuous professional growth is necessary for the renewal of the certificate, the rehabilitation professional / personnel should undergo in-service programme periodically to update their professional knowledge. Each registered professional/personnel will be required to get himself /herself renew his registration periodically. The periodicity will be decided by the council from time to time. The activities for enrichment training programmes in the form of Continuous Rehabilitation Education (CRE) is decided by the RCI.

15. Requirements of Physical Infrastructure and Materials

The following are the specific requirements for starting a Diploma in Hearing Aid and Ear Mold Technology with an intake of 20 students in addition to the general requirements documented by RCI.

Infrastructure

The following infrastructure is a must for a batch of 20 students.

1.0 Staff

1.1 Core faculty

- | | |
|-------------------------|---|
| a) Ear Mould technician | 1 |
| b) ITI instructor | 1 |

1.2 Supporting Faculty / Staff

- a) Lecturer in Audiology 1
[With M. Sc (Audiology)/M.Sc (Sp. & Hg.)/M.ASLP or an equivalent qualification]
- b) Lecturer in Electronics 1
(with B.E- Electronics or M.Sc - Electronics)

1.3 Supporting Staff

- a) Administrative Assistant 1
- b) Library Assistant 1
- c) Attenders 2

2.0 Equipment

1. Hydraulic Press
2. Polishing Unit
3. Thermal / Hot Oven
4. Micro Motor
5. UV light pistol
6. UV Cure Unit
7. Duplicating Device
8. Wax immersion kit
9. Ultra sonic cleaner
10. Plaster dispenser
11. Work bench with Suction Unit
12. Dental Lathe
13. Vacuum mixer
14. Vibrator
15. Pressure pot
16. Air compressor
17. Hearing aid analyzer.
18. Illuminating magnifying lens 3 x for BTE aids
19. Multi meter digital

2.1 Tools

Basic Material for Hearing Aid Repair	
Street nose player 5"	Steel outtr 4"
Screwdrivers 3",4",5"	Brush
Forceps	Knife
Round file Jewellers	Flat file Jewellers
Cutting plier 6"	Benchvice
Small Hacksaw	Hand drill with bits 0.8 mm to 2mm
Battery compartment or battery bolder	Soldering Iron (Soldron or Tony make) 25 watts with different tips

Soldering Iron stand	Soldering paste
Soldering lead 100 gins 60-40	Watch mechanic screwdriver set
Signal injector	Cellotape
Bonifix	Flexible wire 7 stand
Disposable syringe	Spare hearing aid cords 2 pin, single cord, 2 pin v cord, 3 pin single cord
Cord tester and cell tester or multimeter	
Stethoscope without diaphragm	Desoldering pump
Table lamp and 2 tube lights.	Bee wax
Basic Materials for Hard Mold & Hard Shell Making	
Flask & Clamp	Stone Plaster
Glass Bowl	Could Mould Seal 3.5 lt
Cotton Buff	Heat Cure Polymer 3kgs
Soldering Gun	Heat Cure Monomer 4lt
Silicon Impression	Self Cure Monomer & Polymer
Material/Alginate	Pumice 1kg
Impression Syringe	Snap rings
Rubber bowl	L- Connector
Spatula	PVC Soft Tube 1 roll
Plastic sheet	Ear light
Impression Lids	Plaster of Paris
Basic Material for UV Cure Mold Making	
Silicon Impression Material	Lacquer for UV Hard
Impression Syringe	Lacquer for UV Soft
Bayonet Tweezers	Transparent container for Cleaning Liquid
Impression Wax Green	Pre-Bend PVC soft tube
Dipping Sieve	Ear light
Investment form Transparent	Connecting Spring for soft ear mould
Duplicating Gel Agar	LP cleaner
Flex AB 40 (Soft UV Polymer)	LP/H Transparent (Hard UV Polymer)
Pump Dispenser for UV polymer	UV Safety Goggles
Glue for tubing	Glue Primer
Metal snap ring	Place maker for snap ring
Snap ring for soft ear mould	
Basic Materials for Soft Mold Making	
Silicon Impression Material	Scooping Instrument (Probe)
Impression Syringe	Could Mould Seal

