

# **Guidelines - pre-sea & post sea courses pertaining to engineering stream (Obsolete-Superseded by DGS Order No. 7 / 2016)**

**Training Circular No. 1 of 2004**

**No.11-TR(47)/2003**

**Dated: January1, 2004**

**Sub: Guidelines - pre-sea & post sea courses pertaining to engineering stream.**

As per META Manual, there are 13 streams for pre-sea engineering courses. However, detailed guidelines of pre-sea and post-sea courses pertaining to engineering stream have not been compiled and circulated.

Draft guidelines have been prepared in the Directorate in consultation with various stakeholders. These guidelines were placed on Directorate's website and comments of training institutes and INSA, MASSA, FOSMA were solicited. Based on the responses received a meeting was held with the training institutes who had sent responses. The draft guidelines were finalized on the basis of input then received.

After the above exercise, the guidelines for pre-sea and post-sea courses for engineering discipline have been finalized and are issued as [Training Circular No.1 of 2004](#). (Please click here to view guidelines) This Training Circular should be read in conjunction with [DGS Order No.1 of 2003](#).

**Sd/-**

**(Naresh Salecha)**

**Sr.Dy. Director General of Shipping**

**P.S.: Since the attached document contains 145 pages it may take long time to open. Please bear with us.**

**Training Circular No. 01 of 2004**

**Corollary to the DGS order no. 1 of 2003**

**Mandatory Guidelines**

**For accreditation with the**

**Director-General of Shipping**

**for all Institutes, training Centres conducting DGS  
approved Pre-sea and Post Sea Courses**

**for Pre-Sea & Post Sea Training in the Engineering Stream for the Merchant Navy**

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Mumbai, 400 001  
01.01.2004.

# ABBREVIATIONS

1. ASW	- Assistant Superintendent Workshop
2. ATS	- Alternate Training Scheme
3. CGPA	- Cumulative Grade Point Average
4. CPO	- Chief Petty Officer
5. DGM	- Deputy General Manager
6. DGS	- Director General of Shipping
7. DME	- Diploma Mechanical Engineers
8. EIT	- Engineer in Training
9. GME	- Graduate Mechanical Engineers
10.IE	- Institute of Engineers
11.IMARE	- Institute of Marine Engineers
12.IMARest	- Institute of Marine and Structural Engineers
13.IMO	- International Maritime Organization
14.JCO	- Junior Commissioner Officer keeping
15.LTP	- Lecture Tutorial Practical Management.
16.MEIT	- Marine Engineer in Training
17.MERI	- Marine Engineering & Research Institute
18.MET	- Marine Engineering Training
19.META	- Marine Education Training and Assessment
20.MI	- Maritime Institutions
21.MOS	- Ministry of Shipping
22.NCC	- National Cadets corps
23.NSS	- National Scouts Services
24.PGDMOM	- Post Graduate Diploma in Maritime Operations and Management
25.PRO	- Public Relation Officer
26.QIPRG	- Quality Incentive Programme
27.SNAME	- Society of Naval Architecture and Marine Engineers
28.STCW	- Standards of Training Certification and watch
29.TAR	- Training and Record book

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## 1. EXECUTIVE SUMMARY

These guidelines are a model reference for use by all institutions engaged in Maritime Training . Maritime Training, as an academic field, encompasses two broad areas: (1) acquisition, deployment, and management of Maritime Training resources and services (the Maritime Training function); and (2) development and evolution of technology infrastructures and systems for use in organizational processes (systems development). This guideline provides the background material that leads to new and revised set of references. It includes a mapping from the course structure of MET to the newer methodologies in ministering and mentorship set. It also includes a detailed set of course descriptions and advice to the intended users of the guideline who have a stake in the achievement of quality MET programs. The model guideline is based on common structures and training programs worldwide. Assumptions about student backgrounds and training programs may not be applicable universally in other countries. The model, however, is grounded in a fundamental body of “ **Maritime Training understanding and knowledge**”. It can, therefore, be employed as a reference model for international use. The curriculum represents a reasonable consensus of the MET community. Principally it is divided into *Six* parts.

- PART - A :** States the objective philosophy of constituting guidelines.
- PART - B :** States the assumptions made and basic of formulation of Guidelines
- PART – C :** States the applicable sections of equipment, academic tests etc.
- PART – D :** States the norms for infrastructure
- PART - E :** States the norms for Post sea training courses
- PART – F :** States the guidelines for continued learning and bench marking for a rating system.

These guidelines must be read in conjunction with the general guidelines contained in DGS Order No. 1 of 2003 and any amendments therein.

## 2. **OBJECTIVES**

- 2.1 Identify areas in various disciplines with respect to Maritime training needs with national and global priorities.
- 2.2 Support of new ideas and innovations in technology and practices with the purpose to implement them so as to produce good watch keeping Engineers.
- 2.3 Support institutions, scholars and trainers , to develop specialized training objectives at various levels in emerging areas and accommodate new ideas and innovative methods to influence teaching, training, academic excellence, competency with relevance to overall development.
- 2.4 Consider steps to encourage, promote and make use of the excellent ideas for promoting scientific and technological applications for the benefit of the Maritime Industry.
- 2.5 Assist user departments / organisations / agencies / industries who may actively participate and take benefit of the course or programme and trained manpower and also sponsor students for the course.
- 2.6 Nurture and strengthen such courses in emerging areas in the Maritime field so as to introduce it as a specialized paper at various level.
- 2.7 Provide support for the above purposes in bringing innovation in various disciplines and excellence in emerging areas.
- 2.8 Identify new and emerging areas and specialised or interdisciplinary courses at the Pre sea and Post sea levels by the involved institutions, Maritime Industry which can have the involvement of active social scientists, technologists, industrialists and academicians, for the general benefit of trainees.
- 2.9 Finalise the policies, strategies and decisions for their induction under the approval programme as well as the required reviews, within the periphery of technical support.
- 2.10 Suggest modification and improvement in guidelines and modifications in emerging areas, keeping in view the national, global perspective from time to time for the training programme.
- 2.11 Receive from time to time status report and suggest corrective steps .

### 3. TERMS OF REFERENCE

- 3.1. The training curriculum and methodology must be in accordance with the requirements laid down in model course 7.04 of IMO in general.
- 3.2. The *education and* training curriculum and methodology of all Pre sea Institutions conducting training in the MERI pattern *are required to be conforming closely to the* Syllabus for Degree Course in Marine Engineering of MERI ( *As* approved by Fet, Jadavpur University, Resolution No. 12 of its meeting held on 8<sup>th</sup> March ,2002) and amended from time to time.
- 3.3 The training curriculum and methodology of ATS Courses and workshop based Marine Engineering diploma courses (10+2 entry) , must be in accordance with the requirements laid down in META Manual 1 & 2.
- 3.4 The training curriculum and methodology of graduates / diploma's from disciplines approved by the DGS .
- 3.5 The *education and* training curriculum and methodology of graduate *in* Mechanical Engineers , Electrical Engineers, *Naval Architecture* must be in accordance with requirements laid down in META Manual 1 & 2.
- 3.6 *The education and training curriculum and methodology of pre sea courses conducted for Electrical Engineering and Electrical & Electronics Engineering must be in accordance with requirements laid down in META Manual 1&2.*
- 3.7 *The education and training curriculum and methodology of pre sea courses conducted for Diploma holders in Mechanical Engineering and Shipbuilding Engineering must be in accordance with requirements laid down in META Manual 1 & 2.*
- 3.8 *All training imparted must be supported by TAR books.*
- 3.9 All training imparted are subject to revision of rules , modification of standing orders , circulars , instructions and notices issued by the Directorate, *AICTE and concerned Universities* from time to time . However, the guidelines issued by DGS shall be overriding over other guidelines.
- 3.5. All training in pre sea phase imparted must be supported by TAR books including 6 months ERWO in the Post sea phase.
- 3.6. All mandatory Post sea short courses are in accordance with IMO model courses.

#### 4. SCOPE OF REQUIREMENTS

- 4.1 Most essential and critical requirements of staff, laboratory equipments , workshop etc., required for starting and running the training course/innovative programme.
- 4.2 Optimum time required to implement the *education & training* programme
- 4.3 The workshop / organisation / industry where the course / training project will be undertaken has agreed to provide the required infrastructure facilities for the students
- 4.4 Mention *of* innovative and creative part of the training (Highlight innovation or creative quality to be brought in ) *by continual improvement of trainers / teachers through Q.I.programme and feed back from stake holders on one hand and creating new avenues in the other..*
- 4.5 Whether the training is meeting National and Global requirements in hi-tech, emerging, thrust areas or it is a proposal to solve some issues or problems of national priority or thrust?
- 4.6 How it is going to influence core competence ?  
What is the percentage of the possibility or success of this training proposal / guideline.
- 4.9 To provide specific item-wise details for Capital equipment and consumables. The list of the equipments priority wise needs to be provided. The infrastructure/facilities created, if any, may be kept in view.

## PART – A

( *Objective philosophy of constituting guidelines* )

### **A1. ADMINISTRATION AND APPROVAL**

**SCOPE :** These *guidelines* shall stipulate requirements for approved Maritime Engineering Colleges and Marine Workshops offering training and education leading to issuance of certificate of competency. The objective is to ensure:

- that maritime education and training is properly designed,
- *that it* contains clear objectives as to results of the training,
- *that maritime education and training* is carried out by qualified instructors/assessors and is evaluated, assessed with experience under rule requirements of the D. G. Shipping.
- *that* all maritime training activities are to be under an accredited quality system.
- *that all such activities* are continuously improved in accordance with evolving standards and market demands.
- *all* maritime training duties should be involved in a comparative rating system leading to the accreditation .

All such institutions, which train marine engineers under the 4 yrs core course scheme, ATS scheme, diploma scheme, graduates engineer scheme will henceforth be referred to as Maritime Institutions ( MI ). This excludes institutions doing modular courses up-gradation and preparatory courses.

### **A2. MOTIVATION FOR THE GUIDELINES**

Since the last revision of the training guidelines, three major factors have spurred the need to reexamine and update the existing standards. These were the advent of the Internet, the changes in student computing literacy, and the technical performance based accreditation movement. This section reviews each of these motivating factors.

**A.2.1 Web based learning :** As stated earlier discussed previously, much of the work in developing MET occurred prior to 1995. During the writing of MET guidelines the utility of Web based learning was not yet foreseen, with limited references to technological oriented programming concepts, applications, and other relevant content. Although it was known, that the impact of these then novel concepts could be large, it was at that time unrealized. In the intervening years, the Web base learning has grown to become a major aspect of all MET environments worldwide.

**A.2.2 Emerging Areas :** Introduction of subjects and teaching in emerging areas should be encouraged. There should be continuous effort to explore new areas and enough thrust should be given to develop these new areas. Possibility of introduction of these programmes in the form of appropriate electives to start with, might also be explored as this would help in creating a minimum of necessary infrastructure.

**A.2.3 Changes in Student Computing Literacy :** Over the past decade, there has been a significant change in the basic computer literacy of incoming MET apprentices. In the past, very few students entered a MET program having significant skills in using a desktop computer, with even fewer students owning or having easy access to a computer. Today, with the advent of the Web based learning most students entering a MET program have at least a modest level of computer literacy.

**A.2.4 Technology Performance based Accreditation Movement :** There is a remarkable change in the concepts of ship operations, machinery maintenance and repair safety and pollution awakener and tribology in general. Continuous monitoring of ship and machinery parameters as well as performance of personnel quality of performance of men and machines is a key factor.

There has been interest in the accreditation of programs in MET Systems, or at least a rating system for Institutions which has long been in use in other industries. The work on MET with its support from the major Maritime professional institutes provided a catalyst for MET accreditation. With the support of various stakeholders and rating bodies, the Criteria for the Accreditation of Programs in MET Systems are being developed, serving as the basis of the MET criteria.

The motivations for this compilation include the explosive growth of E-based learning, the increased computing literacy of entering students and the performance based accreditation movement. Several characteristics of the MET profession have been relatively constant over time and have been integrated into the training programme . These are:

- MET professionals must have a broad techno managerial and real world perspective.
- MET professionals must have strong analytical and critical thinking skills.
- MET professionals must have interpersonal communication and team skills and have strong ethical principles.
- MET professionals must design and implement innovative technology solutions that enhance organizational performance.

The curriculum assumes that students have prerequisite knowledge in academic basics commonly used in organizational work or that remedial modules will provide these skills. The MET available to students can be organized programmatically in three levels in the Pre-sea phase.

- General training in basic workshop technology suitable for all apprentices regardless of their background **(Level –1)**
- Specialized workshop technology and application designed modules for practice work all levels in Marine Engineering Trainings . **(Level – 2)**
- Specialized application, deployment, and work management training for competency on capacity building officers in Marine Engineering. **(Level – 3)**

The MET curriculum is designed to produce a proficient mariner, equipped to function in entry level Marine Engineering positions with a strong basis for continued career growth. The training reflects input from both industry and Academic Institutions. It responds to industry requests for both increased emphasis in technical orientation and improved skill in individual and group interactions. The training requires an embedded problem solving and critical thinking framework in all courses. The exit characteristics of MET students are defined in the guideline . The curriculum has formal MET courses but also assumes use of prerequisite or co-requisite courses in communications, environmental , Pollution , Safety managerial functions. The communications prerequisite aspects should provide students with listening skills and the knowledge to be effective in written and oral communication. The theoretical prerequisites provides basic quantitative and qualitative techniques. The Management pre-requisites covers common operative functions, operative economics, and international implications.

The architecture of the MET curriculum in its totality consists of five curriculum presentation areas:

- Marine Engineering fundamentals;
- Marine Engineering theory and practice;
- Marine Engineering technology;
- Marine Engineering systems development; and
- Marine Engineering systems deployment and management processes.

### **A3. PRINCIPLES GUIDING THE DESIGN OF THE TRAINING COMPONENT OF THE CURRICULUM**

The key principles that guided this effort were as follows:

- A.3.1. The model training aspect of the curriculum should represent a consensus from the Marine community.
- A.3.2. The guideline should be designed to help MET faculty produce competent and confident entry level mariners well suited to work-place responsibilities.
- A.3.3. The guideline should guide but not prescribe. Using the guidelines, faculty can design their own courses.
- A.3.4. The guidelines should be based on sound functional and educational methodologies and make appropriate recommendations for consideration by MET faculty.
- A.3.5. The guidelines should be flexible and adaptable to most MET programs.

#### **A4. GUIDING ASSUMPTIONS ABOUT TRAINING IN THE MARINE ENGINEERING PROFESSION**

In conceptualizing the role of information systems in the future and the requirements for MET curricula, several elements remain important and characteristic of the discipline. These characteristics evolve around four major areas of the MET profession and therefore must be integrated into any MET curriculum:

A.4.1. MET professionals must have a broad technological base and real world operational perspective. Students must therefore understand that:

- MET professional are integral to any successful performance in organizations
- MET professionals span and integrate all organizational levels and maritime functions
- MET professionals are increasingly of strategic significance because of the scope of the maritime organizational systems involved and the role systems play in enabling national and international operational strategy.

A.4.2. MET professionals must have strong analytical and critical thinking skills. They must therefore:

- Be problem solvers and critical thinkers
- Use systems concepts for understanding and framing problems
- Be capable of applying both traditional and new concepts and skills
- Understand that a system consists of people, procedures, hardware, software, and data

A.4.3. MET professionals must exhibit strong ethical principles and have good interpersonal communication and team skills. They must understand that:

- MET requires the application of professional codes of conduct
- MET requires collaboration as well as successful individual effort
- MET operational and management demand excellent communication skills (oral, written, and listening)
- MET requires persistence, curiosity, creativity, risk taking, and a tolerance of these abilities in others

A.4.4. MET professionals must learn to and implement Marine Engineering Technology solutions that enhance organizational performance. They must therefore:

- Possess skills in understanding and formulating instructional processes and information, defining and implementing technical and process solutions, managing operations, technical information and integrating systems
- Be fluent in techniques for acquiring, converting, transmitting, and storing and its understanding
- Focus on the application of Marine Engineering Technology in helping individuals, groups, and organizations achieve their goals

## **A5. GUIDELINES FOR ACCEPTABLE EXPERIENCE FOR ENGINEERS IN TRAINING**

The DGS is charged with the responsibility of regulating the Pre sea and Post sea MET within the country . The duties of the DGS with respect to the safeguarding of the public are clearly defined within the legislation embodied within the M. S. Act. Similarly, the responsibilities of the individual engineer to the public, the employer, and fellow engineers are embodied within the framework of the code of professional conduct, contained within the provisions of the Act, the META MANUALS and the STCW code . These documents together serve to define the Practice of Marine Engineering. The Engineer-in-Training is strongly advised to obtain a copy of these documents for review.

The Practice of Engineering involves a requirement for ongoing experience to enhance one's competence in the field of practice. It is the responsibility of each individual Engineer to judge when his or her competence is appropriate for a particular engineering activity and when it is necessary to refer to someone with more relative expertise. This is the essence of a self-regulated profession.

It is therefore very important that the minimum period of experience for an Engineer-in-Training (EIT) involve not only the application of appropriate technical knowledge, but also exposure to the kind of activity that will achieve the necessary level of judgment regarding personal competence.

It has been deemed that this level of judgment can only be properly achieved through direct association with one or more of one's peers in the profession.

For this reason, the Directorate General of Shipping , through the META manuals has decided to publish and distribute a set of guidelines pertaining to the type and depth of experience deemed desirable for Marine Engineers-in-Training (MEIT's) to acquire during their period of apprenticeship. This document is therefore directed at three primary audiences:

- the Engineer-in-Training;
- the sponsoring engineer who certifies the MEIT's experience.
- the employer of the Engineer-in-Training or the trainee
- the META manuals are intended as a guideline to promote consistency in the interpretation of the experience requirements for entry to the Marine engineering profession.

The META manuals address four primary aspects :

1. Describes the rationale for the basics of eligibility.
2. Provides guidelines in some depth for the scope and breadth of experience that the DGS recommends for MEIT's.
3. Describes the procedure required of an MEIT to become registered as a candidate for certifications.

4. the Role of the Chief Examiner of Engineers Committee, provides an overview of the function of this committee, especially as it relates to the certification of engineering experience.

These guidelines go into areas of training and code for institutions and trainees not addressed in the META manuals.

#### **A6. PRE- AND CO - REQUISITES TO A MARINE ENGINEERING TRAINING PROGRAMME**

There are general academic requirements that should be met prior to formal MET courses (prerequisites) or concurrent with MET courses (co-requisites).

- Apprentices are expected, as a prerequisite, to have a basic knowledge in the fundamental tools of basic skills and individual working tools.
- All MET apprentices should be able to communicate effectively *in english* both orally and in writing.
- They should be able to apply both quantitative and qualitative data analysis techniques.
- MET apprentices should have acquired strong interpersonal skills.
- They should have a basic understanding of the main functional areas of an organization and should have been exposed to concepts of contemporary marine technology . Some of the topics should be prerequisites but others may be interleaved with MET courses.

Prerequisite or interleaved topics directly applicable to the MET curriculum therefore include:

- Communication. This should cover general and technical writing, oral communications, presentations, and listening skills.
- Quantitative and qualitative analysis. This includes such topics as some basic discrete mathematics, introduction to introductory statistics, and archival document analysis.
- Functional and operational areas of an organization. Students should be exposed to the principles of operational economics and functional areas of the organization.

Finally, as a basis for lifetime learning, students should also have a solid foundation in behavioral, social, and natural sciences.

The co-requisites for a marine engineering trainers are inputs in keeping with the professional growth of the trainee.

- Needs to know what is technology in current state in enusaged
- Needs to know human factors involved in technology development
- Needs to know the interfacing of technology and human

To assist him in doing that, it would be *obligatory* for him to be a member (Trainees) of the Institute of Marine Engineers (India) and participates in their technical activities to ensure professionals *ism* in their outlook.

## PART – B

*(Assumptions made basic formulation of Guidelines)*

### **B1. ESSENTIAL OF COREQUISITES FOR TRAINEES**

#### **B.1.1 Introduction**

This guideline is aimed at graduates and diplomas holders in the Marine , Mechanical , Naval Architecture / *Ship building* or *Electrical* or Engineering Disciplines who have just received their degree or diploma from a University, Technical/Vocational College, and who wish to pursue a career in marine engineering.

These newly qualified graduates and *diploma holders* need to be guided on what they should do now that they have completed the second phase of their education and are qualified. This is a stage where they are not finished yet with their education, nor are they professionally qualified. The redeeming feature it that they are about to embark on a most rewarding career in the most diversified discipline in engineering – marine engineering.

They hear that they must 'register with IMarE' and "join their Institute" but are confused about what these organization do and why it is necessary to join them. They also need ongoing guidance once they have joined, so that they can take their rightful place in industry. The institute of Marine *Engineers(I)* works closely with the Chief Examiner of ~~the~~ Engineers in the Directorate General of Shipping, in assessing the needs of *the* profession and then give feedback on the professional development of these mariners.