Flask and clamp	Silicon Packing Material
Rubber Bowl	Silicon Injector
Plaster Spatula	Mixing Canula
Plaster of Paris	Canula tip
Stone plaster	Lacquer
Bayonet Tweezers	Pre Bend PVC soft tube (1.5x2.5mm)
Ear light	Pre Bend PVC soft tube (2.0x3.1mm)

3.0 Space

- | | |
|---------------------------------|-------|
| a) 10x15' Classroom | 1 No. |
| b) 10x15' Ear lab | 1 No. |
| c) 10x 15' Hearing aid workshop | 1 No. |
| d) 10x10' Office room | 1 No. |
| e) 10' x 15' Library | 1 No. |

4.0 Furniture

- Furniture for storing finished products
- Chairs and work benches (4 each)
- Wooden table measuring 2'x 4' with 2' height (4)
- Chairs (4) and steel almirahs (2)
- 5 amps multisocket with switch (2)

5.0 Library

The following books are minimum

- Floyd, T.L. (1986). Digital fundamentals. Universal Book Stall, New Delhi.
- Hersh M. A. & Johnson M.A. (2003). Assistive technology for the hearing impaired deaf and deaf blind. Springer, London.
- Johnson, G. H. (2002). Impression materials. In R.G. Craig and J. M. Powers (Ed.). Restorative dental materials 11th India Private Limited.
- Katz, J. (1978). Handbook of clinical audiology, 2 ed. Chapter on Ear moulds, Vol I, Williams and Wilkins, Baltimore.
- Leavitt. R. (1981): Ear moulds: Acoustic and structural consideration. In Hodgson W. R. And Skinner P. H (Eds). Hearing aid assessment and use in audiological habilitation
- Loavenbruk, A. M., &Madell, A. I. (1981). Hearing aid dispensing for audiologist. A guide for clinical service. New York: Grune and Stratton.

- Mehta, V.K. (1994). Principles of Electronics. S Chand & Co., New Delhi.
- Pollack , M. C., & Morgan, R. (1980). Ear mould technology and acoustics. Pollack M. C. (Ed). Amplification for the hearing impaired. 2nd Grune and Stratton, 111 – 113.
- Sandlin, R. E. (1995). Hand book of hearing aid amplification. Singular Publications, San Diego.
- Tucker, I., & Nolan, M. (1984). ‘The Ear mould’ in Educational Audiology, Great London, Croom Helm Ltd., 172 – 199). Baltimore, Williams and Wilkins, Vonlanthen, M. (2000). Hearing instrument

16.0 Course Content

DHAEMT 1

HEARING AIDS & ASSISTIVE LISTENING DEVICES

180 Hours (6 Credit)

Objectives

After training in this subject, the student should be able to

- a) identify and describe function(s) of each component used in hearing aids.
- b) undertake repair of body worn and BTE hearing aids, assistive listening devices etc.
- c) carry out electro-acoustic evaluation of hearing aids and interpret the analysis report.
- d) organize and manage a hearing aid repair lab
- e) maintain and repair assistive listening devices, and
- f) advise hearing aid users on the maintenance and care of hearing aids and other hearing devices.

Unit 1. Electronic Components

36 hrs

1.1 Passive components

- a. Resistors: Definition of resistance, Ohm's law, color coding, power rating, types of resistors, series and parallel combination, variable resistors such as trim-pots, multi-turn pots, volume controls etc.
- b. Capacitors: Definition of capacitance, working of a parallel plate capacitor, color coding, voltage rating, types of capacitors, series and parallel combination, variable capacitors.
- c. Inductors: Definition of inductance, working of an inductor, types of inductors, variable inductances, inductor rating.
- d. Transformers: Principle of electromagnetism – mutual inductance – transformer theory, types of transformers such as voltage transformer, current transformer, power transformer, output transformer, pulse transformer etc.

1.2 Active components

- a. Diodes: Forward and reverse biased PN junctions, different types of diodes such as rectifier diode, signal diode, zener diode, light emitting diode, diode rating and specifications.
- b. Transistors: Basic structure and working of NPN and PNP transistors. How does a transistor work as an amplifier, CE, CB & CC configurations, types of transistors, specifications and rating of transistors, structure and working of JEET's & MOSFETs.

Unit 2 Basic Electronic circuits and digital electronics 36 hrs

- 2.1 Transistor amplifiers: Single stage and multistage amplifiers, voltage amplifiers and power amplifiers, R-C coupled, direct coupled and transformer coupled amplifiers, class A, B, AB, C & D operation of amplifiers, AF, wideband and RF amplifiers, positive and negative feedback.