The Directorate General of Shipping is a statutory body. Amongst its many functions, it accredits academic standards and sets training and professional development standards for registered institutions. Its primary function is to protect the public interests particularly in training certification and competency, by ensuring that minimum standards are maintained by registered professionals. As a vehicle for professional development and assimilating knowledge and contemporary technology, association with a professional institute like the ImarE is necessary.

The reasons for registering with the IMarE are as follows

The benefits to the individual are:

- Peer recognition of qualification and experience
- Marketability in employment sectors
- International recognition
- Statutory empowerment
- Accesses to latest developments

The benefits to employers and the profession are:

- Confidence in the professional competence of the individual
- Marketability and hence growth of organization
- Compliance with statutory requirements
- Safety, health and environmental awareness in the interests of public protection

To satisfy these concerns and expectations, the engineering fraternity recommends that these academically qualified individuals should register with IMarE as "Trainees" in the appropriate category and locate an experienced engineer, technologist or technician who can advise, support and guide them through the first few years of their working life. This will ensure that they are properly trained and registered for their chosen career. Only after a minimum period of well-defined training and development, can one apply for registration with IMarE as a professional person - this is when the mariner becomes recognized as professionally qualified. Their ongoing education training and professional development is then left to the individual, although the profession encourages members to maintain contact with their advisors and to widen their field of contacts.

An advisor such as this is generally called a "**Mentor**" (**The Guru**). The word Mentor stems from Latin and can be defined as "one who acts as a wise and faithful guide, advisor and monitor, especially of younger persons".

This guideline will explain mentorship in brief by answering the sort of questions that the Trainee is likely to ask,

### **B.1. 2 When is a mentor required?**

When a person has academically qualified from University, or Technical/Vocational College and has a degree or diploma, that person still needs '**on the job**' experience and further training before they can be considered as a fully competent professional. This training period lasts for three to four years after graduation and during that time the services of a Mentor are required to assist and monitor the Trainee.

A person who has been *practising his / her* profession for several years is deemed to have had sufficient exposure to most activities within their discipline including associated practical experience, that they may apply for direct full registration with IMarE, i.e. they should not require a "Mentor". This should generally apply to experienced professionals of the navy. Sea going engine driver fishing vessel engine driver and others categories changing over to the 'NCV' grade

### **B.1.3 Who is a trainee?**

During this three to four year period after academic through puts, the graduate or diplomats *diploma holder* is referred to as a "Trainee" in the engineering discipline which covers four different categories :

- Engineer in Training (Graduate marine, Mechanical, Electrical, Naval Architecture)
- Engineering Technologist in Training (ATS, 10+2, Workshop)
- Certificated Engineer in Training (Naval personnel, SGED, FVED, Diploma holder etc.)
- Engineering Technician in Training (vocational courses, ITI)

These categories would be very clearly and carefully defined by IMarE. In this document we will simply refer to a "Trainee", i.e. covering any of the above four categories. The Training institution has to register a Commitment and Undertaking (CU) with IMarE in which they undertake to train their trainees in accordance with IMarE. This principally involves the appointment and formal recognition of a Mentor, who must also be a registered person with IMarE. IMarE will then issue the training institution with a Certificate of Registration for (CR) the specific type of training. This certificate will have a registration number which must be stated in all associated correspondence with IMarE including the Trainees registration application and application for all examinations thereafter.

#### **B.1.4. How is a mentor found?**

The Institute of Marine Engineer (IMarE) will assist a Trainee to find a suitable Mentor for their geographic area, should one not be available within the Trainee's own organisation.:

The IMarE will in the first instance provide an application form that the Trainee must complete and return. Alternatively, the form can be filled in **on-line**. This form "**Application for a Mentor**" is simply to obtain full details of the Trainee and the type of training that needs to be provided. If possible a Mentor should be from the same organisation and geographic area as the Trainee but this is not essential.

The selected Mentor will be provided with **Guideline for Mentors**. This document instructs the Mentor on how to approach the important task of mentoring and sets out answers to the sort of questions which Trainees usually ask. The Mentor, for reference purposes, usually gives a copy of the **mentors' guide** to the Trainee.

#### **B.1.5. What are the duties of a mentor?**

A Mentor is generally required to provide the following specific advice, guidance and support:

- Guidance on career planning and professional development
- Advice on training opportunities
- Advice on suitable training programmes
- Guidance on performance and quality of work
- Guidance on networking within the profession
- Guidance in applying for membership of professional bodies

- Guidance on applying for registration with ImarE (membership)
- Advice on new challenges/new technologies
- Support for achieving aspirations
- Guidance on further study
- Guidance on professional ethics

*A mentor is not necessarily the person who 'trains' the Trainee, he is normally the Trainees supervisor or a senior discipline colleague within the training institution.*

### **B.1.6 What are the benefits of mentorship?**

The benefits of mentorship are that at the conclusion of the training period, the Trainee has a number of valuable attributes. The Trainee becomes :

- An appropriately trained and developed professional who can take responsibility for a wide range of engineering activities which they are competent to perform
- A well integrated professional who can contribute meaningfully to the profession and the good name of their employer
- Appropriately trained and developed to ensure full fledged membership registration with IMarE within the minimum period on first application
- A professional who can ensure economic benefit to themselves, who can assist in the growth of their company and who may have acquired the attributes for promotion
- A professional who can contribute to the continuing mentorship of others in due course
- A professional who renders a safe and reliable service to the profession and the community with integrity and who adheres to the profession's code of conduct A person who is likely to earn Peer recognition and develop their own skills

### **B.1.7. What does mentorship cost?**

Mentorship is a service that the DGS expects ImarE and its members to provide in the course of their duties in the organisation, which should be available at no charge. It is a “**Guru Shishya Parampara**” and no costs can be affixed. It is desirable that the trainee continues to claim higher levels of membership from the ImarE during the professional career.

### **B.1.8. What is the difference between DGS and ImarE ?**

DGS is a statutory body linking the requirements of government, as promulgated in The MS Act , as amended from time to time with that of the marine engineering profession and the built maritime environment.

The IMarE is a professional body registered under the Charitable Trust Act which provides specific discipline and industry related support services to its members, while also acting as an independent authority and spokesbody for our profession / DGS

recognizes the important role played by institutions such as the IMarE and Institute of engineers ( Marine div) and expects them to consistently improve, the qualitative characteristics of the marine engineering professional towards continued global acceptability and recognitions.

**B2. EXIT CHARACTERISTICS OF MARINE ENGINEERING TRAINEES**

The product of a MET program should be equipped to function in an entry level position and should have a basis for continued career. **Table 1** presents a high-level categorization of the exit characteristics that emphasizes the central role of Technology-Enabled architecture Development. **Table 2** Provides the main architecture as well as the concrete, practical representative examples of the exit characteristics in each subcategory. The overarching objective for MET professionals is to enable them to utilize their skills learnt, technical knowledge and , understanding of advanced operational practices and communications and related information technology to achieve their strategic objectives with an eye towards achieving national and personnel goals.

**B3. HIGH-LEVEL CATEGORIZATION ARCHITECTURE OF MET PRODUCT EXIT CHARACTERISTICS**

**TABLE – 1**

**Representative Capabilities and Knowledge Expected for MET Program Products.**

ANALYTICAL AND CRITICAL THINKING		
Organizational problems	Ethics and Professionalism	Creativity
<ul style="list-style-type: none"> <li>▪ Problem solving models, techniques, and approaches,</li> <li>▪ Personal decision making,</li> <li>▪ Critical thinking,</li> <li>▪ Methods to collect, summarize, and interpret data</li> <li>▪ Statistical and mathematical methods</li> </ul>	<ul style="list-style-type: none"> <li>▪ Codes of conduct-Ethical theory</li> <li>▪ Leadership - Legal and regulatory standards</li> <li>▪ Professionalism - self directed, leadership, time management</li> <li>▪ commitment to and completion of work</li> </ul>	<ul style="list-style-type: none"> <li>▪ Creativity concepts</li> <li>▪ Creativity techniques</li> <li>▪ The systems approach</li> </ul>
OPERATIONAL FUNDAMENTALS		
Operational Problems	Functional Areas	Evaluation of operational Performance
<ul style="list-style-type: none"> <li>▪ Contemporary and emerging operational models</li> <li>▪ Organizational theory, structure, and functions</li> <li>▪ System concepts and theories</li> </ul>	<ul style="list-style-type: none"> <li>▪ Human Resources</li> <li>▪ Logistics and Manufacturing</li> <li>▪ Repair and Maintenance safety</li> <li>▪ Tribology, innovative methods.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Benchmarking</li> <li>▪ Value chain and value network analysis</li> <li>▪ Quality, effectiveness, and efficiency</li> <li>▪ Valuation of</li> </ul>

		operational activities	
		<ul style="list-style-type: none"> <li>▪ Evaluation of Technical performance.</li> </ul>	
<b>INTERPERSONAL, COMMUNICATION, AND TEAM SKILLS</b>			
<b>Interpersonal</b>	<b>Team Work and Leadership</b>	<b>Communication</b>	
<ul style="list-style-type: none"> <li>▪ Listening,</li> <li>▪ Encouraging</li> <li>▪ Motivating,</li> <li>▪ Operating in global,</li> <li>▪ culturally diverse environment</li> </ul>	<ul style="list-style-type: none"> <li>▪ Building a team</li> <li>▪ Trusting and empowering</li> <li>▪ Encouraging</li> <li>▪ Developing and communicating a vision / mission</li> <li>▪ Setting and tracking team goals</li> <li>▪ Negotiating and facilitating</li> <li>▪ Team decision making</li> <li>▪ Operating in a virtual team environment</li> <li>▪ Being an effective leader</li> </ul>	<ul style="list-style-type: none"> <li>▪ Listening , observing, interviewing , and</li> <li>▪ Documenting</li> <li>▪ Abstraction and summary writing</li> <li>▪ Developing multimedia content</li> <li>▪ Writing institutions , reports and documentation</li> <li>▪ Giving effective presentations</li> <li>▪ Communicating with subordinate</li> </ul>	
<b>TECHNOLOGY</b>			
<b>Application Development</b>	<b>Systems Architecture and Development</b>	<b>Database Design and Administration Integration</b>	<b>Systems Infrastructure and Integration Implementation</b>
<ul style="list-style-type: none"> <li>▪ Marine Power Systems- Pneumatics , hydraulics electrical , electro pneumatic, electro hydraulic, electro mechanical</li> </ul>	Modifications Reengineering, conversions	<ul style="list-style-type: none"> <li>▪ Safety input,</li> <li>▪ Research input,</li> <li>▪ Operational input,</li> <li>▪ Risk, Liabilities,</li> <li>▪ Limits, endurance etc.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Logistics,</li> <li>▪ Inter disciplinary technical links,</li> <li>▪ Quality obligations, and</li> <li>▪ Requirements.</li> </ul>

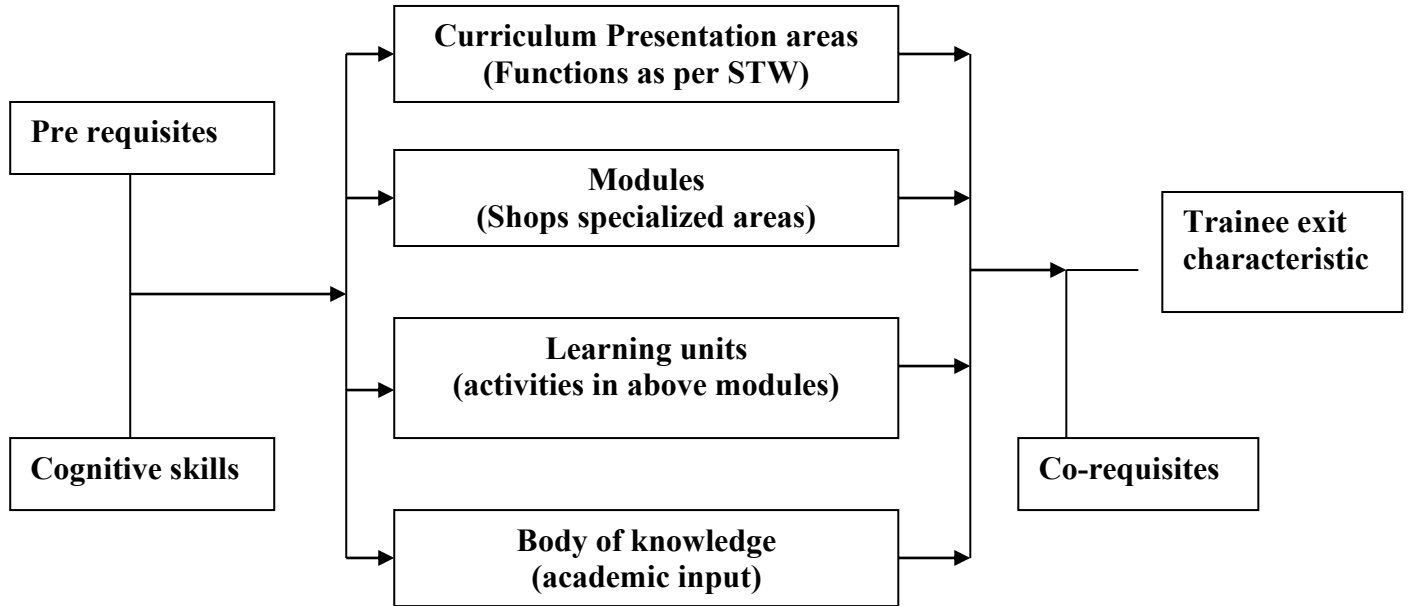
#### **B4. ARCHITECTURE OF THE MARINE ENGINEERING TRAINING PROGRAMME**

The MET 2003 guideline is organized as a set of curriculum presentation areas. Each of these areas has one or more module . Each course should be built from learning units. The, Guidelines focuses on presentation goals that blend elements of the MET total body of

knowledge and understanding and the level of proficiency achieved . Learning unit objectives provide a mechanism to assess student performance.

Each of the elements will be expanded later in **The Annexes** given starting with the curriculum presentation areas.

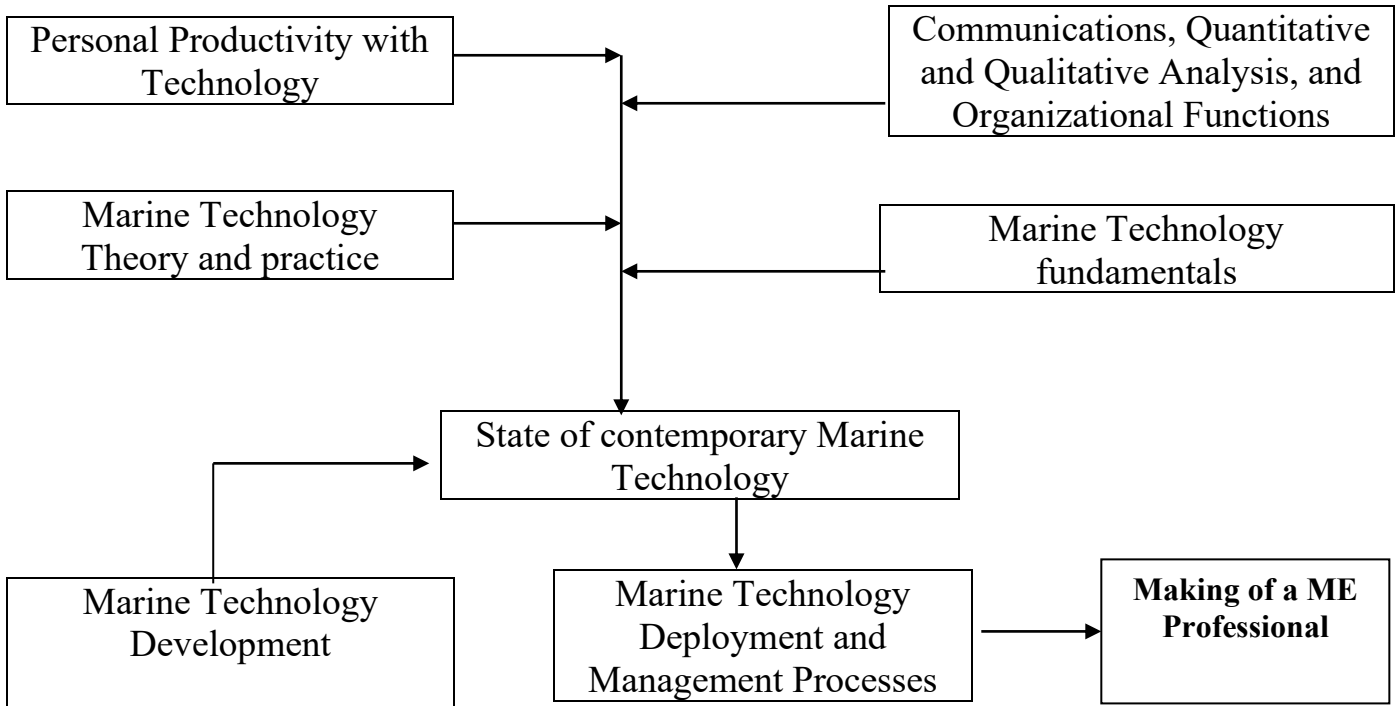
TABLE - 2



**B5. CURRICULUM PRESENTATION AREAS**

A view of the curriculum depicting the MET curriculum presentation areas is given in Table 3 . The box on the left shows the prerequisite knowledge to the presentation areas whereas the box on the right highlights the part of the program taught by faculty in other functional areas or other academic units. The other four boxes show the part of the program generally taught by the MET faculty. The figure also depicts the general sequence in which the material is acquired by students in the MET program. A description of the content for the five areas is presented in Table

**TABLE - 3**



A learning unit as is prescribed in the TAR books describes a set of material to be learned by the trainees. A module is a group of learning units in a particular speciality. Each learning unit is stated in terms of a goal, a set of objectives, and elements of the MET body of knowledge along with competency or depth of knowledge levels. This is illustrated later in the Annexes.

The material to be covered by a learning unit is expressed in a presentation goal. The learning unit is designed to combine elements from the MET body of knowledge. Competency levels are specified for each included element from the body of knowledge. A sequence of behavioral objectives is provided within each learning unit. These objectives are written to describe a specific competency level. The objectives form the basis for assessment of trainees accomplishment.

Learning units : Each learning unit is specified by a goal statement that explains the purpose of the learning unit. For example, a learning unit goal might be “to operate a centrifugal pump.” The learning unit goal statement is elaborated by one or more learning unit objectives. These are stated as behavioral objectives defining what a trainee student should be able to do after learning the material in the unit. The trainee should be able to explain, discuss, use, apply, and demonstrate central concepts. For example, a behavioral objective for a learning unit might be “apply system functions to analyze use and performance characteristics for a centrifugal pump”. This is very well illustrated in IMO model course 7.04 and **Meta Manuals 1 & 2**

The learning objectives can be used by faculty to assess student achievement relative to the learning unit or by students in evaluating their knowledge.

Each learning unit has a set of topics that define the coverage for the unit. These topics consist of elements from the MET body of knowledge. The depth of coverage for each topic in a learning unit is specified by a depth of knowledge level ranging from 1 to 3 (with 3 being the highest competency level specified for an undergraduate program). A topic may be covered at a low depth of knowledge level as part of an introductory course and in more depth (higher competency) in a subsequent course.

The learning units provide the basis for detailed course design. The objective is to present elements of the MET body of knowledge to willing learners through pedagogical techniques associated with desired levels of learning. The pedagogy differs for desired depth of knowledge levels. A low level of competency may be achieved with lectures and exercises; the highest level of knowledge is achieved by active learning techniques such as projects.

**Body of Knowledge :** The MET body of knowledge consists of the topics to be taught at some level of competency in an MET curriculum. The body of knowledge was derived from surveys of practitioners and academics and mapping of relevant topics from curricula for MERI and other MET related disciplines.

The elements or topics in the MET body of knowledge form the lowest level building blocks for the curriculum. The elements, with desired competency levels, are grouped under learning units and learning units are grouped into courses.

## **B6. RESOURCES FOR MARINE ENGINEERING TRAINING PROGRAMME**

A capable faculty is the first required resource. In addition, workshops, laboratory, classroom, and library resources are essential elements for a successful training program. In a rapidly changing technical environment, trainees should be exposed to a variety of up-to-date equipments and tools that adequately represent the professional setting in which they will be employed.

**B.6.1 Faculty Requirements :** Faculty members are vital to the strength of an Information Systems program. Its faculty needs both academic training and practical experience. There must be enough faculty to provide course offerings that allow the students to complete the training in a timely manner. The interests and qualifications of the faculty must be sufficient not only to impart the training but also to plan and modify the courses and curriculum.

- Faculty members must remain current in the discipline. Professional development and scholarly activities are a joint obligation of the institution and the individual faculty member.
- The training institutions should support continuing faculty development. Given the rapidly changing technology, it is particularly critical that faculty members have sufficient time for professional development and scholarly activities.
- Resources should be provided for faculty to regularly attend conferences, workshops, and seminars, and to participate in academic and professional

organizations. The program is enhanced significantly when faculty acquire practical experience in the profession through activities such as consulting, sabbatical leaves, and industry exchange programs.

- Faculty must also be equipped to develop teaching materials for their trainees. Faculty must have available technology at least equivalent to and compatible with that available to trainees so that they may prepare educational materials for use by trainees . In addition, faculty must be connected to the Internet in order to have access to trainees and to the larger academic and professional community. The number of full-time faculty needed by the program is influenced by such factors as the number of trainees in the program, the number of required courses, the number of service and elective courses offered, and the teaching and training load of the faculty. A program should have a minimum number of full-time faculty with primary commitment to the Marine Engineering Training program in order as per DGS Order No. 1 of 2003 to meet the teaching and training needs of the program and to provide depth and breadth of faculty expertise.
- The professional competence of the faculty should span a range of interests in Marine Engineering including Technical concepts, Marine Engineering concepts, Operational data management, Operational systems design and development, Operational systems integration, and Marine technology management and policy.
- Additional faculty will be needed to teach the service courses that provide foundation-level knowledge across the campus.
- All faculty should be member of some professional institutes such as IMarE , IE, IMARest, SNAME etc.

**B.6.2 Workshops Requirements** : Programs in Marine Engineering Training require equipment and other infrastructure for structured, open/public, and specialized workshops . Trainees must have an opportunity to use learning materials in both structured and unstructured workshops. All such facilities must have the approval of the DGS

Trainees should be provided opportunities to work together on team-oriented projects. The group skills developed in this mode are critical to a successful Marine systems professional. Technological support, is expected for group and team activities. All workshops must have adequate technical support in terms of professional staff to provide for installation and maintenance of the equipment. The staff should be proficient in both technological hardware and systems software applications. Complete documentation must also be available. Workshops should be able to support the following types of functions:

**B.6.2.1. Structured workshops** : ( Fitting shop, Machinshop, Blacksmith shop etc) A structured workshop is a closed, scheduled, supervised experience in which trainees complete specified exercises. An instructor who is qualified to provide necessary support and feedback to the trainees provides supervision. Exercises are designed to reinforce and complement the lecture material.

**B.6.2.2. Open Workshops** : (dry-docks, assembly yards, outfitting etc ) These are open facilities where the trainee must observe and learn by various means of assimilation, the activities that are going on . In this type of facility the trainee has direct contact with the job supervisor and the workers, for a one to one learning without much peer supervision

**B.6.2.3. Specialized Laboratories / Workshop** : (pneumatic lab., Hydraulics lab, strength of materials lab etc. ) Laboratory facilities are necessary to support team projects and special indepth knowledge of the basics of operative equipment. Special facilities may be needed for systems development, machinery support infrastructure, and other advanced technologies. Laboratory training should be given in (a) in house facility of the institute or (b) An Engineering college or polytechnic

**B.6.2.4. Afloat training** : (onboard ships, ships in campus ) This is a hands on training in real time environment , and must be done in small groups on board a sea going vessel which is in operation which is currently in port for commercial or repair activities. A ship in campus, with an operational engine from replicating an engine room of a modern sea going general cargo vessel is also a good afloat training facility.

**B.6.3. Classrooms** : Suitable classroom facilities, equipped with information technology teaching resources, should be provided. A computing system with multimedia facilities is necessary for demonstrating the development, implementation, and application of marine technology as well as conducting walkthroughs and making presentations. Classrooms could have access to the Internet and extranet networks, either with port per seat or wireless networking capabilities. Computer training must be given in house or at a recognized computer institutes.

**B.6.4. Library** : Library support is an important part of a training program. It is especially important for disciplines with rapid development of knowledge such as in the Marine Engineering field. Libraries should provide both traditional and digital access wherever possible to journals, proceedings, monographs, and reference books. The holdings should include access to digital journals and proceedings of the maritime professional societies. Such lists of books & journals useful for training could be obtained from ImarE , IMO and kept updated every quarter.

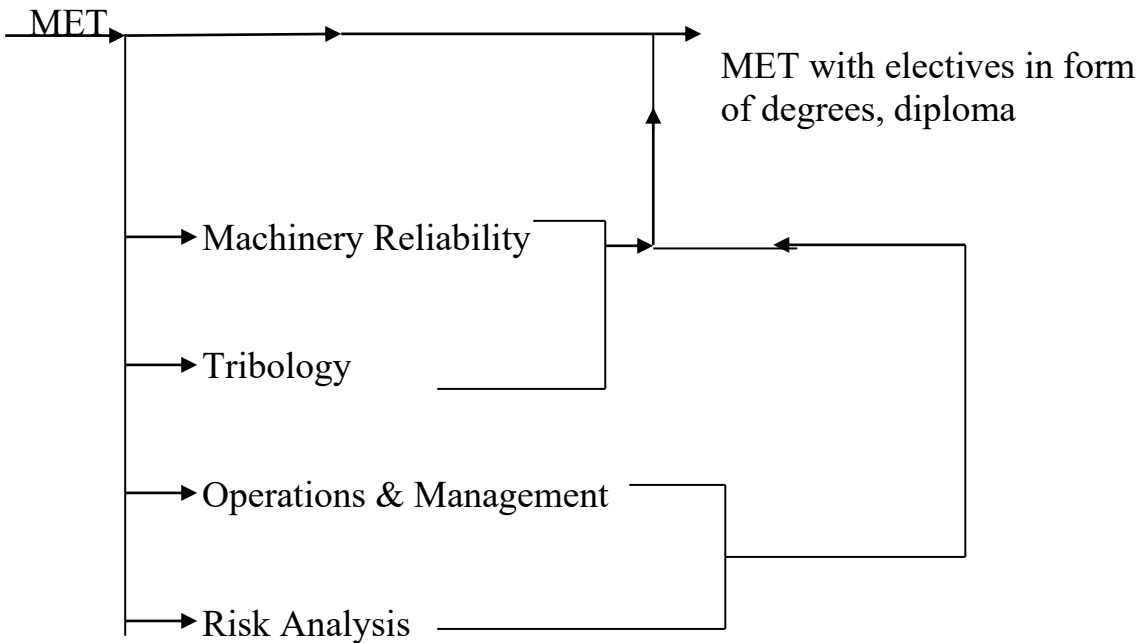
## **B7. SHARED COURSES WITH OTHER TRAINING DISCIPLINES**

### **(Simultaneously doing graduation , diplomas etc.)**

As explained earlier in the report, there is a close relationship between the academic fields of Marine Engineering training and other disciplines, and there are also very significant differences. The context for Marine Engineering Academic course is an organization and its systems. In contrast, the context for Marine technological training is a vocational processes for Marine Engineering and associated technical and technology issues. There are complementary strengths for these academic units in preparing graduates/ diploma for Marine Engineering work in organizations. A Marine Engineering academic unit is typically strong in preparing students for the organizational environment. This advantage

is especially strong when the Marine Engineering Training program is within or closely tied to organizational or professional studies. The challenge for an MET unit may be in maintaining adequate depth of instruction in some technology subjects. On the other hand, a Marine Engineering Academic program sometimes reverses the comparative position of an MET unit. It is typically strong in teaching technology and related algorithmic processes, but organizational, technical and operational functions and systems may not be an area of emphasis for them.

This high level perspective of complementary strengths suggests that there may be opportunities for courses taught by any marine technology institutions that also meets the needs of MET majors; similarly for courses taught by MET for students desiring more MET knowledge from other areas. It is also possible to conceptualize a common core for multiple programs, and in fact, such shared core courses are taught at a number of institutions. This guideline has not attempted a formal definition of such a course sequence because there is no fixed organizational model of the relationship between the varied programs to which such a definition could be addressed. If a common core sequence appears to be useful for an institution, a useful approach is for the institution to take the core requirements for MET as described in this guideline and, considering the local situation in terms of organization of academic units and distribution of strengths of faculty and workshops resources, to design a common core sequence. Some typical examples are given.



## **B8. MULTIUSE OF FACILITIES**

To make maximum use of available facilities (resources), sharing of resources among the institutions closely located should be encouraged. However such sharing must exclude basic facilities and include only specialized faculties which are exclusive to MET. Such as Drydocks, Shipyards, Diesel engine plants.

It goes without saying that similar facilities should not be duplicated within one institution by different departments. Facilities existing in one department should be freely available to another within the institution. Central facilities could be established for teaching/research/consultancy work. There should be a proper MOU with the facility providers to that effect .

It will be desirable to have a consortium-approach of having centralized laboratories of sophisticated instrumentation by mobilisation of funds from the group of departments / institutions and share those facilities. This scheme can be adopted where the institutions can form themselves as a group to, achieve both optimization of resources and also overall fiscal economy. Simulator facilities is one such area where multiuse can be encouraged. A central sophisticated and multiuse simulator facility, such as full mission Engine room simulator, Towing tank simulator, ship motion simulator should be as far as possible be of multiuse.

## **B9. INSTITUTIONAL PLANNING AND PERIODIC REVIEW**

In cooperation with the academic head / GM / Principal Dean or other appropriate administrative official, each MET department should participate at regular intervals in a process of periodic planning and evaluation. Participants in the process should include faculty, students, alumni, client departments, external MET reviewers, and deans or other administrators. The faculty and any external consultants directly involved in this review should adequately reflect both the program mission and the faculty of the MET program or department being reviewed. The process should lead to a strategic plan, acceptable to the department and to its head , for enhancing strengths and remedying deficiencies identified in the planning and evaluation process.

The major components of the planning and evaluation process should be :

- B.9.1. A statement that clearly defines the mission of the undergraduate MET department.
- B.9.2. A delineation of the educational goals of the program as well as a statement of how attainment of these goals is expected to fulfill the mission of the program.
- B.9.3. Procedures for measuring the extent to which the educational goals are being met. These measures will, of necessity, be multi-dimensional since no single statistic can adequately represent departmental performance with respect to most

departmental goals. Measures of trainees learning and other trainees outcomes should be included in the procedures.

B.9.4. A process for regularly reviewing (and revising, if necessary) departmental and academic program components in light of measurements of program success.

B.9.5. A departmental and institutional plan to allocate, over time, the resources needed to implement the strategic plan agreed to by the department and its dean.

## **B10. INDICATION OF PERFORMANCE**

The periodic reviews should examine all aspects of the department's training and academic program. Reviewers should consider the departmental mission and goals statements, faculty and staffing issues, the extent to which the department's curriculum is consistent with those statements and with the needs of the trainees being served, evidence that indicates the extent to which the department's service courses give trainees the background they need to take subsequent courses in other departments, evidence that indicates the extent to which the department's major program is successful in enabling trainees to meet the department's academics and training goals, the effectiveness of the department's advising practices, and the success of the department in recruiting and Curricul an quality and effectiveness should be judged in comparison with MET programs at peer departments such as MERI and in comparison with the most recent DGS recommendations on the MET curriculum. When related to the department's goals, further indicators of program quality may include

- Students performance in seminars,
- departmental comprehensive examinations,
- course-embedded assessment,
- undergraduate research activities,
- efficiency of workshop training programmes
- consulting experiences, and
- national competitions and examinations,
- actuarial examinations,
- Other indicators include trainee evaluations that are obtained through surveys and interviews.
- Reviewers should also consider the accomplishments of the trainees of the department's programs and, where appropriate, the number of MET trainees produced compared to peer departments and to national averages,
- the success of the 10+2 trainees who fair in proficiency exams ,
- the success of bachelor's degree recipients who fair in proficiency exams, and the employability of the department's trainees or bachelor's graduates.
- Reviewers should also address institutional and departmental resources, including physical facilities and library resources.

## **B11. PROGRAM FACULTY AND STAFFING**

### **B.11.1. Educational Background : (Academics)**

**B.11.1.1.** Except as indicated in item c below, those who are hired to teach theoretical sciences courses for undergraduate credit should have a minimum of a master's degree in a theoretical science subject . This applies to both full-time and part-time faculty wherever the institution's courses are taught.

**B.11.1.2.** Training Institutions frequently offer courses in several disciplines. Ideally, a course should be taught by a faculty member with a graduate degree equivalent in the discipline of the course. In the many departments where this is not possible, the course should have a developer/coordinator, who has a graduate degree equivalent in that discipline. The developer/coordinator should hold regular meetings with the faculty teaching the course in order to discuss such items as the course syllabus, textbooks, resources, teaching methods, technical matters, and evaluation. The department's curricular needs should be a major factor in departmental hiring decisions.

**B.11.1.3.** Since they are potential future faculty members of institutions , it is important that graduate trainees have some instruction in teaching including serving as apprentice teachers. Thus, even though they might not meet the requirements above, Marine Engineering graduate trainees may teach or assist with the teaching of courses under the close supervision of faculty members. A graduate trainee who has a master's degree or equivalent in any stream may be assigned as the independent instructor of record in a course. In addition, the graduate trainee should be provided with the same resources for teaching that are available to full-time faculty teaching in the same course, including office space, computer and library resources, and mentoring by full-time faculty. Other activities that are suitable for graduate teaching assistants include grading papers, staffing laboratories, conducting discussion or recitation sections, and tutoring.

**B.11.1.4.** If undergraduate trainees assist in undergraduate instruction, their efforts should be restricted to classroom organizational duties such as collecting papers; reading and commenting on homework assignments; tutoring or assisting in training, and laboratories, workshops, and recitation sections; and holding supplementary instruction sessions.

**B.11.1.5.** For subjects that are peculiar and specific to Marine Engineering such as Marine Diesel engines, Marine Boilers, Marine auxiliaries etc it is necessary that a Marine Engineers must deliver the subject / training.

### **B.11.2 FACULTY QUALIFICATIONS AND SELECTION PROCEDURE**

An engineering training division shall have the staff as given below:

1. Administrative In-charge and teaching faculty
2. Workshop Staff
3. Technical Supporting Staff

4. Library and Computer Centre Staff
5. Administrative Staff
6. Maintenance staff and other Miscellaneous staff.

The number of staff should be commensurate with the number of trainees and the number of batches being trained annually.

#### **B.11.2.1. Faculty Cadre**

The faculty should principally consist of the following categories:

#### **B.11.2.2 Permanent faculty**

- (a) Teaching (academic)
- (b) Training - skills, practical, competencies

#### **B.11.2.3. Visiting faculty**

- (a) Teaching (academic)
- (b) Training skills, practical, competencies

The classification used for academic staff are on lines of those practised in accordance with UGC and enduring norms of the marine industry that is

**Professor :** Phd/ M.Tech/ Extra First Class Engineer with 15 years of relevant experience / PGDMOM From IIT / KGP

**Asst. Professor :** B. Tech/ B.E. / Msc. / First Class Motor or Steam Certificates with 12 years of relevant experiences / PGDMOM From IIT . For IMO model courses Master Mariners with 15yrs relevant experience can be used as applicable .

**Lecturers :** First Class Motor with 7 years of relevant experience. For IMO model courses Master Mariners with 7 years of relevant experience can be used as applicable .

**Instructors :**

- a. Instructors should be trained and experienced mariners holding the superior certificate of appropriate grade of training being imparted but with specialized higher grade of training and experience in the field of training imparted.
- b. Instruction for basic fire fighting must have Class II COC or COS having undergone a specialized approved course in Advanced Fire Fighting training.

Certificates of service holders will be given appropriate classification solely at discretion of MI based on experience and capabilities. Radio Officer holding COP Class II, Class I. Doctors holding MBBS, MD shall be given appropriate Classification at discretion of MI.

The permanent faculty and visiting faculty must be pre-approved by the Directorate. Generally the visiting faculty must constitute only 50% of the total faculty. However exceptions can be made with prior permission from the Directorate in case of outstanding cases. All the faculty whether permanent or visiting will be under constant scrutiny by Academic Council by virtue of student response forms, its own inspection and assessment and institutional reports.

**B.11.2.4. Faculty Structure :** The knowledge, skills, attitudes and values of staff are aspects, which greatly contribute to their own individual effectiveness as well as to institutional performance. In addition to the norms on pattern and structure of staff, guidelines should also emphasize on the process of recruitment, development as well as appraisal. These guidelines should be generated by, the MI themselves keeping in view the norms of good practice.

The norms herein stipulated are primarily for an engineering institution with an annual intake of 40 to 120 *Trainees*. These norms will have to be modified for various programmes offered by specific institution e.g. distance-learning mode (ATS) etc.

**B.11.2.5 Cadre distribution flexibility :** In the case of degree courses the desirable ratio for Professor, Assistant Professor and lecturer could be 1:2:4 for each engineering department. However, for Undergraduate courses (ATS/diploma), a minimum of 1 Professor and 2 Asst. Professors / Readers at the senior level of the faculty for each course being offered may be ensured. This is to provide for situations where the institution may not be able to identify Programmes to ensure appropriate senior faculty at the U.G. level also.

As far as the workshop training departments are concerned, there is need for a senior faculty member at Professor level provided it is ensured that such a senior faculty member is involved in inter-disciplinary activities also. Therefore, while the need for a Professor will depend upon the level of academic activities, the utilization of an Assistant Professor, even at the stage of establishment of the institution is required. Training should be in ratio of 1:2 for senior trainer and junior trainers. Senior trainers must have done “the training for Trainees / (TOTA)

However, in either case effort should be made to reach the desirable ratio.

#### **B.11.2.6. Student Teacher ratio**

The student staff ratio in a class will depend upon:

1. Teacher's time required for formal institution and contact hours
2. Student time devoted to formal learning requiring teacher's contact and
3. Class size and type of instructions.

The desirable student to teacher ratio for engineering degree program for the model curriculum will be 8:1. The same ratio should be maintained for all tutorial classes where imparting

The teacher will engage in Group/Class sizes for formal teaching in the ratio given below:

	<b>Student-teacher ratio</b>
Theory lecture class	40: 1
Tutorials (Training classes)	20: 1
Lab. practical/Workshop/drawing	8: 1
Project work / work benches	8: 1
Machine work	3: 1 for each machine

**B.11.2.7. Training and Placement of Students :** Each training organization should have a Training and Placement cell headed by Director / Principal and assisted by an Officer of the rank of Deputy General Manager (DGM) and who is responsible for developing linkages between institution and industry/corporate bodies. He should evaluate the job potential for students passing and arrange for in-campus interview, and in-plant training etc. If it is not possible to find full time DGM for placement and training, it is suggested to appoint one of the Heads of Department as Placement Officer who should be assigned a nominal workload of teaching also. The Training and Placement Officer may have an officer who may serve as Public Relation Officer (PRO). It shall be the duty of the placement officer to ascertain that shipping companies who sponsor the trainees must discharge their moral obligation adequately.

**B.11.2.8. Training and Leave Reserve :** To enable institutions to sponsor teachers for staff development programmes and to allow teachers to avail leave to which they are entitled, it is necessary ' that adequate reserve capacity should be available in accordance with leave training reserves sanctioned by Central/State Government from time to time. It will be desirable to have about 10% staff in excess.

**B.11.2.9. Selection and Recruitment of the Teaching Staff :** The positions of faculty members should be filled up through an open selection process. Institution should adopt reliable and valid procedures for selecting candidates on the basis of competence, knowledge, skills, attitude and values required for the profession, adhering to the stipulation regarding qualification and experience.

**B.11.2.10. Qualification, Experience and Scales of Pay :** Mariners must have 1<sup>st</sup> class Certificate of Competency and minimum of 7 years relevant experience thereafter. Non mariners must have a M. Tech or equivalent and 7 years of experience on relevant subject. Trainers must have minimum 15 years experience and service as CPO / JCO in the Navy or Merchant Navy. Mariners with lesser qualification may be accepted subject to the conditions that they have undergone some specialized training in the relevant subject / topic. Instructors with diploma and adequate industrial experience can be an alternative. Remuneration to the visiting faculty must be commensurate with the best in the industry. There can be no visiting faculty of instructors.

**B.11.2.11. Performance Appraisal :** A performance appraisal system for teachers should be set-up, well integrated with institutional functioning and this should lead to the identification of individual training and development needs. This should also enable the identification of faculty members whose performance is outstanding. Such performance and excellence should be well recognized and rewarded. All institutions should introduce a system for performance-appraisal conforming to the guidelines formulated in this regard.

**B.11.2.11.1 Training and Development :** Teachers will be provided with opportunity to improve their qualifications through quality Improvement programmes. The opportunities will be provided for pedagogy and professional training.

Under the Quality Improvement Program a variety of short-term courses will be provided to meet training needs for all levels of teachers. Institutions would have to plan in advance their training requirements and will deploy teachers on an annual basis for making use of these programmes.

Training of teachers is expected to contribute both towards their professional development and improvement in career prospects.

**B.11.2.11.2 Technical and Other Staff :** The Workshop Superintendent should be of a cadre of an Assistant Professor with a nominal teaching workload. The Assistant Superintendent Workshop (ASW) / Foreman in the Workshop should be given a cadre equivalent to that of Lecturer. The six workshop facilities consist of Electrical Welding, Smithy, Machine Shop, Fitting and Hull. Each of these facilities would have a mechanic and an attendant. All these facilities should be, headed by an ASW/ Foreman.

The ratio of non-teaching (inclusive of administrative, ministerial, technical and other unskilled and semiskilled staff) to teaching staff should not exceed 3:1.

### **B.11.3 Promoting Excellence in Teaching (Academic)**

**B.11.3.1** Teaching ability and commitment to teaching should be key factors in all appointments to the teaching staff.