- 2.2 Operational amplifiers: Concept of differential amplification, concept of an OPAMP and its ideal characteristics, inverting, non-inverting, summing and integrating amplifier circuits using OPAMPs.
- 2.3 Oscillator: Theory of oscillations – sine-wave, oscillators – Wein bridge oscillator, TC phase shift oscillators, Hartley, Colpits, Crystal oscillators, etc.
- 2.4 Filters: Classification of filters based on frequency response, active and passive filters, basic concept of a digital filter.
- 2.5 Modulation and demodulation: Necessity for modulation, different types of modulation-amplitude modulation, frequency modulation and demodulation.
- 2.6 Linear integrated circuits: IC 741, IC 552, IC LE507 –pin out and applications.
- 2.7 Binary number system: Decimal to binary and binary to decimal conversion. Logic gates, operation of NOT, AND, OR, NAND, NOR, EX-OR & EX-NOR gates and their truth table.
- 2.8 Analog to digital and digital to analog converters: Structure and function of different types.
- 2.9 Brief introduction to computers & peripherals: Block diagram, components and specifications.
- 2.10 Bluetooth technology and its application in hearing aid/cochlear implant/ALD.

Unit 3 Hearing Aid Components & Amplification

36 hrs

- 3.1 Introduction to hearing aids: General block diagram, familiarization with different components used in the hearing aids, types of hearing aids – body level, behind the ear, in the ear, in the canal, CIC, RIC etc., mild, moderate, strong and extra-strong categories.
- 3.2 Microphone: Structure and working of condenser and electret condenser microphones, directional microphones, requirements of a hearing aid microphone.
- 3.3 Receiver: Structure and working of different types of receivers, requirements for a hearing aid receiver.
- 3.4 Amplifier: 3 stages of amplification – Preamplifier, second stage amplifier, output amplifier, requirements of hearing aid amplifier.
- 3.5 Hearing aid controls and cords: Volume control, OTM switch, Tone Control, Peak Clipping (PC), Maximum Power Output (MPO), 2 pin/ 3 pin S-cord, Y-cord.
- 3.6 Battery: Different types of cells used in hearing aids and their features, requirements for a hearing aid battery.
- 3.7 Linear amplification: Threshold and uncomfortable levels of hearing, dynamic range, soft sounds, loud sounds etc., problems with linear amplification in hearing aids.
- 3.8 Non-linear amplification: Need for non-linear amplification, compression – Need and types of compression, compression ratio, compression threshold, AGC – Need and types – input AGC & output AGC, attack time, release time etc.
- 3.9 Amplifier circuits for hearing aids: Transistorized circuits, IC based circuits & circuits with AGC.

Unit 4 Digital Hearing Aids & Electroacoustic Evaluation

36 hrs

- 4.1 Introduction to digital hearing aids: Block diagram and working of each stage, need for digital technology, advantages and limitations.
- 4.2 Basics of digital signal processing: Functions of a digital signal processor in hearing aids.

- 4.3 Channel separation: Number of channels, bandwidth, controlling the gain of each channel and bands.
- 4.4 Programming a digital hearing aid: Block diagram of the setup, interface (wired and wireless), organizing a programming set up etc.
- 4.5 Remote hearing programming and its technical limitation.
- 4.6 Programmable hearing aids: Block diagram and working of each stage, need for programmable technology, advantages and limitations.
- 4.7 Electro acoustic measurements: Hearing aid analyzer, parameters of evaluation, hearing aid standards.
- 4.8 International and Indian standards for hearing aids and ALDs
- 4.9 Speech perception through hearing aids: Quality of output sound, factors affecting quality, intelligibility of sound, factors influencing intelligibility.
- 4.10 Preventive maintenance and care: How to take care of hearing aids and their components.
- 4.11 Troubleshooting: Probable troubles and their remedies – BTE & body level hearing aids.

Unit 5 Group Hearing Aid Systems & Assistive Listening Devices

36 hrs

- 5.1 Introduction: Difference between personal and group hearing aids, need, advantages of group hearing aids over personal hearing aids, types of group hearing aid systems.
- 5.2 Block diagram, principle of operation, implementation, applications, advantages and limitations of the following systems:-
 - a. Induction loop system
 - b. Hardwire system
 - c. Infrared system
 - d. FM system
 - e. ALDS: Discussion of different types of assistive listening devices & trouble shooting.

Books for Reading

- Floyd, T.L. (1986). Digital fundamentals. Universal Book Stall, New Delhi.
- Hersh M. A. & Johnson M.A. (2003). Assistive technology for the hearing impaired deaf and deaf blind. Springer, London.
- Mehta, V.K. (1994). Principles of Electronics. S Chand & Co., New Delhi.
- Sandlin, R. E. (1995). Hand book of hearing aid amplification. Singular Publications, San Diego.
- Vonlanthen, M. (2000). Hearing instrument technology. San Diego, San Diego.

DHAEMT 2

EAR MOULD TECHNOLOGY

180 Hours (6 Credit)

The objectives of this course is to train students

1. to make ear molds of different types and in different set-ups, and
2. to organize and manage an ear mold lab

Unit 1 Anatomy and acoustics of conductive pathway

- 1.1 Anatomy of the external ear and its variation
- 1.2 Acoustics of external ear and its importance
- 1.3 Brief anatomy of middle and inner ear

Unit 2. Hearing loss

- 2.1 Nature and types of hearing loss
- 2.2 Causes of conductive, mixed and sensorineural hearing loss
- 2.3 Candidacy for hearing aids

Unit 3. Ear molds: Types and impression

36 hours

- 3.1 Ear mold and its role in hearing
- 3.2 Types of ear molds
- 3.3 Parts of ear molds
- 3.4 Materials used in ear mold impression and ear mold, its properties, bio-interaction with skin allergies and precautions while selecting materials
- 3.5 Procedure for taking ear Mold impression and precautions

Unit 4. Making of ear molds

36 hours

- 4.1 Stages in making hard mold
 - a. Methods of hard mold making
 - b. UV curing
 - c. Acrylic
- 4.2 Stages in making soft mold
- 4.3 Acoustic modifications of ear mold and its consequences

Unit 5. Organization skills and ear mold for special purposes

36 hours

- 5.1 Setting up of ear mold lab
- 5.2 Impression taking and shell making of custom hearing aids
- 5.3 Community based ear mold impression taking and ear mold making
- 5.4 Making of ear plugs and swimmers plugs
- 5.5 Care, maintenance and counselling about ear molds

Books for Reading

- Katz, J. (1978). Handbook of clinical audiology, 2 ed. Chapter on Ear moulds , Vol I, Williams and Wilkins, Baltimore.
- Johnson, G. H. (2002). Impression materials. In R.G. Craig and J. M. Powers (Ed.). Restorative dental materials 11th India Private Limited.
- Loavenbruk, A. M., & Madell, A. I. (1981). Hearing aid dispensing for audiologist. A guide for clinical service. New York: Grune and Stratton.
- Leavitt. R. (1981): Ear moulds: Acoustic and structural consideration. In Hodgson W. R. And Skinner P. H (Eds). Hearing aid assessment and use in audiological habilitation
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- Tucker, I., & Nolan, M. (1984). 'The Ear mould' in Educational Audiology, Great London, Croom Helm Ltd., 172 – 199). Baltimore, Williams and Wilkins,

DHAEMT 3
EMPLOYABILITY SKILLS

CREDITS---02

Teaching Hours: 60hrs

www.employabilityskills.net

Skills to be achieved and assessed for internal assessment and practical examination

DHAEMT 4
Practical
HEARING AIDS & ASSISTIVE LISTENING DEVICES
360 Hours (12 Credit)

Practical skills relating to

1. Identification of the problem
2. Cause finding
3. Rectifying the problem
4. Verification as the specification
5. Client satisfaction
6. Counseling the client

DHAEMT 5
Practical
EAR MOULD TECHNOLOGY

360 Hours (12 Credit)

Practical skills relating to

1. Inspection and documentation of the status of external ear canal
2. Selection of material for impression taking and ear mold making
3. Ear mold fitting skills
4. Trouble shooting of ear molds, and
5. Practical records of the following type:
 - a) The students are required to maintain records of 50 ear impressions and 10 finished s of each type at the end of the year.
 - b) Student should maintain records of at least 25 impressions of custom hearing aids technology. San Diego, San Diego.