**B.11.3.2.** Orientation and training programs should be provided to familiarize new staff members with departmental expectations and the needs of trainees. New faculty should receive a description of the teaching and teaching-related duties expected of them and the means by which those duties will be evaluated.

**B.11.3.3.** Faculty should be supervised, monitored, and evaluated in order to help them improve their teaching.

**B.11.3.4.** The courses assigned to faculty, especially those newly hired, should be chosen to aid in their development as trainers.

**B.11.3.5.** A regular program for maintaining and improving training expertise is essential for all trainer's .

**B.11.3.5.1** Departments should provide long-term structured opportunities for acquisition and improvement of training skills by all who train . This might be accomplished through demonstrations of pedagogical approaches and strategies for good training and may include videotaping and peer critiques, observing classes taught by outstanding trainer's , team training with these trainer's , or working with faculty mentors.

**B.11.3.5.2.**Departments should provide regular opportunities for and support the professional development of faculty members to learn of the most recent findings about training and learning in the field of Marine Engineering and of the most recent developments in technology that support training and learning.

**B.11.3.5.3** When a department decides to use technology in a course or program, it should offer appropriate training for faculty in that technology and its effective use in instruction.

**B.11.3.5.4.** All full-time faculty members should participate regularly in activities to maintain and improve their training expertise.

**B.11.3.5.5** Participation in programs designed to assist workshop trainer's is particularly important for members of a department who sometimes teach outside of their own discipline. These programs should be extensive in scope and require substantial investment of time by participants. Many faculty have found that earning a master's degree or equivalent in a second discipline or other discipline appropriate to the teaching assignment gives them the needed background.

**B.11.3.5.6.**When instituting programs for the improvement of teaching by graduate teaching assistants and part-time instructors, consideration should be given to the characteristics of the model programs conduct in premier institutions.

**B.11.3.6** In certain circumstances, part-time faculty can make unique contributions to a Engineering Training department. Departments that employ part-time instructors should provide them with all of the resources necessary for teaching that are provided to full-time instructors, including office space as well as computer, internet, and library resources. Full-time faculty should mentor part-time faculty in resolving problems, in meeting responsibilities, and in familiarizing them with the procedures and expectations of the department

**B.11.3.7.** Departments should ensure that senior faculty assume a leadership role in the academic and training program by participating fully in teaching, curriculum development, and trainee advising. In addition, they have key responsibility for reviewing and nurturing junior faculty and teaching assistants.

**B.11.3.8** Both senior and junior faculty should, at least on occasion, teach courses at all levels of the undergraduate program as well as the training program.

#### **B.11.4. Promoting excellence in academic quest**

**B.11.4.1** All full-time faculty members should, as part of their work assignments, engage in disciplinary or interdisciplinary Academic quest , broadly defined to include the discovery of new knowledge, the integration of knowledge, the application of knowledge, and Academic quest related to teaching. Successful Academic quest includes the obligation of timely communication of results to peers. Faculty should sustain their Academic quest throughout their careers. Guidelines for the acceptable forms of this Academic quest and for the nature of communication of results to peers should be made available in writing to faculty members. A department should encourage, recognize, and value the diverse nature of faculty Academic quest that is directly related to the department's mission and program goals.

**B.11.4.2** A regular program for maintaining and improving disciplinary or interdisciplinary expertise is essential for all training and teaching faculty. Departments should support professional development of faculty members to enable them to remain current with the most recent advances in the field. Appropriate development opportunities include participation in seminars, higher level training courses, appropriate courses in other disciplines, conferences, symposia, short courses, and professional meetings. As all full-time faculty members should participate in appropriate professional development, such activities should be a part of each faculty member's work assignment. Sabbaticals, other faculty leave programs, faculty exchanges, and periodic workload reductions provide faculty the necessary time for professional development.

**B.11.4.3.** Mentoring programs and faculty development opportunities designed specifically for new faculty should be available, and all new faculty should be encouraged to participate in such activities.

**B.11.4.4.**In order to foster a sustained commitment to Academic quest among faculty, departments and their institutions should provide sabbatical or research leaves at appropriate intervals and should have generous policies allowing leaves without pay for research and scholarly activities.

#### **B.11.5. Promoting Excellence in Service**

**B.11.5.1.** Departments should expect senior faculty to seek and accept committee assignments within the department, the institution, and the profession. Departments should expect junior faculty to become involved in service, at a level consistent with local expectations for tenure, with the understanding that faculty governance responsibilities increase upon the award of tenure.

**B.11.5.2.** Departments should expect all full-time faculty members to be formally involved in their professions by participating in professional organizations.

**B.11.6. Assignment of Duties** : In this section, "hours" will mean semester hours, and a "course" will be considered to carry three semester credit hours. Appropriate adjustments should be made for quarter hours, for labs, or for courses carrying credit hours other than three.

**B.11.6.1** Institutional and departmental missions vary considerably. Work assignments for faculty should reflect institutional and departmental missions. They should be consistent with locally defined expectations for promotion and tenure as well as with comparisons to assignments in peer departments at other institutions.

**B.11.6.1.1** Faculty for whom personnel decisions are based primarily upon assessment of substantial scholarly accomplishments or higher level teaching and research supervision should have teaching assignments that do not exceed two courses per semester.

**B.11.6.1.2.** Faculty for whom personnel decisions are based upon assessment of contributions in teaching, Academic quest , and service should have teaching assignments that reflect these multiple expectations and allow for attention to non-classroom responsibilities. Teaching assignments above three courses per semester, when combined with other faculty responsibilities, do not allow the time needed to develop and maintain a program of sustained Academic quest with the result that tenure and promotion might be effectively unattainable. For such faculty, teaching assignments above the level of three courses per semester must be avoided.

**B.11.6.1.3.** Faculty for whom personnel decisions are based predominantly upon assessment of teaching and service responsibilities must have sufficient time for class preparation, course development, conducting office hours, advising, and other duties in service of the profession in addition to formal classroom teaching. Teaching assignments that exceed five courses or a maximum of three different class preparations or fifteen contact hours do not allow sufficient time for these responsibilities.

**B.11.6.2** Depending on department or program mission and priorities, appropriate reductions from the normal teaching assignments described above should be made for extensive involvement in professional activities or service. This may include such activities or service as committee or administrative assignments; course, courseware, program, or technology development; laboratory supervision; project work direction; and Academic quest .

**B.11.6.3** In the assignment of duties, departments must exercise careful monitoring of an individual faculty member's total responsibility to the program. Total responsibility for a large number of trainees in a single course or supervision of course assistants can add as much to work assignments as an additional course. In making teaching assignments, departments must take into account not only the number of contact hours assigned, but also the number of trainees enrolled in those classes and, if teaching assistants are used, any additional supervisory responsibility.

**B.11.6.4.** A valuable part of the professional duties of some MET faculty members is the use of their expertise in providing professional consulting for their institution. The

institution and the faculty member should place in writing an agreement describing exactly what the institution expects from the faculty member in these professional consulting activities that are not part of the workloads of all faculty members. The agreement should describe how the consulting activities will be evaluated, how they will be considered in the tenure and promotion process, and how they fit in the faculty member's work assignment.

**B.11.6.5.** The institution and the department should have a written policy on the amount of time that a full time faculty member can spend during the academic year on outside activities for compensation.

### **B.11.7. Adequate Staffing Levels : Department staffing levels should be**

**B.11.7.1.** Sufficient to allow personal interaction between trainee and instructor to occur in all courses,

**B.11.7.2.** To give tenure-track faculty adequate time to meet tenure expectations,

**B.11.7.3.** To allow faculty to engage in scholarship consistent with departmental expectations,

**B.11.7.4.** To meet work assignment expectations similar to those of peer departments at comparable institutions. Many MET programs today tend to have too large a percentage of part-time faculty, and, over time, should convert part-time positions into full-time positions. This fosters the participation of a greater percentage of faculty in the work of the department.

### **B.11.8. Securing and Sustaining a Diverse Faculty**

**B.11.8.1.** The MET programs are in constant need of being strengthened and replenished by drawing well-educated and competent individuals from the broadest possible pool of talent. It is essential to widen the spectrum from which MET faculty are drawn. Members of traditionally underrepresented groups, including women, minorities, the physically challenged and those from educationally deprived backgrounds, deserve special attention in this regard. The first step toward widening the talent pool from which new faculty are drawn is to make certain that all new positions are advertised in places seen by all potential faculty members.

**B.11.8.2** Hiring decisions are only first steps in achieving and sustaining a diverse faculty. Subsequent issues of faculty development are equally important.

**B.11.8.2.1** A department should maintain an atmosphere that welcomes all people who seek to work and study in the Marine Engineering disciplines in that department.

**B.11.8.2.2.** Departments have a special responsibility to newly hired faculty from historically underrepresented groups to protect them from excessive demands on their time

and energy from advising and committee service that go beyond what is expected of other faculty members.

**B.11.8.2.3.** Departments recruiting faculty from historically underrepresented groups must accept the responsibility for nurturing the professional growth and advancement of these faculty, especially during their early years of employment, in order to insure long-term diversity rather than short-term.

**B.11.8.2.4.** Departments should be on record as endorsing and enforcing the institution-approved personnel policies, including policies on non-discrimination and sexual and other harassment.

### **B.11.9. Faculty evaluation and rewards**

**B.11.9.1.** The department should have written procedures for evaluating its faculty members on the basis of teaching, Academic quest , and service. These departmental procedures should be made available to all departmental faculty and should be reviewed periodically.

**B.11.9.2.** Tenure-track, non-tenured faculty should be counseled annually as to progress toward tenure.

**B.11.9.3.** Departments should use the best available methods, they may be, for evaluating teaching, academic quest , and service while also seeking to develop better methods of evaluation.

**B.11.9.4.** Every institution and department should work to develop efficient, robust, reliable, and trusted measures of teaching effectiveness. These could include peer evaluation, surveying of trainees from current and previous semesters , studying trainee achievement in subsequent courses, reviewing syllabi and examinations, and other techniques.

**B.11.9.5.** In accordance with departmental mission and priorities, some consulting and other professional activities may advance the academicquest and teaching of faculty members and the department. Consulting and other professional activities may fit into the category of teaching or academicquest and in that case should be evaluated accordingly, or such activities might be evaluated as a separate category, with correspondingly less emphasis on other categories. Supervision processes and evaluation procedures for formal consulting activities should include the monitoring of faculty progress in maintaining and improving the quality of these activities. Evaluation criteria and procedures for consulting activities must be a part of a written agreement among the faculty member, the department, and the appropriate head.

**B.11.9.6.** Professional expectations vary considerably among the Marine Engineering disciplines. When a department has faculty members from several disciplines, it is particularly important that there be a mutually accepted, written statement concerning expectations for the faculty members in the areas of teaching, academicquest , and service,

and, if relevant, consulting. It is important that the agreed upon expectations statement be the basis for personnel decisions. Departments should consult position papers of various professional societies in preparing such expectations statements. Furthermore, if the department has only one or two faculty members in a discipline, it should seek outside persons to serve as advisors for departments and mentors for these isolated faculty members early in their careers. If such outside advisors or mentors are used, it is important that they and the department give the same messages to the faculty member about departmental and institutional expectations. Professional societies can identify senior faculty members who are willing to serve as outside advisors and mentors.

**B.11.9.7.** "Each department must develop a rewards system consonant with its own mission and the mission of the institution. In formulating a rewards structure, each department must analyze who its constituencies are, what they need from the department, and whether those needs are being met.

**B.11.9.8.** Support Staff : Clerical and technical staff should be sufficient to support the teaching and scholarly activities of the department. It is particularly important to have adequate technical staff to maintain equipment used by trainees, faculty, and clerical staff. Faculty should not be expected to provide logistical and technical support for the department.

## **B12. CURRICULUM PLANNING AND REVIEW PROCEDURES**

The department should have the primary responsibility and most influential voice in setting the placement policies, the prerequisites or co-requisites, the course content, and the exit competencies for the department's courses.

Departments should discuss with client Statutory authorities, Organization, Universities and plans to change Engineering training courses or programs in ways that would have significant effects on academic and training in the industry . This consultation should continue throughout the process of making the change.

**B.12.1.** There should be established procedures for periodic review of the curriculum. These reviews, which should be a part of the duties of faculty assigned by the department, should include careful scrutiny of course syllabi, prerequisites, equipment and textbooks. These reviews should examine the curriculum in the context of the departmental goals and institutional mission. They should include consideration of the curriculum's relevance and appropriateness for the trainees being served. Effective reviews often lead to revision, addition, or deletion of courses.

**B.12.2.** Many courses within Marine Engineering programs are organized with a sequence of prerequisites. Course prerequisites should be clearly stated and equitably enforced. A current syllabus for each course should be on the web and on file for review by faculty colleagues and by students. Catalog course descriptions should be kept up-to-date. Departments should take the necessary steps to ensure that all sections of a given course are consistent in content, use of technology, focus, and rigor.

**B.12.3.** In cases where the department regularly teaches trainees who transfer from 10+2 and diploma streams, the department should cooperate with those two-year colleges in facilitating trainee transfers. Marine Engineering faculty members at the institutions should work together to ensure compatibility of appropriate courses, and course equivalencies should be published. Faculty should ensure that the courses taught at the diploma and degree colleges are consistent in content, technology, focus, and rigor.

**B.12.4.** The development and review process for courses that support other programs should involve faculty members from those programs. In addition, informal contacts with faculty from other departments can provide useful information concerning the Marine Engineering courses that their trainees must take. Working collaborations with faculty colleagues in departments of basic academic streams must be established to strengthen the programs that prepare teachers for these streams .

**B.12.5.** In cases where a department offers a course or courses in a particular discipline, but does not have a faculty member with expertise in that discipline, the department should take special care to consult the curricular guidelines of the relevant professional society in that discipline.

### **B13. CURRICULUM ACCESS AND PEDAGOGY**

**B.13.1.** The Marine Engineering curriculum should be responsive to the needs of the department's trainees. Course and program offerings should provide suitable academic challenge and should be based on the expectation that all students can be trained equality.

**B.13.2.** Departments must be provided with the resources necessary to deliver high quality teaching that includes the opportunity for students to interact frequently and nontrivially with their instructors.

**B.13.3.** The instructional staff assigned to each course should be sufficient to allow for regular and frequent feedback to trainees about their progress. Feedback from instructors should take various forms, such as critical reviews of short quizzes and hour tests, comments and suggestions for homework or writing assignments, and critiques of trainees presentations of projects and contributions in seminars. Interaction in classes, laboratories, and workshops provides additional feedback. Instructors should consider all of these forms of evaluation not just as evaluation of the trainees but also as information that can be used to improve their training and Instructors can gain information for improving their teaching also from trainees journals and mid-semester questionnaires.

**B.13.4.** Courses which are required in a trainees program of study but have a history of low enrollment should be scheduled and taught at least once every two years regardless of the low enrollment.

## PART – C

*(Applicable sections of equipment, academic tests etc.)*

### **C1. RESEARCH AND INNOVATIONS IN TEACHING AND LEARNING**

Departments should be aware of the results of research and innovations on teaching and learning in Marine Engineering and they should make use of those results in improving instruction. Such research can provide a useful framework for such pedagogical matters as what trainees know and can do, how they develop their understanding of technological concepts, how they solve problems, how various kinds of Engineering Training affects learning, and how trainee's read proofs. No one method of instruction is optimal for all trainee's, for all faculty members, or for all subject matter. Departments should encourage and assist faculty members who investigate, try out, and evaluate alternative teaching techniques that show promise in helping some trainee be more successful in learning in the Marine Engineering field.

### **C2. IMPACT OF TECHNOLOGY AND ITS ADAPTATION**

Marine Engineering departments should employ technology in ways that foster teaching and learning, increase the trainees understanding of Marine Engineering concepts, and prepare trainees for the use of technology in their careers or their graduate study. Where appropriate, courses offered by the department should integrate current technology. The availability of new technological tools and their pervasive use in the workplace have the potential for changing both the curriculum and the way that the Marine Engineering can be taught.

Departments should review and adjust the curriculum to reflect the expanded use of technology in each discipline and in the workplace.

**C.2.1.** In courses where the use of modern technology will enhance student learning, departments should adopt methods of teaching technology oriented courses that make full use of appropriate current technology. These methods include workshops sessions and assignments using computer software or graphing calculators, electronic communication with trainees, demonstrations in class using projection equipment, group activities fostered by technology, and use of the Internet.

**C.2.2.** The trainees activities and experiences related to technology should be designed primarily to enhance the learning of technology and may serve to introduce the trainees to operations related technology.

**C.2.3.** Faculty should consider the many different ways to employ technology in order to foster interaction among instructors and trainees.

**C.2.4.** Departments should develop a general policy for assessment of trainees work that acknowledges the role of technology in the curriculum. In particular, departments should

**C.2.4.1.** Adopt a policy of testing trainees in the way that they actually do their coursework. That is, if trainees regularly use graphing calculators or computer software for assignments, then the same facilities should be available during tests. If desired, trainees may be tested separately for computational facility and particular facts without the use of technology.

**C.2.4.2.** Adopt a policy on assessment of technology-based student projects and assignments.

### **C3. GUIDING NORMS FOR MAINTAINING ACADEMIC FACILITIES:**

The number of academic facility, classroom facilities, library, infrastructure must be in accordance with the AICTE norms for AICTE approval engineering colleges of a stream in addition to DGS norms. For those training institution such as ATS, 10 + 2 core training schemes, DGS approved Marine Engineering schemes the following norms would apply.

#### **C.3.1. Program Objectives**

To improve upon the present technical education system and incorporate the aforesaid observations one major step would be to modify the engineering and training curriculum with the following main objectives:

Greater emphasis on design and application oriented teaching, teaching of design and application methodologies, problem-solving approach.

Greater exposure to industrial and application processes.

Exclusion of outmoded technologies and inclusion of the new appropriate and emerging technologies.

Greater input of management education and professional communication skills.

A sincere effort to train and assess and then retrain on a continuous basis.

#### **C.3.2. Design and application oriented Teaching**

Engineering is a design and application oriented activity and engineering design is the most important ingredient in the education and training of an engineer. It is design that distinguishes an engineer from a scientist. So, the design content in the curriculum must be substantiated. Teaching of design methodologies and problem-solving approaches are essential features of marine engineering education. In earlier years, conceptual design, detailed specifications, manufacturing, assembling, commissioning and testing, formed part of the curriculum in every discipline. During the decades of sixties and seventies,

significant changes in the engineering curricula took place, influenced largely by the practices in some western countries. This has resulted in a considerable shift in emphasis from design and application oriented teaching to basic sciences. The introduction of more basic and engineering science courses has generally been at the cost of design courses and fieldwork. We must move to emphasise design and application into engineering education. Moreover, meaningful projects dealing with real life problems should form the culmination of the education programmes.

**C.3.3. Exposure to practical fields and areas of application :** In the industrially advanced countries of the world, there exists a long tradition of close partnership between academic institutions and industry in promoting technical education and research. In our country, despite a growing awareness of the importance of forging linkages between universities and industry, the interaction between them is still rather limited. Although both sides realize that this gap needs to be bridged, most of the initiative towards such, bridge building have come from educational institutions, hitherto with little success. The result is that education has remained stagnant while industries have advanced. The curriculum must aim to provide to the student greater exposure of actual ship board processes. Students projects should be related to actual problems identified with the help of practicing engineers. Greater stress should be laid on the practical training of engineering graduates and hands on training programmes should be encouraged wherever feasible.

**C.3.4. Emerging Technologies :** The role of technology is not limited to the production of manpower for the organized shipping sector alone; it must also cater for the needs of the infrastructure and service sectors as well as the unorganized and small sectors such as marine related fields (**offshore, fishing, ocean engineering**). The scope of enhancing productivity in these sectors by induction of improved technology is considerable. Most technical institutions in our country today deal with conventional technologies and disciplines.

We should constantly monitor the developments in emerging technologies and recommend changes in the curriculum and allocation of proper funds for development of infrastructure facilities.

**C.3.5. Management Education and Professional Communication Skills :** Marine Engineering includes a systems approach to solving problems involving management of persons, machines and materials. To work with people from different backgrounds, the engineer has to have some training in behavioural Sciences, Industrial Psychology etc. Also communication skills are as important as management and engineering skills. The engineering curriculum therefore needs to include some courses on communication skills along with economics, finance and marketing. Group discussions, seminars, symposia should also be a part of the curriculum.

#### **C4. EXAMINATION AND ASSESSMENT NORMS**

Training institutions should adopt a range of methods of instruction such as, case studies, lectures, group and individual exercises, class assignments, project work and presentations, role play, management games, etc. The student evaluation shall be continuous and may comprise of the following:

1. Class participation / group discussions
2. Multiple choice questioning
3. Assignments / Field Work / term paper
4. Assessment using simulation on computers
5. Shop and equipment related evaluation.

The academic performance of trainees could be assessed in terms of grades of percentage of marks obtained in different courses as well as in terms of Cumulative Grade Point Average (CGPA) - a simple average of grades computed or percentage marks obtained in aggregate as per illustration given below:

Grade	A+	A	B+	B	C+	C	D	F
Corresponding Grade Point	8	7	6	5	4	3	2	0

A trainee whose CGPA at the end of I Year, say on eight point scale, is 4.0 and above or 50% and above marks in aggregate, and who has not obtained more than two permanent Fail (F) grades, he should be permitted to undertake the summer project and be promoted and permitted to register for the second year. A similar scheme should be devised for Diploma and ATS courses exclusively for the project work..

The minimum-passing grade at the end of the second year of the programme should be a CGPA of five or more on an 8 point scale or 60% in aggregate. A trainee who fails to obtain a CGPA of five or more or 60% or more marks in aggregate at the end of the first year, and/or has obtained more than two Fail (F) grades in course and/or has obtained a Fail (F) grade for the summer project will be declared fail. In the case of workshop skill tests a suitable grade point system should be used, so that an apprentices should not be allowed to proceed further without having a satisfactory grade in the last skill test.

*Note : If an institution ( ATS, 10 + 2 core marine diploma s)is not part of University and it is conducting its own examinations, it will be required to conduct its examination system with full transparency. Institution will also maintain its examination records for any inspection in future for a period of five years.*

## **C5. ACADEMIC CONTACT HOURS (CREDITS/UNITS)**

The teaching is reckoned in terms of credits based on contact hours. The contact hours are sum of lecture, tutorial & practical hours. One lecture hour per week is rated as one credit and two tutorials or two practical hours per week are rated as one credit. Depending upon the structure of the courses its credit will be rated as for example a course of 3-0-0 will

carry three credits, 3-2-0 will carry four credits 3-2-2 will carry five credits, 0-0-6 will carry three credits. Under exceptional circumstance weightages for lecture hour, tutorial, practical hour may vary slightly. Unit system currently followed in some of the institutions may be suitably related to the credit system in order to facilitate their interpretation by institutions within the country or abroad.

A course with LTP (Lecture, Tutorial, Practical) loading of 3-1-2 or 3-2-2 or 0-0-6 may be considered as one unit to be taught in a year. This definition of unit however should not be considered as rigid. It is only a guideline and variations may occur depending upon the nature of the subject, the homework required and the intensity of the courses.

The training program like semester should be so arranged that each training period cover 25 to 30 credit. In addition, a provision of some contact hours per week should be made for informal discussions / consultation and counseling with the students. For this purpose 5 contact hours per week are considered as adequate for a class. Accordingly, this additional teaching load has to be provided for the teachers and be reflected in the timetable.

## **C6. TRAINING NORMS FOR CANDIDATES**

- C.6.1 They must all wear safety *boots* and orange colored overalls and easily identifiable during workshop, onboard training.
- C.6.2. They must all wear name tags
- C.6.3. They must undergo comprehensive 48 hour session of classroom + field instruction in Safety (Personal) before commencing actual training.
- C.6.4. Their training hours must not exceed 1152 hours in a year in workshop and classroom. Physical and extra-curricular activities may be given additional time.
- C.6.5. They must be accountable at any time during the training period.
- C.6.6. Training logs must be regularly filled and reports sent to the MMD under whose jurisdiction the workshop is located on a quarterly basis, (Detachable ) of TAR book.
- C.6.7. Apprentices must always carry their photo Identity Cards.

## **C7. MINIMUM NORMS FOR MAINTAINING WORKSHOP FACILITIES:**

- C.7.1. List given in **ANNEX - 1** broadly gives the basic tools and test equipment required.
- C.7.2. List given in **ANNEX - 2** broadly gives the laboratory equipment required for training , alongwith the experiments.
- C.7.3. For Colleges that require AICTE approval, basic facilities in accordance with AICTE regulations must be provided. Those with MERI equivalency

Graduate Engineer training with workshop facilities and ATS must have equipment as per [ANNEX – 3](#)

- C.7.4. List of subjects for theory classes in core competencies are given in [ANNEX– 5](#)
- C.7.5. The teaching and sample training facilities required is laid out in [ANNEX – 6](#)
- C.7.6. General details questionnaire given in [ANNEX–4](#), [ANNEX–7](#) , [ANNEX -8](#) to be submitted every year during Academic Council inspection to the chairman Academic Council for making necessary recommendation to the Training Branch at DGS.
- C.7.7. Man-hours per apprentice is as given in the TAR Books. [ANNEX - 9](#)
- C.7.8. Each shop must have facilities as indicated in the [ANNEXE 10](#)
- C.7.9. States topics of competence [ANNEX – 11](#)
- C.7.10. States operational tasks to be completed in Level – 3, Afloat try / on board training [ANNEX - 12](#)

## **C8. FRAMEWORK**

Experience in the practice of Marine engineering may be divided into a number of distinct subject areas. It is felt that Marine Engineers-in-Training should ideally be exposed to, and gain hands-on experience with, each of these subject areas covered within the following broad framework:

1. Practical Experience in operational areas
2. Application of Theory
3. Management of operational requirements
4. Communication Skills
5. Social Implications of Marine Engineering

The purpose of these guidelines is to present a qualitative framework to assist in identifying potential activities qualifying as Marine engineering experience. The framework is not intended as a point rating system. In determining whether the candidate has gained acceptable engineering experience the Chief Examiner of engineering examines the experience obtained by an individual Engineer-in-Training, particularly with respect to the following criteria:

1. A well-rounded work program. Some experience in each of the five categories is highly desirable. However, it is recognized that few if any of the MEIT's will be exposed to all of the individual components of the framework.

2. It is important that the MEIT develop an understanding of his / her limitations with respect to the practice of marine engineering.
3. The Marine Engineer-in-Training must show progression into work of greater complexity and increased responsibility.

**C.8.1. Practical Experience :** Upon completion of an academic programme undergraduate degree where theory supported by workshops work is the basic input, Marine Engineers-in-Training must be exposed to the practical limitations applicable to their speciality. Only by possessing the two knowledge sets of theory and practical experience can Marine engineer achieve his or her objective of the optimum conversion of the resources of nature to benefit mankind.

These guidelines recommend that practical experience should include, but not necessarily be limited to, the following categories:

**C.8.1.1 Exposure to engineering work through**

C.8.1.1.1 Field work

C.8.1.1.2. Trips and visits to equipment or systems in both the operational and maintenance modes.

**C.8.1.2. Application of the equipment as part of the larger systems, including:**

C.8.1.2.1. Understanding the end product of Marine engineering work

C.8.1.2.2. Understanding the requirement for reliability in components, equipments and operations used on board ships.

C.8.1.2.3. Understanding the role of systems to the total engineering work system on board ships

**C.8.1.3. Limitations and constraints**

C.8.1.3.1. Operational methods

C.8.1.3.2. Value engineering

C.8.1.3.3. Tolerances of manufacture

C.8.1.3.4. Maintenance philosophy

C.8.1.3.5. Performance minimums

C.8.1.3.6. Competent mariners ability to perform , including exposure to the operation and the end user

C.8.1.3.7. The relationship between the system and equipment as the system operator.

C.8.1.4. Timeframes:

C.8.1.4.1. Work flow process

C.8.1.4.2. Wear out/replacement schedules.

**C.8.2. Application of Theory :** To become a competent Engineer, the Marine Engineer-in-Training must be able to apply the technical training learned through the study of engineering theory to engineering operations, so that optimal solutions are developed and implemented.

As a MEIT, it is important that the engineering experience expose the young engineer to a variety of technical projects that require more than routine analysis for solution. This requires the MEIT to build on his or her engineering training by seeking out further knowledge. It should prepare the MEIT for the necessity to remain current of technological advances in his or her field of speciality.

A representative list of activities to which an MEIT could apply learned theory may include:

**C.8.2.1. Analysis:**

- C.8.2.1.1. Scope and operating conditions
- C.8.2.1.2. Compatibility and interface issues
- C.8.2.1.3. Technological assessment
- C.8.2.1.4. Safety and environmental factors or issues
- C.8.2.1.5. Economic assessment.

**C.8.2.2. Design:**

- C.8.2.2.1. Ship Structural analysis
- C.8.2.2.2. Functionality of system specifications on board ships
- C.8.2.2.3. Reliability factors of hull and machinery
- C.8.2.2.4. Maintenance features of hull and machinery
- C.8.2.2.5. Component selection for equipment
- C.8.2.2.6. Integration of sub-components into a complete working system
- C.8.2.2.7. Environmental factors.

**C.8.2.3. Testing Methods:**

- C.8.2.3.1. Testing methodology and techniques, and their limitations
- C.8.2.3.2. Verification of functional specifications for a new equipment
- C.8.2.3.3. New technology commissioning and assessment.

**C.8.2.4. Implementation Methods:**

- C.8.2.4.1. Engineering cost studies
- C.8.2.4.2. Technology application
- C.8.2.4.3. Control systems optimization
- C.8.2.4.4. Quality assurance program methodology
- C.8.2.4.5. Quality control methodology
- C.8.2.4.6. Safety problem identification and recommendation
- C.8.2.4.7. Process flow and time studies
- C.8.2.4.8. Environmental issues
- C.8.2.4.9. Maintenance and replacement evaluation of engineering works.

**C.8.3. Management :** Management covers a wide area of an Marine engineer's work, and not just the supervision of staff. Operational management, including the social management of the technology, is an essential part of a marine

engineer's knowledge base. Thus, management\_experience is now an essential part of training, and must be considered as part of experience.

The following components of operational management experience should be taken as a representative framework:

**C.8.3.1. Planning**

- C.8.3.1.1. Concept development
- C.8.3.1.2. Identification of requirements
- C.8.3.1.3. Assessing the resources required.

**C.8.3.2. Scheduling:**

- C.8.3.2.1. Developing activity/task schedules
- C.8.3.2.2. Determining interactions and constraints
- C.8.3.2.3. Allocation of resources
- C.8.3.2.4. Assessing the impact of delays
- C.8.3.2.5. Interaction with other concurrent operations
- C.8.3.2.6. Interaction with service providers , vendors

**C.8.3.3. Budgeting:**

- C.8.3.3.1. Development of conceptual budget
- C.8.3.3.2. Development of detailed budget, including estimates of labour, material and overhead
- C.8.3.3.3. Risk assessment of cost escalation potential
- C.8.3.3.4. Review of budget in light of changes.

**C.8.3.4. Supervision:**

- C.8.3.4.1. Leadership and professional conduct
- C.8.3.4.2. Organization of manpower
- C.8.3.4.3. Team building
- C.8.3.4.4. Management of technology

**C.8.3.5. Project Control:**

- C.8.3.5.1. Understanding elements of the operation as it relates to the total operation.
- C.8.3.5.2. Coordinating the phases of operational work
- C.8.3.5.3. Monitoring of expenditure and schedule and taking appropriate action
- C.8.3.5.4. Performance measurement and analysis

**C.8.3.6. Risk Assessment:**

- C.8.3.6.1. Operating equipment and system performance
- C.8.3.6.2. Personals performance
- C.8.3.6.3. Social and environmental impacts.

**C.8.4. Communication Skills :** The rapid expansion of technology creates an increasing requirement for communication skills. This applies to all aspects of the work environment,

and includes communication with Shipowner's , Shipmanager, government regulators, agencies and the general public. It is important that a competent marine engineer be able to communicate concerning his or her work orally and in written form. Typical forms of communication for the operational engineer include:

**C.8.4.1. Written Reports :** An MEIT should be given an opportunity to prepare written reports, including participation in larger reporting tasks being undertaken by the institution or unit in which he or she is undergoing training.

**C.8.4.2. Oral Reporting :** This form of communication may include:

C.8.4.2.1. Reports to superiors

C.8.4.2.2. Reports to senior management; or

C.8.4.2.3. Exposure to, or participation in, reports to vendors or regulatory authorities.

**C.8.4.3. Public Speaking :** If the opportunity arises, an MEIT should be exposed to, or allowed to participate in, presentations on behalf of the institution to the public.

**C.8.4.4. Communication with Fellow Employees :** Opportunities should be given for an MEIT to communicate information on behalf of the institution to other colleagues.

To assist in the development of communication skills, it is important to provide direct feedback on progress, and assistance through seminars or other means.

**C.8.5. Social Implications of Engineering :** An important facet of the Marine engineering profession is an understanding to the social implications of engineering works. This understanding should include:

**C.8.5.1.** An awareness of a marine engineer's professional responsibility to guard against all conditions dangerous or threatening to life, limb or property, and to call any such conditions to the attention of those responsible.

**C.8.5.2.** An awareness of potential impacts, both positive and negative, of the operations with which the engineer is involved. This should include an understanding of:

**C.8.5.2.1.** The safeguards in place to protect the ship and its personnels and mitigate adverse impacts

**C.8.5.2.2.** The quality assurance measures involved with the operational process

**C.8.5.2.3.** An awareness of the value of the operational aspects of marine engineering knowledge of the interface between the engineering organization and the public when communicating the impacts and benefits of engineering works; and a demonstrated interest in the wider social implications of engineering, through attendance at public meetings, or seminars sponsored by the Association.

## **C9. THE ROLE OF THE CHIEF EXAMINER OF ENGINEERS COMMITTEE**

The Chief Examiner of Engineers Committee plays an integral role in the certification of engineering training experience, as part of their overall mandate. The recommendations of The Chief Examiner of Engineering Committee are submitted to the Directorate General of Shipping , Training Branch for appropriate action. In this manner, precautions are taken to ensure that each applicant meets the requirements, in the interest of protection of the public.

The primary documentation used by the Chief Examiner Engineers Committee in the individual assessment of each candidate for training is that completed by the applicant and his or her sponsors as part of the Application for (in format **proforma “A” and proforma “B”**) training. A significant portion of this document is devoted to the recording by the applicant of academic pursuits with accompanying time periods. After receipt of the application through the sponsors or otherwise proceed for verifications authority and then approved.

The Chief Examiners Committee relies heavily on the proper verification of certificates submitted by the applicant.

The sponsor has a responsibility to ensure that:

1. Each period of experience and academic certificate that is authenticated qualifies for true engineering experience, within the context of the guidelines
1. They are familiar with the details of the engineering work, either through direct supervision, or ongoing contact with the applicant.

**The CEEC also details on issue of**

1. Type and nature of training to be imparted
2. Type of facilities needed for training
3. Eligibility criteria
4. Examination and certification protocol

Hence, training and academic permits can only be amended modified and renewed with the approval of CEEC.

### **C.9.1. Course Duration :**

For the GME, DME, ATS and 4 yrs core course training periods in workshops, the periods and the hours are as mentioned in META manual I & II .

For 4 year degree in marine engineering and the academic inputs of DME, GME and ATS courses the entire teaching in a week will consist of about 30-40% time devoted for lectures and the balance for tutorials and practical. In any case, more than 60% of the contact time should not be allotted to lectures while for workshops work and for tutorial work the contact time should be above 25% and 10% respectively. Approximately 30-40%

of the 8th semester must be devoted to project work, which may desirably be initiated in the 7th semester itself for the 4 year degree courses. The entire degree program will consist of approximately 200 credits. For a 1-year workshop- training course it should consist of approximately 60 credits. DME and ATS courses will have 130 credits each. The 4 year core course programme with Diploma or AMIE should have 200 credits.

**C.9.2. Program Structure** : (for 4 year marine engineering degree / ATS courses and Diploma courses / the 4 year core course with Diploma or AMIE ).

The subject materials to be included in a four-year degree program in engineering need to be sub-divided as below. The same pattern must be adopted for ATS and Diploma courses, and the 10+2 core course with Diploma or AMIE in credit based version of the curriculum.

**General 5-10%**

It will be desirable to have a minimum of one course in each of the areas as below:

1. Language/Communication skills
2. Logical analysis methodologies.
3. Economics and Principles of Management
4. Human resource development and relationships

All these courses should cover the basics only. Advanced courses if considered desirable should be offered from the time allotted in professional courses. For students deficient in English language, special courses should be provided outside the normal contact time.

**Basic Science 15-25%**

It will be desirable to have a minimum of one course in each of the areas as below:

1. Computer Literacy with Numerical Analysis
2. Mathematics
3. Physics
4. Chemistry

Institutions may strengthen their curricula with common additional courses required by them as per their need to make up a maximum to 25% of the contact time available.

**Engineering Sciences 15-25% and Technical Arts**

It will be desirable to have a minimum of one course in each of the areas as below:

1. Engineering graphics
2. Workshop Practice
3. Engineering Mechanics

4. Electrical Science I (Basic Electrical Engineering)
5. Thermodynamics and Heat Transfer
6. Material Science and Engineering
7. Electrical Science II (Electronics and Instrumentation)

It is also suggested that courses like (1) Engineering Systems Design (2) Manufacturing Materials (3) Rudiments of inspection and Surveying (4) Transport Phenomena may also form a part of this core curriculum.

**Professional subjects                      55-65%**

The engineering discipline will have its own minimum number of core courses. Rest of the courses will cover professional subjects as per list suggested by experts, (DGS, AICTE) in line with the academic regulations of the institution.

Wherever possible, about 10% Electives should be made available to the students. Open interdisciplinary electives allow a student to diversify his/her spectrum of knowledge. Accordingly, it is desirable that these electives be also taken from outside the main discipline. In order to create a variety of individual skill and profile, it will be desirable to have a provision for some audit (non-credit) courses during the last two years of the degree program.

In the case of workshops practical a bank of experiments be prepared, and every year new experiments/modifications be introduced. A majority of experiments should preferably be open-ended. The students are expected to work by themselves without the aid of technicians.

Further, there should be continuous evaluation in tutorials, practical work and workshops and project assignments.

**C10. CONSTITUTION OF ADVISORY BODY FOR MANAGEMENT OF THE INSTITUTIONS**

All MI approved by the Directorate are required to constitute an advisory body with the constitution and functions given below:

Constitution

1.	A person of eminence from the Region/ Territory either from University of National repute in the relevant field	1 No. (Chairman)
2.	Representative of a recognized / Industrial / Commercial All India Body.	1 No.
3.	An Alumni of the Institute	1 No.
4.	Representative from INSA / FOSMA / MASSA	1 No.
5.	Representatives from ImarE	1 No.
6.	Expert in the field of management from outside State/Region.	1 No.

7.	A representative from the higher / technical education department of State / Director Technical Education of State.	1 No. Optional
8.	A representative of AICTE	1 No. Optional
9.	One senior faculty member of the Professor's rank.	1 No.
10.	The Director / Principal of the Institute.	1 No. (Member Secretary)

**C11. CREDIT RECOMMEDATIONS FOR MEIT INVOLVED ORGANISATIONS (assessment form)**

The following are credit recommendation for organizations that are involved in the overall making of a marine engineer. The credit rating is an a scale as follows.

Grading	Notation	Marks
Very High	A	10
High	B	8
Medium	C	6
Low	D	4
Very Low	E	2

This assessment form is an input for the overall studying of the academic and workshop training program. This must be preceded by the names of organizations involved, so as to get a clearer picture of the strategy to be evolved.

**C12. STATUTORY AND REGULATORY BODIES FACILATING TRAINING AND ACADEMIC (academic council , state boards, accreditation bodies)**

TOPIC	CREDIT
ensuring close coordination among institutions to avoid duplication and to ensure maximum effectiveness.	
providing an appropriate balance between technical and management programs	
providing effective publicity about continued learning programs.	
developing remote access programs through modern information channels (e.g. through video-conferencing, television, the Internet).	
involving engineers from industry in the planning and delivery of continuing education programs.	
providing maximum flexibility in the times that courses are offered to marine engineers.	
supporting and assisting the establishment of continuing education programs delivered by the private sector.	
maintaining and providing permanent and portable records of participation in both credit and non-credit courses.	
assisting alumni and local engineers, through their technical societies and professional bodies, in their further education by providing tailored educational offerings. rewarding staff who contribute and participate in the delivery of continuing education programs.	
enhancing continuing education programs in the new technologies and in those involving multi-disciplinary fields.	

### **C13. ACADEMIC INSTITUTION AND TRAINING ORGANIZATIONS**

**(colleges, institutions, workshops)**

Maintaining primary responsibility for ensuring the competency of professional engineers through:

TOPIC	CREDIT
developing practical guidelines for the various participants in the continued learning process.	
publicizing availability of continuing educational programs, short courses, seminars which have been developed by public and private sector educational providers.	
maintaining records bearing on the continuing competence of professional engineers, including: a) evidence of participation in formal courses (e.g. continuing education units), and b) recognition of achievements in the profession (e.g. design innovations, research contributions, international recognition).	
taking appropriate actions in the event that individual engineers and/or their employers fail to ensure competencies are maintained through continued learning.	
developing continued learning requirements for engineers seeking to re-enter the profession after a period of absence.	
establishing continued learning guidelines for engineers wishing to practice in multi-disciplinary areas.	
establishing continued learning guidelines for engineers in management positions, including those having financial, economic and human resource responsibilities.	

#### **Technical Societies (ImarE, IE)**

Continuing to improve the technical and management skill of marine engineers, through:

TOPIC	CREDIT
enhancing effectiveness of traditional information sharing channels such as publications and conferences.	
expanding range of tutorials and technology updates.	
preparing advanced study plans appropriate for various technology areas.	
promoting technology development in multi-disciplinary areas in collaboration with other technical societies.	
maintaining inventory of the continuing education services available, including those of private sector service providers.	
developing continuing education offerings suitable for engineers employed by small and medium-size companies (SMEs) and those working in remote locations.	
improving access to technical information by electronic journals accessed by Internet.	

## **PART - D**

### **D1. NORMS FOR INFRASTRUCTURE**

#### **D.1.1. General**

The norms for space and buildings have been arrived at, based on the functions, a technical institution offering degree or equivalent programmes, has to perform. In all the cases, unit norms have been evolved taking the absolute minimum needs, which are indicated as norms. As such the institutions, while envisaging their space and building requirements, must keep their perspectives for development in mind and formulate their plans accordingly workshops imparting training must also adhere to these norms as a comprehensive training institutions .

Around the administrative buildings, classrooms and drawing halls there is considerable movement of students and, therefore, there must be adequate veranda space in this part of the college building so that the classes do not get disturbed. For this reason, the ratio of plinth to carpet area for the normal building may be taken as 1.4, while that for Workshop type of space this ratio will be 1.25.

#### **D.1.2. Classification of Building Area**

The building area required for an engineering institution can be classified as instructional area, administrative area, amenity area and residential area. Instructional area will include class rooms, tutorial rooms, drawing halls, laboratories, workshops, computer center, library, instructional resource center, seminar hall etc.

Administrative area comprises In-charges room, visitors lounge, staff rooms, college office, departmental offices, stores, conference room, confidential room, etc.

Area for amenities consists of common rooms, recreation center, hobby center and offices for Gymkhana, N.C.C., N.S.S. and Alumni Association, Co-operative Stores, Dispensary, etc. If there are appended amenities or existing amenities as in workshops, which usually have these facilities, they must be made available to apprentices. Residential area includes student and staff hostels, staff quarters and guesthouse.

#### **D.1.3. Building Space for Instructional Area**

The course structure of any technical institution degree program will include lectures, tutorials, drawing and design work, laboratory work and seminars / colloquium. The institutions must have adequate building areas for all these instructional activities.

According to the model curriculum, during different semesters, the total number of hours per week for which the student is to have contact with the teacher will vary between 27 to 34. In view of this, for the instructional schedule, if spread over a period of 34 hours a

week, the institutions can work for six hours from Monday to Friday and for four hours on Saturdays. (\* In technical institution the period is envisaged to be of one hour's duration.)

In case of academic course the student strength in a theory class should not exceed 40. The class be divided into smaller groups of 20 in case 15 students for the senior and a teacher is assigned to each group. In case of tutorial work, these smaller groups must be accommodated in separate rooms.

For drawing and design assignments, the class can have a maximum size of 40 students but one teacher must be assigned to each group of 15 to 20 students for the junior / senior classes as in the case of tutorial and practical classes.

The seminars/colloquium of the senior students must be conducted with the entire class of a particular discipline.

The model curriculum lays considerable stress on undergraduate project work. It provides 2-3 hours in the seventh semester for project work and 12-16 hours in the eighth semester. Though the students are to work on the assigned project work consulting the teacher-supervisor whenever required.

In the case of workshop practice classes for junior students, which emphasise the skill component of the training, the classes will have to be divided into smaller groups and work assigned in different shops. Considering this specific nature of training, the workshop practice classes of junior students can have maximum batch strength of 20 students. However, senior class (i.e. V, VI, VII & VIII semester) must have a batch strength of 15 students as in the case of any other laboratory.

#### **D.1.4. Number of Rooms for theory Classes**

The number of rooms required for the theory class can be determined by applying the following relationship.

NL = A (TL/SL) where,

NL = Number of rooms required for the lecture classes

TL = Total number of students in the college.

This number depends on the admissions to different disciplines. (this includes all categories of apprentices in case of workshops)

SL = Class strength i.e. the number of students in the class.

A = A factor obtained on the basis of:

(a) Lecture hours per week per class, say 15

(b) Average teaching hours per week say 30

(c) Utilisation factor of lecture rooms say 0.66.

A =  $(15) / (30 * 0.66) = 0.75$

#### **D.1.5. Number of Rooms for tutorial work**

The number of rooms required for the Tutorial work can be determined by applying the following relationship.

NT = B (TL/ST) where,

NT = Number of rooms required for conducting tutorial classes

ST = Class strength for tutorial. Tutorial batches must have strength of 20 in case of 1<sup>st</sup> and 2<sup>nd</sup> year classes, whereas in the case of senior classes it should be limited to 15. Hence an average value of 17.5 can be assumed.

TL = Total Number of students in the College belonging to all classes of all discipline who attend tutorial classes in the groups of 15 to 20.

B = A factor obtained on the basis of:

(a) Average number of tutorial hours per week per class, say 7.0

(b) Teaching hours per week, say 30.

(c) Utilization factor say 0.66.

B =  $(7.0) / (30 \times 0.66) = 113.0$

#### **D.1.6. Number of Drawing Halls**

One drawing hall of 75 sq. m. is needed up to the intake of 120 students in first year. If the intake exceeds 120 students per year then two such halls to be provided. It has been worked on the basis of teaching load common for all branches. Teaching load for Drawing of other than first year students is to be adjusted in tutorial rooms. The Computer graphic laboratory is to be provided separately in computer Centre for Engineering & Technology students.

#### **D.1.7. Rooms Size for theory Classes, Tutorial Work and Drawing Halls**

The carpet area requirement of the class rooms and tutorial rooms depends upon the number and type of seating arrangement for the students and provisions for a platform, a table and a chair for the teacher. In an Engineering & Technology class, very frequently students make use of a data book, a calculator and notebook. As such he will require slightly more spacious desk as compared to the requirements of classes for students of general education. Further, as the space required for the teacher will remain the same irrespective of the class strength, the per student requirement of carpet area will increase with the decrease in class strength.

The drawing halls will have to be provided with drawing tables and stools for the students. The drawing tables must be arranged with passages so that the teacher can approach the drawing table of each student. The drawing halls will also be provided with a platform for the teacher.

Considering the above requirements and the sizes of classroom furniture and drawing tables normally used in the institution, the following carpet area norms per student are prescribed for classrooms of different sizes and drawing halls.

Type of Rooms Classification of Size	Carpet Area Requirement in Sq. m. / student	
	Minimum	Desirable
Class rooms for 15-20 students	1.3	1.5
Class rooms for 30-40 students	1.2	1.4
Drawing / examination halls	2.5	2.8

#### **D.1.8. Laboratories**

The requirements of the laboratories depend upon the programmes that are being offered by the institution, the curricula adopted for these programmes irrespective of the students population. The norms for the carpet area of the different laboratories are given in the Table below. Care should be taken to provide laboratories in all allied subjects to be taught in a program.

The number of tools/equipment/apparatus to be provided depends on the size of students group, utilization factor, capital cost and operating cost. The number of students in laboratories in any batch should not be, more than 20 with one teacher and 30 with two teachers.

Typical Layout of the Laboratories for a Marine Engineering program are essentially as given below

(a) Purpose:	Demonstrating, guiding, evaluating by the teacher and investigation, discussing, measuring and testing by the students.
(b) Terminology	The names of the laboratories should be in accordance with the terminology used in the model curriculum.
(c) Support	Technical support staff duly qualified should be provided to assist the trainees through out the lab. Work.

Sr. No.	Laboratory	Batch size	Norms for Carpet Area (sq. m.)
A.	Core Courses		
1.	Physics	20	200
2.	Chemistry	20	175
3.	Mechanics and Kinematics	20	100
4.	Materials Testing Strength of Material	20	200
* 5.	Electrical Science (a) Electronics (b) Elect. Engineering	20	200
6.	Computer Centre	20	300
B.	Marine Engineering Courses		
1.	Electrical Mechanics (Electro-mechanics)	20	350
2.	Power system Protection	20	150
3.	Measurement & Inst.	20	150
4.	Drives & Power	20	150
5.	Control Systems electrical and electronics	20	100
6.	Control Systems pneumatic and hydraulic	20	100
7.	Applied Electronics / Project	20	100
C.			
1.	Thermal Science (a) Steam (b) I. C. (c) Refrigerator (d) Heat Transfer	20	500
2.	Fluid Mechanics	20	200
3.	Measurements	20	100
4.	Dynamics of Machines	20	100
5.	Metrology	20	100
6.	Machine Tools	20	100

The above areas do not include the rooms of the teaching staff even though such staff rooms are attached to the laboratories. However, they do include the sitting space for the technical supporting staff and storage of laboratory consumables and instruments. Space for the above must be provided at the MI or other location of facility providers with proper MOU's.

#### **D.1.9. Workshops**

The workshop of an approved marine engineering training institute must have the following shops: **(Level - 1)**

- Carpentry including Pattern Shop
- Fitting Shop
- Smithy Shop
- Welding Shop
- Painting and sheet metal shop
- Foundry shop
- Machine shop
- Stores

According to the model syllabi, courses on workshop practice are to be offered to all students in engineering during the 1st and 2nd semesters. During the first semester each student has to complete about 10 to 12 exercise in Carpentry, Fitting and Smithy shops and the total batch periods of engagement will be 45. In the 2nd semester students have to complete 10 to 12 exercises in welding, painting, sheet metal. Foundry and Machine shops and for this course also the batch period of engagement will be 45. In addition, students of 4 years degree course in Marine Engineering program are required to undertake in 5th and 6th semester courses on Production Processes, which are practical components to be carried out in the workshops. For each of these courses the batch period engagement of the workshop will be 12.

To accommodate the equipment and infra-structural facilities, to organise the above mentioned course work, to provide facilities for student projects and maintenance of equipment, the workshop of the institutions must have a minimum carpet area of 900 Sqm. Since an industrial shed is more suitable for a workshop, the plinth area will be 1.25 times the carpet area. Thus, the norms for the plinth area of the workshop will be 1125 sq. m.

#### **D.1.10. Inspection Checklist / Violations**

On a bi-weekly basis, training staff will conduct a brief safety inspection of each lab to assess compliance with labeling, storage, postings, user training and access, current inventory etc. The inspection team is composed of at least one Safety Committee member. Results of the inspection are summarized and any corrective actions necessary will be taken. If necessary, a report will be provided to the faculty advisor(s) and to the training Manager.

**Inspection Checklist** : A sample list of check items are given below . Since the emphasis is on safety of trainees and trainers , each institution can prepare its own exhaustive list

- D.1.10.1. Are walkways, eyewash stations, and emergency shower stations clear of obstructions?
- D.1.10.2. Are work areas organized and tidy?
- D.1.10.3. Are chemicals stored in approved storage areas and separated from incompatible chemicals?

- D.1.10.4. Are electrical devices powered safely (no daisy chaining of power strips and no use of extension cords).
- D.1.10.5. Are all gas cylinders securely chained?
- D.1.10.6. Are all chemicals labeled and containers closed?
- D.1.10.7. Is the Emergency/Call list on the door?
- D.1.10.8. Are quantities of stored chemicals excessive?

These periodic inspections will help you identify safety hazards in the labs and will remind you of our routine safety requirements. Faculty advisors or their designated group supervisor are responsible for routine auditing of their assigned laboratory and user personnel. Equipment and procedures may be shut down if they are not in accordance with the established safety practices.

**D.1.11. Violations of safety norms :** When a faculty advisor or a safety inspector detects safety rule violations, the following disciplinary guides are recommended:

**D.1.11.1. Initial** - Verbal on-the-spot warning and thorough review of the rule to insure complete understanding. Notification to faculty advisor.

**D.1.11.2. Repeat** - Verbal on-the-spot warning and thorough review of the rule. A repeat violation noted on the safety inspection report demands immediate attention, at the expense of the regular lab work, until the safety problem is completely resolved.

When you become aware of a safety problem, please report it to a member of the Safety Committee or training Manager. Day-to-day problems or equipment design problems should be directed to the training Manager or your Faculty Advisor.

## PART - E

### GUIDELINES FOR POST SEA COURSES

#### E.1.1 General :

The guidelines for Post sea course takes into consideration the experienced mariner and the need for internationally accepted training inputs. These are normally derived from model IMO courses. Since the course may vary from a course of a few days as spelt out in IMO model courses to courses of a few weeks which are specially tailored by the Indian administration, the need for faculty may require greater range of input as well as flexibility. Some courses have been specifically tailored such as the

1. Class I management level course – refer **Engine circular No. 016 dated 3<sup>rd</sup> Oct, 2003.**
2. Revalidation and Up-gradation course for engineer refer **Engine Circular No. 015 dated 20-10-2003**

The underlying principles of objectivity, infrastructure and faculty as spelt out in these guidelines are applicable. In specialized IMO model courses, most of the requisites are spelt out. The specialty or skill is the mode of delivery and quality of delivery. The faculty would vary as per application but the essential qualifications would remain the same as specified in these guidelines. The model courses are all in the form of tutorials. The preparatory courses are a judicious mixtures of lectures and tutorials. The course content and the hours for the courses are clearly indicated in the various sections of META Manual 2. The application of methodology, provision of infrastructure requirements, faculty qualifications etc. are all spelt out in these guideline.

#### E.1.2 Preparatory courses

The Preparatory courses are specifically structured for the budding marine engineer so that he is kept abreast of current technologies and issues. These courses are continuously being updated and organized. For reference of the course content META manual 2 is the appropriate document

#### E.1.3. IMO Model courses :

Reference for all these courses shall be found in the IMO publications being issued from time to time.

#### E.1.4. Value added courses :

These courses have been also published by IMO for the benefit of marine engineers. There are certain other courses specifically devised by Shipping companies for training. Reference must be made to these guidelines for relevant applications of infrastructure, faculty, objectivity, candidate facilities etc. As regards course content reference must be made to IMO Model courses or specific courses devised by reputed training institutions.

## PART - F

### **F1. GUIDELINES FOR CONTINUED LEARNING AND BENCHMARKING FOR A RATING SYSTEM**

Building on the many best practices that have been developed for continued learning, the Directorate suggests the following guidelines for trainee engineers, their employers, educational institutions, professional licensing bodies and technical societies. These evolved credit *ratings* will be on the same format as used earlier i.e.

Grading	Notation	Marks
Very High	A	10
High	B	8
Medium	C	6
Low	D	4
Very Low	E	2

This grading will be used by the Academic councils to assess the efficacy of the entire course and the effectiveness of the involved personnel and organizations.

#### **F.1.1. Individual Trainee Engineers**

A commitment to continued professional development and competence, including:

TOPIC	CREDIT
preparing and periodically updating a continued learning plan, consistent with one's general career aspirations, with discussions with employer and colleagues.	
understanding and defining one's field of practice and the requirements for competency.	
identifying logical extensions to one's skill base and significant knowledge gaps	
maintaining accurate and full records of major achievements in engineering and the successful completion of continuing education courses.	
making a continuing time and financial commitment to continued learning; in all likelihood, this will be modest in comparison to the large past investments made to achieve one's initial engineering training and certification.	
if involuntarily terminated, identifying potential skills needed to reenter the market place. If possible, seek out employers who would be willing to consider hiring once those skills have been obtained.	

#### **F.1.2. Employers / Sponsors**

Establishing an evolving and effective professional development policy for engineering staff at all levels in the organization, including:

TOPIC	CREDIT
establishing a written or implied contract between the employer and the trainee engineer setting out the commitments of both parties to continued learning. This should be introduced at the time of sponsoring.	
maintaining a directory of available training programs relevant to the business of the company, and communicating this information to employees.	
developing in-house training programs for topics specific to the business of the employer.	
recognizing employee marine achievements in continuing education when considering opportunities for career advancement.	
providing infrastructure to support continued learning such as support staff, training rooms, and access to on-line instructional networks.	
encouraging senior engineering staff to serve as mentors to assist junior staff in developing continued learning plans.	
ensuring that continued learning accomplishments that contribute to performance and capability are recognized in performance reviews and in remuneration.	
allocating a reasonable budget for 2-5 day short courses and for periodic longer advanced credit programs, possibly cost shared and time shared with the employee (2% of the engineering budget is considered by some firms as the minimum level required).	
maintaining an awareness of emerging technologies that may affect their business several years hence, and assisting employees who have an interest in obtaining a competency in these fields.	

### F.1.3. Educational Institutions

Establishing continued learning programs for marine engineers as a major institutional mission, including:

Establishing an evolving and effective professional development policy for engineering staff at all levels in the organization, including:

TOPIC	CREDIT
ensuring close coordination among institutions to avoid duplication and to ensure maximum effectiveness.	
providing an appropriate balance between technical and management programs	
providing effective publicity about continued learning programs.	
developing remote access programs through modern information channels (e.g. through video-conferencing, television, the Internet).	
involving engineers from industry in the planning and delivery of continuing education programs.	
providing maximum flexibility in the times that courses are offered to	

industrial engineers.	
supporting and assisting the establishment of continuing education programs delivered by the private sector.	
maintaining and providing permanent and portable records of participation in both credit and non-credit courses.	
assisting alumni and local engineers, through their technical societies and professional bodies, in their further education by providing tailored educational offerings. rewarding staff who contribute and participate in the delivery of continuing education programs.	
enhancing continuing education programs in the new technologies and in those involving multi-disciplinary fields.	

#### **F.1.4. Professional bodies facilitating Licensing**

Maintaining primary responsibility for ensuring the competency of professional engineers through:

TOPIC	CREDIT
developing practical guidelines for the various participants in the continued learning process.	
publicizing availability of continuing educational programs, short courses, seminars which have been developed by public and private sector educational providers.	
maintaining records bearing on the continuing competence of professional engineers, including: a) evidence of participation in formal courses (e.g. continuing education units), and b) recognition of achievements in the profession (e.g. design innovations, research contributions, international recognition).	
taking appropriate actions in the event that individual engineers and/or their employers fail to ensure competencies are maintained through continued learning.	
developing continued learning requirements for engineers seeking to re-enter the profession after a period of absence.	
establishing continued learning guidelines for engineers wishing to practice in multi-disciplinary areas.	
establishing continued learning guidelines for engineers in management positions, including those having financial, economic and human resource responsibilities.	

### F.1.5. Technical Societies

Continuing to improve the technical and management skill of marine engineers, through:

TOPIC	CREDIT
enhancing effectiveness of traditional information sharing channels such as publications and conferences.	
expanding range of tutorials and technology updates.	
preparing advanced study plans appropriate for various technology areas.	
promoting technology development in multi-disciplinary areas in collaboration with other technical societies.	
maintaining inventory of the continuing education services available, including those of private sector service providers.	
developing continuing education offerings suitable for engineers employed by small and medium-size companies (SMEs) and those working in remote locations.	
improving access to technical information by electronic journals accessed by Internet.	

## ANNEX - 1

**LIST OF WORKSHOP EQUIPMENT : This list of equipment, tools must be in possession and can not be shared.**

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	Work benches			
	-vices	Yes	1	
	-tool storage lockers & cabinets	Yes	1	
2	Portable power tools	Yes	1	
	-drilling machines upto 10 mm dia	Yes	1	
	-pedestal grinder	Yes	1	
3	Measuring equipment			
	-external & internal verniers	Yes	1	
	-inside & outside calipers	Yes	1	
	-standard & adjustable micrometers	Yes	1	
	-depth gauges	Yes	1	
	--limit gauges-internal micrometers	Yes	1	
	-depth micrometers	Yes	1	
	-dial micrometers	Yes	1	
4	Hand Tools			
	-Flat chisels	Yes	1	
	-cross cut chisels	Yes	1	
	-diamond point chisels	Yes	1	
	-round-nose chisels	Yes	1	
	-60° centre punch	Yes	1	
	-90° centre punch	Yes	1	
	-hacksaw	Yes	1	
	-flat scraper	Yes	1	
	-half round scraper	Yes	1	
	-drills	Yes	1	
	-parallel reamers	Yes	1	
	-taper shank reamers	Yes	1	
	-hammers	Yes	1	
	-taps	Yes	1	
	-stocks & dies	Yes	1	
	-die nuts	Yes	1	
	-spanners & wrenches	Yes	1	
	-double cut rough files	Yes	1	
	-second cut rough files	Yes	1	

	-double cut smooth files	Yes	1	
	-single cut smooth files	Yes	1	
	-second cut smooth files	Yes	1	
5	Marking out table	Yes	3	
6	-Scribers	Yes	1	
	-Scribing blocks	Yes	1	
	-try square	Yes	1	
	-master square	Yes	1	
	-trammels	Yes	1	
	-protractor	Yes	1	
	-dividers	Yes	1	
	-odd leg calipers	Yes	1	
	-straight edge	Yes	1	
	-bevel gauge	Yes	1	
7	-Vee Blocks	Yes	1	
	-leveling devices (wedges)	Yes	1	
	-leveling devices (shims)	Yes	1	
8	-Pedestal grinding m/c	Yes	1	
9	-sensitive drilling m/c (app.6mm)	Yes	1	
10	Pedestal drilling m/c (app.15mm)	Yes	1	
11	Radial drilling m/c(app.35 mm)	Yes	3	
12	Elec.Powered hand drilling m/c	Yes	1	
13	Machine vices for above machines	Yes	1	
14	One forge for heat treatment	Yes	3	

## **ESSENTIAL ADDITIONAL EQUIPMENT COMPLIMENTARY TO THE TRAINING**

These are facilities which are complimentary to the equipment and tools used .

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	A small quenching tank.	yes	-	Central
2	Lockers for storing personal possessions.	yes	1	Central
3	Storage for protective clothing, e.g. overalls, gloves, goggles, safety helmets, ear muffs.	yes	1	Central
4	Washing facilities.	yes	5	Central
5	Material store areas.		-	Central
6	Material cutting facilities.		-	Central
7	Scrap disposal containers.		-	Central
8	First-aid equipment.	Yes	1 set	Central

### **MACHINE TOOLS**

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	Shaping m/c with m/c vice	yes	3	
2	One 100 mm swing machine	yes	1	
3	Three 150 mm swing machines	yes	3	
4	One 300 mm swing m/c	yes	3	
5	3 & 4-Jaw Chucks for above m/c	yes	-	Varied
6	Face plates for above machines	yes	-	Varied
7	Lathe tools like drills, etc.,	yes	-	Varied
8	Tool holders for lathe & shaping m/c	yes	-	Varied
9	Protective equipment	yes	1	
10	Following lathe tools	yes	1	
	-Straight knife-edge tool	yes	1	
	-Straight roughing tool	yes	1	
	-Facing knife-edge tool	yes	1	
	-Facing roughing tool	yes	1	
	-Straight parting tool	yes	1	
	-Round nose tool	yes	1	
	-Finishing tools	yes	1	
	-Cranked tools	yes	1	
	-Boring tools	yes	1	

## FABRICATION, WELDING, JOINING & CUTTING

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	Chalk-line	yes	1	
	Flat square	yes	1	
	Surface colouring	yes	1	
	Large dividers	yes	1	
	Large odd-leg calipers	yes	1	
2	Cutting shears for light sheet metal	yes	1	
3	Bending rolls for sheet metal	yes	1	
4	Bending m/c for small diameter pipes	yes	3	
5	Oxy-Acy. Welding & Cutting equipment	yes	3	
6	Electric-Arc Welding equipment	yes	3	
7	Steel welding benches	yes	3	
8	Soldering equipment	yes	3	
9	Brazing equipment	yes	3	
10	Protective clothing, inc. gloves, mask	yes	1	
11	Welding booths	yes	-	Central
12	Fume extraction/ventilation	yes	-	Central
13	Gas storage	yes	-	Central
14	Welding electrodes for M. S.	yes	-	Central
15	Filler rods for Mild steel	yes	-	Central
16	Mild steel plate upto 15 mm thick	yes	-	Central
17	Various steel bars, angles & sections.	yes	-	Central

## ADVANCED WORKSHOP PRACTICE

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	Hori/ Vert/ or Univ. Milling machine	yes	3	Varied
2	A range of cuttings tools & arbor	yes	-	Varied
3	Work securing vice & devices	yes	-	Varied
4	A simple dividing head	yes	-	Varied

**MARINE ENGG. DRAWING & DESIGN**

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	Benches, stools & drawing boards	yes	-	Central
2	Drawing sheet storage container	yes	-	Central
3	Drawings	yes	-	Central
	-Microfiche of an Engg. Drawing	yes	-	Central
	-Assy, Gen. Arrgt., Component, Single-part & pictorial drawings	yes	-	Central
4	Models of			
	-Cone	yes	3	
	-A Square pyramid	yes	3	
	-Intersecting cylinders	yes	3	
	-Square-to-round transition piece	yes	3	
5	Socket-head screws	yes	3	
6	Machine screws	yes	3	
7	Locking devices	yes	3	
8	Blind rivets	yes	3	
9	-'Hucbolt' fasteners	yes	3	
10	Symbols for welded constructions	yes	5	
11	Tables of limits, fits & tolerances	yes	5	
12	Symbols for geometrical tolerancing	yes	5	
13	A <i>section</i> of plain, ball & roller brgs.	yes	-	Varied
14	A <i>section</i> of rubbing & non-rubbing seals above	yes	-	Varied
15	<i>samples</i> of models with cut-away sections	yes	-	Varied
16	A supply of good quality Drg. paper	yes	-	Varied

**INDUSTRIAL CHEMISTRY**

Sr. No.	Description	In Possession	Man /Machine Ratio	Remarks
1	Acidic, alkaline & neutral solutions	yes	-	Varied
2	Alk./Acidity ind. Such as litmus papers	yes	-	Varied
3	Samples of Al. & Cu with an oxide film	yes	-	Varied
4	Samples of noble & less noble metals	yes	-	Varied
5	A galvanometer	yes	3	
6	Samples of pitting corrosion	yes	3	
7	Samples of graphitized cast iron	yes	3	
8	Samples of dezincification	yes	3	

9	Salinometers & hydrometers	yes	3	
10	Samples of gasoline, kerosene, Diesel fuel, residual boiler oil	yes		Varied
11	A <i>viscometer</i>	yes	3	
12	A flashpoint apparatus	yes	3	
13	A water-content apparatus	yes	3	

### THERMODYNAMICS

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	Calorimeter	yes	3	
2	A throttling/separating calorimeter	yes	3	

### MECHANICAL SCIENCE

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	Force boards	Yes		Varied
2	Apparatus to demonstrate pressure on an immersed surface	Yes	3	
3	Apparatus to demonstrate loss of head when water flows through a section of pipe of reduced diameter	Yes	3	

### MARINE ELECTROTECHNOLOGY

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	Model of an atom	yes	3	
2	App. To demonstrate static electricity	yes	3	
3	Examples of electrical diagrams	yes	3	
4	Ammeters	yes	3	
5	Voltmeters	yes	3	
6	Powermeters	yes	3	
7	Wiring	yes	3	
8	Connectors	yes	3	
9	Resistors	yes	3	
10	Electrical sources	yes	3	
11	Selection of marine cables	yes	3	
12	Equipment & cable runs for test purposes	yes	3	
13	Insulation testers	yes	3	
14	Continuity testers	yes	3	
15	Digital & Analogue Multimeters	yes	3	

16	Thermistors	yes	3	
17	Diodes	yes	3	
18	Clampmeter	yes	3	
19	Live-line testers	yes	3	
20	Lead-acid & alkaline batteries	yes	3	
21	Charging circuit	yes	3	
22	Distilled water	yes	3	
23	Hydrometer	yes	3	
24	Magnets	yes	3	
25	Iron filings	yes	3	
26	Solenoid	yes	3	
27	Iron-cored solenoid	yes	3	
28	Induction coil	yes	3	
29	Model AC & DC Generators	yes	3	
30	Used AC & DC Generators & Motors	yes	3	
31	Motor starters	yes	3	
32	Switches	yes	3	
33	Circuit breakers	yes	3	
34	Fuses	yes	3	
35	A sectioned transformer	yes	3	
36	An earth lamp model system	yes	3	
37	Equipment suitable for use in gas, oil & chemical tankers	-	-	Varied

## MARINE ENGG. MATERIALS

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	Tensile testing machine	Yes	3	
2	Samples	Yes		Varied
3	Sections or pictures of following welding defects are required:	Yes		
	a. overlap	Yes	3	
	b. undercutting	Yes	3	
	c. spatter	Yes	3	
	d. blowholes	Yes	3	
	e. porosity	Yes	3	
	f. inclusions	Yes	3	
	g. incomplete penetration	Yes	3	
	h. lack of fusion	Yes	3	

## MARINE HEAT ENGINES

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	A Diesel Eng. Cyl. Pressure- Vol Indicator	Yes	3	
2	Indicator diagrams for each trainee	Yes	1	
3	Portable refrigeration demonstration unit	Yes	3	

## LIST OF APP. FOR CONTROL/ *ELECTRICAL* /ELECTRONIC LAB

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	DC Position Control System Demo. Unit	Yes	3	
2	DC Motor speed Control System	Yes	3	
3	Control Engineering trainer - with Oscilloscope	Yes	3	
4	Pneumatic servo system Demo. Unit & Hyd. Servo system Demo. Unit	Yes	3	
5	Electrical machine tutor	Yes	3	
6	Induction machine tutor	Yes	3	
7	Digital Instrumentation tutor (I,II,III)	Yes	3	
8	DC Servo Motor speed - Torque Unit	Yes	3	
9	AC Servo motor speed - Torque Unit	Yes	3	
10	Temperature & Speed measurement bench	Yes	3	
11	Pneumatic circuit trainer	Yes	3	
12	Hydraulic circuit trainer	Yes	3	
13	Industrial Electronic Trainer	Yes	3	
14	OP-AMP Trainer	Yes	3	
15	Discrete Component trainer	Yes	3	
16	Digital IC Trainer	Yes	3	
17	Digital & Linear IC Trainer	Yes	3	
18	Transistor Designer, Experimental Trainer	Yes	3	
19	Magnetic Amplifier trainer	Yes	3	
20	Megger (0~1000V)	Yes	3	
	Digital & Analogue multimeters	Yes	3	
	Different Electronic Components viz.	Yes	3	

	Resistors, Diodes, Transistors, Capacitors, Inductors, IC Chips Thyristors, Triacs, etc.,			
21	Controllable DC Regulated power supplies for exp.	Yes	3	
22	SCR Voltage Regulation & Speed regulation trainer	Yes	3	
23	Digital linear Trainer	Yes	3	
24	Model Induction Motor 3 phase	Yes	3	
25	Semiconductor devices characteristics	Yes	3	
26	Three Terminal Voltage Regulator	Yes	3	
27	Measurement of power for AC Motor load & to find the p.f. with ammeter, V'meter & W/meter	Yes	3	
28	Measurement of voltage & current with the help of clip-on type ammeter-voltmeter, use of Avometer Vaccum-tube voltmeter, digital multi-meter	Yes	3	
29	To measure the insulation resistance of motors with the help of megger	Yes	3	
30	Wiring of light, fan & plug point	Yes	3	

**LIST OF EQUIPMENT IN ELECTRICAL – ENGINEERING AND CONTROL  
ENGINEERING LABORATORY**

Sr. No.	Description	In Possession	Man/ Machine Ratio	Remarks
1	Portable trainer for conducting experiments on all types of electronic components viz. germanium and silicon diodes, zener diodes, photo diodes, varactor diodes, pup-npn transistors, field effect transistors, unijunction transistors, photo transistors, diac, triac, thyrister, LED, thermister, voltage dependent register, light dependent resister, opt of coupler, linear and digital ICs.	Yes	3	
2	Portable measuring instruments viz. ultrasonic thickness gauge, meggars, motor checker, insulation tester, multimeter, clamp meter, neon testers, digital watt meters, earth leakage tester, etc.	Yes	3	
3	Electrical machine tutor for all types of electrical machines.	Yes	3	
4	Electronic trainers viz. voltage regulators, digital instrumentation tutor, temperature measurement bench.	Yes	3	
5	AC and DC servometer characteristics tutor.	Yes	3	
6	Three phase induction motor pole changing.	Yes	3	
7	DC position control demonstration unit.	Yes	3	
8	D.C. motor speed control demonstration unit.	Yes	3	
9	Process control system trainers.	Yes	3	
10	Pneumatic and Hydraulic servo system.	Yes	3	
11	Speed and torque measurement.	Yes	3	
12	Pneumatic and hydraulic circuit trainers.	Yes	3	
13	Whirling shaft apparatus.	Yes	3	
14	Microprocessor based water level control.	Yes	3	

15	PC based temperature, pressure, level control.	Yes	3	
16	Control valve characteristics.	Yes	3	
17	PC based programmable logic control.	Yes	3	
18	Pneumatic pressure controller using PI action.	Yes	3	

## ANNEX – 2

The following is a list of general laboratory equipments to be used in laboratory experiments , tests as well as workshop and is applicable to all courses.

### LIST OF GENERAL LABORATORY EQUIPMENT (Level – 2)

Sr. No.	Description	State In Possession / Shared	Man/ Machine Ratio	Remarks
1	Equipment for determination of MA, VR & Efficiency	Yes	3	
2	Combined Inclined Plane & Friction Slide apparatus	Yes	3	
3	App. For moment of inertia of flywheel	Yes	3	
4	Universal Testing Machine	Yes	5	
5	Torsion testing machine	Yes	5	
6	Impact testing machine	Yes	5	
7	Vickers cum Brinell hardness tester	Yes	5	
8	App. For det. of Thermal Cond. Of Insul. Powder	Yes	3	
9	App. For determining Heat transfer coefficient in Forced convection	Yes	3	
10	Experimental Parallel/Counter flow Heat Exchanger	Yes	5	
11	Redwood Viscometer	Yes	3	
12	Open Flash & Fire Point apparatus	Yes	3	
13	Junkers Calorimeter	Yes	3	
14	Laboratory DC Power supply	Yes	3	
15	DC Shunt Motor for Direct loading Test	Yes	3	
16	AC Motor for direct loading test	Yes	3	
17	Static speed control unit for DC Motors	Yes	3	
18	Static speed control unit for AC Motors	Yes	3	
19	Measurement of Insulation resistance	Yes	1	
21	Lead Acid battery	Yes	3	
22	Wiring Installation Testing	Yes	5	
23	Protective arrangements in Motor Starters	Yes	5	
24	Necessary tools & Instruments	Yes	-	Varied

## EXPERIMENTS IN GENERAL ENGINEERING LABORATORY ( Level – 2)

These experiments are to be carried out by trainees of all categories of courses, and can be done on shared facility basis

Sr. No.	Description	State In Possession / Shared	Man/ Machine Ratio	Remarks
1	Determination of MA, VR & Efficiency of :	Yes	3	
	Screw Jack measurements	Yes	3	
	Differential pulley block measurements	Yes	3	
2	Determination of Tensile strength, Compressive strength & Young's Modulus	Yes Yes	3 3	
3	Det. of Modulus of Rigidity	Yes	3	
4	Det. of Hardness & Impact strength	Yes	3	
5	Det. of Co-eff. Of Friction between two sliding surfaces, verification of friction laws	Yes	2	
6	Det. of moment of inertia of a flywheel	Yes	3	
7	Det. of thermal conductivity of an ins. Powder	Yes	3	
8	Det. of Heat transfer coeff. for forced convection. Comparison of performance bet. Parallel & counter-flow heat exchangers	Yes	3	
9	Det. of viscosity & flash point of an oil	Yes	3	
10	Det. of calorific value of fuel oil	Yes	3	
11	Measurement of power for DC Motor load with ammeter, voltmeter and wattmeter	Yes	3	
12	Liquid level controller operations	Yes	3	
13	On/Off temperature controller operations	Yes	3	
14	DC Motor Speed Controller operations	Yes	3	
15	Tools/Measuring Instruments/Apparatus and their operation	Yes	3	
16	Pneumatic servo system operation	Yes	3	
17	Hydraulic servo system operation	Yes	3	
18	DC Position Servo system Demonstration Unit	Yes	3	
19	Pneumatic circuit trainer	Yes	3	

20	Hydraulic circuit trainer	Yes	3	
21	Pipe surge & water hammer Apparatus	Yes	3	
22	Cavitation test apparatus audit operation	Yes	3	
23	Magnetic Amplifier Trainer	Yes	3	
24	Discrete component trainer	Yes	3	
25	Recirculating Air Conditioning trainer	Yes	5	
26	Steam turbine test rig	Yes	10	
27	Electrical machine tutor	Yes	5	
28	Control Engineering trainer with Oscilloscope	Yes	2	

### ANNEX – 3

**This list of equipments is mandatory for all institutions conducting Marine Engineering Training / Workshop training .**

#### LIST OF EQUIPMENTS

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	Pressure measuring devices	Yes	3	
2	Calibration test rig for measuring Disc. Of water thro' venture meter & orifice meter	Yes	5	
3	Calibration of test rig for measuring discharge of water through notches	Yes	5	
4	Pipe friction apparatus	Yes	3	
5	Meta centric height apparatus	Yes	3	
6	Set of valves & Pumps for dismantling & refitting	Yes	3	Varied
7	Assorted runners of pumps & turbines	Yes	3	Varied
8	Pumping set for supply of water to Laboratory	Yes	3	
9	Single cylinder 4-stroke Diesel engine test-rig	Yes	5	
10	Multi-cylinder 4-stroke Diesel engine test rig	Yes	5	
11	Refrigeration test rig	Yes	3	
12	Working/cut section Models/charts/scrap	-	-	Varied
13	Nozzle compression testing set	Yes	3	
14	Instrumentation Tutor	Yes	3	
15	Analogue To Digital Converter	Yes	3	
16	Digital To Analogue Converter	Yes	3	
17	Portable Digital Tachometer for speed measurement.	Yes	2	
18	Single-Phase Auto Transformer 0-270 v AC 20 Amp, enclosed type.	Yes	5	
19	Digital Tachometer with Different types of probes	Yes	1	
20	synchros-AC, position synchro, synchro transmitter and receiver, synchro control transformer Synchro Differential generator Demo. Unit	Yes	3	
21	3-Phase 0-470V, 30A, auto-transformer air cooled audit operation	Yes	5	

22	Cavitation test apparatus	Yes	10	
	Pipe surge & Water Hammer Apparatus with double beam storage Oscilloscope	Yes	5	
	Mitchell Tilting Pad Bearing Apparatus	Yes	5	
	Journal bearing apparatus	Yes	5	
	Refrigeration tutor	Yes	3	
	Diesel Engine Test rig with Eddy Current Dynamometer	Yes	5	
	Steam Turbine Test rig with Eddy Current Dynamometer	Yes	5	
	Self de-sludging Purifier	Yes	3	
	Samples of Marine Propulsion engine parts such as a. Piston b. Liner c. Cylinder d. Head mountings e. Fuel Pump, etc.	Yes	3	Varied
23	Cut-away view models of different kinds of ships, engine models, turbines, pumps, etc.	Yes	3	Varied
24	Different pump test rigs	Yes	3	Varied
25	Sectional models of different types of boilers - 4 types	Yes	3	Varied
26	Parallel operation of two alternators	Yes	2	
27	Material test lab, like Hardness and tensile, etc.,		-	Varied
28	Package boiler, water tube cutaway views	Yes	3	Varied
29	Working models of	Yes	3	
	a. Auto-clean Purifier	Yes	3	
	b. Oily bilge separator	Yes	3	
30	Different pipe-line valves for Overhauling/maintenance work	Yes	3	
31	Model of steering system	Yes	3	Varied

## ANNEX – 4

**For all Training Institution / Workshops Training Marine Engineering Apprentices following are the essential tools required  
(To be completed and submitted to Academic Council annually)  
(B.E. Marine, Diploma Marine , 4 Year Workshop Trainees, TME etc.)**

### **WORKSHOP EQUIPMENT, TOOLS, ETC. REQUIRED**

#### **HAND AND POWER TOOLS**

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1.	Workbenches fitted with vices tool storage lockers and cabinets.			
2.	Portable power tools such as drilling machines (for upto 10 mm drill diameter).			
3.	Small bench or pedestal grinder, etc.			
4.	Measuring equipment: external and internal verniers, inside and outside callipers, standard and adjustable micrometers (mechanical or electronic, if used), depth gauges, limit gauges, etc., internal micrometers, depth micrometers, dial micrometers.			
5.	Hand tools: flat, cross-cut, diamond-point and round-nose chisels, 60° and 90 centre punches, hacksaws, flat and half-round scrapers, drills, parallel and taper-shank reamers, hammers, taps, stocks and dies, die nuts, spanners and wrenches and double-cut rough, second-cut and smooth and single-cut smooth and second-cut files.			
6.	A marking-out table (approximately 1.25 m x 1.0 m)			
7.	Scribers, scribing blocks, try-square, master square, trammels, protractor, dividers, odd-leg callipers, straight-edge, bevel gauge.			
8.	Vee blocks, levelling devices (wedges, shims, etc.)			
9.	Power tools should include at least one			

	pedestal grinding machine, with twin wheels, for sharpening tools and fine, medium and coarse grinding wheels.			
10.	One sensitive drilling machine (approximately 6 mm diameter drill capacity).			
11.	One pedestal or pillar drilling machines (approximately 15 mm diameter drill capacity).			
12.	One radial drilling machine (approximately 35 mm diameter drill capacity).			
13.	One electrically powered hand drilling machine.			
14.	Machine vices for the above drilling machines.			
15.	One forge for heat treatment.			

### **ESSENTIAL ADDITIONAL EQUIPMENT COMPLIMENTARY TO THE TRAINING**

These are facilities which are complimentary to the equipment and tools used and are mandatory requirements for all types of institutions / workshops conducting MEIT.

Sr. No.	Description	In Possession	Man / Machine Ratio	Remarks
1	A small quenching tank.			
2	Lockers for storing personal possessions.			
3	Storage for protective clothing, e.g. overalls, gloves, goggles, safety helmets, ear muffs.			
4	Washing facilities.			
5	Material store areas.			
6	Material cutting facilities.			
7	Scrap disposal containers.			
8	First-aid equipment.			

## ANNEX – 5

**The following is a brief outline of the academic inputs against each function / subject which needs to be taught in the institutions  
(For all Training Institution / Workshops Training Marine Engineering Apprentices)**

SUBJECTS	SUBJECTS OUTLINE
Introduction to Marine Engineering Materials	Properties, selection and types of steel; properties of cast iron; alloys, heat treatment, applications.
Basic Engineering Science	Mass, volume, density, center of gravity, speed, acceleration, force, resistance, Newton's first and second laws, fundamental force equation, energy, work, power, pressure, fluid pressure head, temperature, heat, calorific values, specific heat capacity, heat transfer, effects of heat on solids, liquids and gases.
Mathematics	Simple calculations, ratios, decimals, fractions, significant figures, indices, mantissas, exponents, logarithms, evaluation, symbols for prefixes, percentages, reciprocals, squares, square roots, fractional indices, use of electronic calculators, simple algebra, simplification of brackets, linear equations, transposition, expansion, simultaneous equations, quadratic equations, angles, degrees, radians, solution of right-angled triangles, sine rule, cosine rule, sines, cosines and tangents upto 360, mensuration of simple figures, centroid, volume of simple solids, center of volume, mid-ordinate rule, Simpson's rule, graphs, sine and cosine waves, concept of differentiation and integration.
Marine Engineering Drawing and Design Parts I and II.	Types of drawing, line-work, pictorial projection, development, screw threads, fasteners, locking and retaining devices, riveted-type fastening, welding connections, dimensioning, limits and fits, geometrical tolerancing, cams, bearings, seals, lubrication of ball and roller bearings, engineering drawing practice.
Industrial Chemistry	Atoms, molecules, elements, compounds, chemical reactions, oxides, solutions, precipitation, acidity, alkalinity, corrosion, galvanic cell, electrolytes, anodes, cathodes, factors affecting rates of corrosion, surface cautions, water testing, water treatment, analysis of fresh water and seawater, scale and sludge deposits, feed water treatment, common fuels, flash point, viscosity, water content.
Hand and Power Tools	Safety, protection, marking out, hand tools, sharpening hand tools, powered hand tools, measurement, drilling, sharpening drills, annealing, normalizing, hardening,

	tempering, adhesives, bonding, joining plastics.
Machine Tools	Function of a center lathe, chucks, carriers, centers, cutting speeds, roughing, finishing, thread cutting, taper turning, function of a shaping machine, stroke adjustment, cutting speeds, selection of work, production of plane, flat and perpendicular surfaces, slots, grooves, cambers, bevels, choice of cutting tools, setting up of cutting tools, sharpening tools, cutting fluids.
Fabrication, welding, joining and Cutting.	Permanent joints, riveting, soldering, self-secured joints, safety and health when welding, principles of gas welding, principles of gas welding, welded joints in low-carbon steels, common faults in welding joints, plate work, marking out, thermal cutting, mechanical cutting, forming, bending plastics, inspection, pipe work.
Marine Engineering Maintenance Parts I and II.	Types of nut and bolt, correct spanners, set screws, studs, locking devices, tightening torque, removal of seized nuts and broken studs, surface protection, isolation of machinery, pressure relief, warning notices, blanking plates, log-book entries, hazardous spillage's, dismantling procedures, use of maintenance tools, lifting gear, transportation of heavy masses, inspection techniques, repair, replacement, re-assembly, testing, test running.
Marine Plant Operation.	Routine preparation for running, starting up, running, stopping and shutting down machinery, collection of data, normal and abnormal running conditions, detection and location of malfunctioning, procedure when faults occur.
Thermodynamics.	Properties, energy systems, energy change, heat transfer, vapors, ideal gases, gas laws, thermo-dynamic processes, work transfer.
Mechanical Science.	Solar and vector quantities representation of force, equilibrates, resultants, movement of force, couples, equilibrium, velocity acceleration, distance traveled, graphical representation, friction on a horizontal plane, force on immersed surfaces, energy in a fluid in motion, rates of volumetric and mass flow.
Introduction to Marine Electro-technology	Electron theory, diagrams and symbols, simple circuits, Ohm's law, series and parallel circuits, ammeters, voltmeters, work, energy, power, electrical power supplies, basic safety, conductors, insulation, testing, measuring, principles of maintenance, batteries, magnetism, electro-magnetism, electromagnetic induction, fundamentals of generators and motors, alternating current, distribution, transformers, oil, gas and chemical tankers.

Introduction to Ships and Ships Routines.	Ship types, ship arrangements and layout, cargoes, main constructional features, enclosed spaces, tonnages, displacement, dead-weight, construction standards, crew qualifications, Classification Societies, surveys, responsibilities of crew, ship- board communications, watch-keeping routines, personal responsibilities.
Marine Engineering Materials.	Basic metallurgy, metals and processes, Non-metallic materials, Welding, Gas cutting, Materials under load, vibration.
Marine Heat Engines.	Heat-engine cycle, Ideal-gas cycles, Rankine cycles, Marine refrigeration cycle, Reciprocating internal-combustion engines, Air compressors, Marine Air Conditioning.
Marine Electro-technology.	Fault protection, Cables, Alternating current, Alternation current, Alternators, D.C. generators, Maintenance of generators and circuit breakers, A. C. motors, D.C. motors, Maintenance of motors and starters, Impedance and inductance, Lighting.
Advanced Workshop Practice.	The milling machine, Milling machine use, Project work.
Operation and maintenance of Main and Auxiliary machinery.	Marine diesel engines, Auxiliary steam boilers, Marine pumps and systems, Evaporators and distillers, Air compressors and systems, Steering gear, Refrigeration plant, Fuels and combustion systems.
Naval Architecture and Ship Construction.	Definitions of principal terms used in naval architecture, tonne per centi-metre of immersion, application of Simpson's rule, Tchebycheff's rule to areas, moment of area, volume and moment of volume. Draught and buoyancy, alteration of mean draught due to change in density of water, buoyancy and reserve buoyancy, effect of bilging amidships compartments. Transverse stability, meta-centric height, shift of C.G. due to addition or removal of mass, transverse movement of mass, suspended mass, inclining experiment. Transverse stability of ships, statistical stability at small angles of heel, distance between center of buoyancy and meta-center, effect of free surface, stability at large angles of heel, curves of statistical stability, dynamical stability. Trim, docking stability on docking. Resistance and propulsion; frictional, wave form, appendage resistance, Froude's law of comparison, model tests, estimation of resistance and power, Admiralty and fuel coefficients; propellers, definitions of common terms, simple problems on pitch, pitch ratio, apparent slip, real slip, wake, thrust and power.

## ANNEX – 6

The following is a distribution of the equipment in the workshop floor laid out as per the functional shop floor training . This is to be maintained as documentary proof of the jobs, tasks and hours spent by the institution / workshops as a record for submission / checking to Academic council, inspections and grading / benchmarking organizations.

### **MACHINE TOOLS**

#### **Teaching facilities:**

A workshop with classroom facilities is required. Most of the learning will take place in the workshop, but, as some group instruction will be necessary at various times throughout the subject, a classroom or classroom-type facilities will be necessary adjacent to the workshop. The theoretical component must also be delivered in accordance with the TAR books.

#### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1.	One shaping machine (350 mm travel) with machine vice and the following metal-turning lathes for every five trainees in the machine tool class will be needed:			
2.	One 100 mm swing machine.			
3.	Three 150 mm swing machines.			
4.	One 300 mm swing machine.			
5.	Three-and four-jaw chucks for the above machines.			
6.	Faceplates for the above machines.			

### **FABRICATION, WELDING, JOINING AND CUTTING**

#### **Teaching facilities:**

A workshop with classroom facilities is required. Most of the learning will take place in the Workshop but, as some group instruction will be necessary at various times throughout the subject, a classroom or classroom-type facilities will be necessary adjacent to the workshop.

#### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1.	Drills, Harboursing tools, etc., for use in lathes.			
2.	Tool holders for lathes and shaping machines.			
3.	Protective equipment.			

### **MARINE ENGINEERING MAINTENANCE (Level – 2)**

#### **Teaching facilities:**

When starting a training programme in plant maintenance in a training institute, the acquisition of suitable marine engineering components and machinery can be difficult, as the high cost would in most cases preclude the purchase of new equipment. The training centre can initially acquire ‘scrap’ items, or seek equipment from manufacturers and ship-owners.

#### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	Pumps.			
2	Air compressors.			
3	A small steam engine.			
4	Motor vehicle petrol engine.			
5	Diesel engines -large four-stroke.			

### **MARINE PLANT OPERATION (Level – 3)**

#### **Teaching facilities:**

A classroom with access to the marine engineering maintenance workshop and, ideally, also to a workshop equipped with operational marine machinery capable of being run in realistic conditions.

#### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records

### **ADVANCED WORKSHOP PRACTICE (Level – 2)**

### Teaching facilities:

Classroom-type facilities will be necessary for giving instruction prior to commencing practical work. Trainees will need access to all of the workshops used in Phase 1.

### Sample Task Work

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	A horizontal, vertical or universal milling machine			
2	A range of cutting tools and Arbor.			
3	Work-securing vice and devices.			
4	A simple dividing head.			

## MARINE ENGINEERING DRAWING AND DESIGN (Level – 1)

### Parts I and II

### Teaching facilities:

A room specially equipped and lit for teaching drawing, with benches, stools and drawing boards or simple drafting machines for A2 size paper for each trainee. A drawing storage chest will also be required.

#### Equipment

Each trainee will require 45° and 60° set squares with the largest side between 200 and 300 mm, HB and 2H pencils, a pencil eraser, precision pencil compasses, a 300 mm engineering scale rule and a 360° protractor.

### Sample Task Work

Sr .No.	Description	Tasks	Man hours / L. P. T.	Records
1	Assembly, general arrangement, component, single-part and pictorial drawings.			
2	Drawings with auxiliary projections.			
3	Models of a cone, a square pyramid, intersecting cylinders and a square-to-round transition piece.			
4	Symbols for welded connections(see objective 8.1)			

## INDUSTRIAL CHEMISTRY (Level – 2)

### Teaching facilities

Ordinary classroom facilities are appropriate with provision for the demonstration of or for trainees to practice on the materials and equipment listed as below.

Materials and equipment:

### Sample Task Work

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	Acidic alkaline and neutral solutions.			
2	Alkalinity/acidity indicators such as litmus papers.			
3	Samples of aluminium and copper with an oxide film			
4	Samples of noble and less noble metals.			

### THERMODYNAMICS (Level – 1)

#### Teaching facilities:

Ordinary classroom facilities are adequate.

Laboratory equipment: as specified are samples

### Sample Task Work

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	Calorimeter, to be used for determining specific heat capacities and the final temperature of mixtures			
2	An apparatus to determine the relationship between vapour pressure and temperature			
3	A throttling/separating calorimeter(steam supply required).			

## **MECHANICAL SCIENCE (Level – 1)**

### **Teaching facilities:**

Ordinary classroom facilities are required with access to force boards; these could be portable and brought into the room.

### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	Force boards, to be used			
2	An apparatus to demonstrate the pressure on an immersed surface.			
3	An apparatus to demonstrate loss of head when water flows through a section of pipe of reduced diameter.			

## **INTRODUCTION TO MARINE ELECTROTECHNOLOGY (Level – 1)**

### **Teaching facilities:**

Ordinary classroom facilities are required but with access to the equipment listed overleaf.

### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	Model of an atom,			
2	apparatus to demonstrate static electricity,			
3	examples of electrical diagrams			
4	ammeters, voltmeters, power meters,			
5	wiring, connectors, resistors,			
6	a selection of marine cables,			
7	equipment and cable runs for testing purposes,			
8	insulation testers, continuity testers,			

## MARINE ELECTRICAL MAINTENANCE (Level – 2)

### Teaching facilities

Ordinary class room teaching facilities are required .

### Sample Task Work

Sr. No.	Description	Tasks	Man hour L.P.T.	Records
1	To detect the live wire of a wiring installation with the help of a test lamp and neon tester.			
2	To detect the positive terminal of a storage battery; charging and maintenance of storage battery.			
3	To check the continuity of earth-continuity conductor and metal conduit throughout the wiring installation with the help of a bell battery set.			
4	To study the functions of protective arrangements in d. c/a .c. motor starters.			
5	To study speed control/reversal of d. c./a. c. motors.			

## INTRODUCTION TO SHIPS AND SHIP ROUTINES (Level – 1)

### Teaching facilities

An ordinary classroom is appropriate. There is no equipment and no particular textbook necessary for this subject, although ship models could be used to some advantage. Instructors will, however, have to prepare drawings for trainees' use.

### Sample Task Work

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1				
2				
3				
4				

## **MARINE ENGINEERING MATERIALS (Level – 2)**

### **Teaching facilities**

Ordinary classroom facilities are appropriate.

### **Sample Task Work**

No equipment is essential but access to a tensile testing machine would be an advantage.

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	Samples, sections or pictures of the following welding defects are required			
2	: overlap, undercutting, spatter, blowholes			
3	, porosity, inclusions, incomplete penetration and lack of fusion.			

## **MARINE HEAT ENGINES (Level – 2)**

### **Teaching facilities**

Ordinary classroom facilities are adequate. There is no requirement for laboratory work.

### **Sample Task Work**

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	A diesel engine cylinder pressure-volume indicator			
2	A diesel engine cylinder pressure-volume indicator			
3	Indicator diagrams for each trainee			
4	Portable refrigeration demonstration unit, to show evaporation and condensation.			

## ADVANCED WORKSHOP PRACTICE (Level – 2)

### Teaching facilities:

Classroom-type facilities will be necessary for giving instruction prior to commencing practical work. Trainees will need access to all of the workshops used in level - 1.

### Sample Task Work

In addition to that listed for the Level - 1 workshops, the following will be required:

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	A horizontal vertical or universal milling machine.			
2	A range of cutting tools and Arbor.			
3	Work-securing vice and devices.			
4	A simple dividing head.			

## OPERATION AND MAINTENANCE OF MAIN AND AUXILIARY MACHINERY (Level – 3)

### Teaching facilities:

Ordinary classroom facilities are adequate, but with access to a wide range of equipment

### Sample Task Work

Sr. No.	Description	Tasks	Man hours / L. P. T.	Records
1	A two-stroke marine diesel engine.			
2	A four-stroke marine diesel engine.			

## LIST OF LABORATORY EQUIPMENT

Sr. No.	Description	In Possession	Remarks
1	Apparatus for determination of velocity ratio, mechanical advantage, efficiency of		
2	Combined Inclined Plane and Friction Slide Apparatus		
3	Apparatus for Moment of Inertia of Flywheel		
4	Universal Testing Machine		
5	Torsion Testing Machine		
6	Impact Testing Machine		
7	Vickers cum Brine Hardness Tester		
8	Apparatus for determination of Thermal Conductivity of Insulating Powder		
9	Apparatus for determining Heat Transfer Coefficient in Forced Convection		
10	Experimental Parallel/Counter flow Heat exchanger		
11	Redwood Viscometer		
12	Open Flash and Fire Point Apparatus		
13	Junkets Calorimeter		
14	Laboratory D.C. Power Supply (220V)		
15	D.C. Shunt Motor for Direct Loading Test		
16	A. C. Motor for direct loading test		
17	Static Speed control unit for d. c. Motors		
18	Static Speed control unit for AC Motor		
19	Measurement of voltage and current using		
20	Measurement of Insulation Resistance		
21	Lead Acid Battery		
22	Wiring Installation Testing		
23	Protective Arrangements in Motor Starters		
24	Necessary Tools and Instruments		

**NAME OF EXPERIMENT**

Sr. No.	Description	Tasks	Records
1	Measurement of pressure by various pressure measuring device		
2	Calibration and determination of CD for: venturi-meter, orifice meter, notch.		
3	Determination of friction factor “f” for pipe flow.		
4	Determination of meta-centric height of a floating body		
5	Starting, running and stopping of: centrifugal pump, Diesel engine, vapor compression refrigeration plant		
6	Measurement of power, fuel consumption and determination of efficiency of : single cylinder Diesel engine, multi-cylinder Diesel engine.		
7	Determination of capacity and COP for vapor compression refrigeration plant.		
8	Testing of fuel injectors.		

**NAME OF DEMONSTRATION**

Sr.No.	Description	Tasks	Records
1	Study of impellers/runners (models) of centrifugal pumps and water turbines, pumps and valves.		
2	Study of marine fire-tube and water-tube boilers (charts/models).		
3	Study of reciprocating steam engines, steam turbines, petrol engine, Diesel engine (4-stroke, 2-stroke) gas turbines (charts/models/scrap).		
4	Study of : Oily water separator, fire fighting appliances (charts/models/scrap).		
5	Study of Transducers, controllers.		

## LIST OF EQUIPMENTS

Sr. No.	Description	Tasks	Records
1	Pressure Measuring Devices		
2	Calibration Test Rig for measuring discharge of water through venturimeter and orifice-meter.		
3	Calibration of Test Rig for measuring discharge of water through notches.		
4	Pipe friction Apparatus		
5	Meta-centric Height Apparatus		
6	Set of Pumps and Valves for Dismantling and Refitting exercises		
7	Assorted Runners of Pumps and Turbines		
8	Pumping sets for supply of water to Laboratory.		
9	Single cylinder 4-stroke Diesel engine test rig		
10	Multi-cylinder 4-stroke Diesel Engine Test Rig		
11	Refrigeration Test Rig		
12	Working/cut section Models/charts/scrap		
13	Nozzle Compression Testing Set		
14	Instrumentation Tutor		
15	Liquid Level controller		
16	On/off Temperature Controller		
17	D.C. Motor Speed Controller		
18	Tools/Measuring Instruments/Apparatus		
19	Pneumatic Servo System		
20	Hydraulic Servo System		
21	D.C. Position Servo System Demonstration Unit		
22	Pneumatic Circuit Trainer		
23	Hydraulic Circuit Trainer		
24	Pipe Surge and Water Hammer Apparatus		
25	Cavitation Test Apparatus		

26	Magnetic Amplifier Trainer		
27	Discrete Component Trainer		
28	Re-circulating Air Conditioning Tutor		
29	Steam Turbine Test Rig		
30	Electrical Machine Tutor		
31	Control Engineering Trainer with Oscilloscope		

## ANNEX - 7

**For all Training Institution / Workshops Training Marine Engineering Apprentices following are the essential tools required  
(To be completed and submitted to Academic Council annually)  
(B.E. Marine, Diploma Marine , 4 Year Workshop Trainees/ TME etc.)**

Models with which to demonstrate the operation and maintenance of marine equipments

### **Subject area I**

The following used machinery and components should be obtained. These should, if possible, be sectioned to expose the internal parts (the sectioning of components can form part of the skill training exercise when trainees are learning the use of machine tools).

Sr. No.	Description	State In possession / Share	Man / Machine ratio	Remarks
1	Exhaust valve	yes	5	
2	Cylinder lubricator	yes	5	
3	Fuel valve	yes	3	
4	Cylinder relief valve	yes	3	
5	Air-start valve	yes	3	
6	Crankcase relief valve.	yes	3	
7	Jerk fuel pump	yes	3	
8	Oil-mist detector	yes	3	
9	Turbocharger	yes	3	
10	Bearing shells	yes	3	
11	Piston	yes	3	
12	Simple engine governor	yes	2	
13	Air-start distributor	yes	2	

## Subject area 2

Access should be obtained to:

Sr. No.	Description	State In possession / Share	Man / Machine ration	Remarks
1	A Water tube boiler	Yes	10	
2	Boiler mountings.	Yes	3	

## Subject Area 3

The following new/ used machinery and components should be obtained. These should, if possible, be sectioned to expose the internal parts (the sectioning of components can form part of the skill training exercise when trainees are learning the use of machine tools).

Sr. No.	Description	State In possession / Share	Man / Machine ration	Remarks
1	Reciprocating displacement pumps	yes	3	
2	Gear pumps	yes	3	
3	Rotary vane pumps	yes	3	
4	Screw-displacement pumps	yes	3	
5	Centrifugal pumps	yes	3	
6	Reciprocating air pumps	yes	3	
7	Water-ring air pumps	yes	3	
8	Glands	yes	2	
9	Seals	yes	2	
10	Cocks.	yes	1	
11	Globe valves(screw-down and non-return)	yes	2	
12	Gate valves	yes	2	
13	Relief valves	yes	2	
14	Quick-closing valves	yes	3	
15	Change-over valve chests	yes	3	
16	Mud-boxes	yes	3	
17	Steam traps	yes	2	
18	Shell and tube coolers	yes	2	
19	Plate-type coolers.	yes	2	

## Subject area 4

Access should be obtained to:

Sr. No.	Description	State In possession / Share	Man / Machine ration	Remarks
1	A seawater evaporator	Yes	5	
2	Samples of seawater which has been evaporated and distilled	Yes	3	
3	Hydrometers and salino-meters to measure densities in p.p.m. and 32 nds.	Yes	3	

### Subject area 5

From a used reciprocating air compressor:

Sr.No.	Description	State In possession / Share	Man / Machine ration	Remarks
1	Cylinder cover	yes	3	
2	Piston	yes	3	
3	Relief valve	yes	3	
4	Fusible plug	yes	3	
5	Suction and delivery valves	yes	3	
6	Water-space safety valve	yes	3	
7	Bursting disc	yes	2	

### Subject area 6

From a centrifugal air compressor:

Sr. No.	Description	State In possession / Share	Man / Machine ration	Remarks
1	A volute casing	yes	3	
2	A gland	yes	3	
3	An impeller	yes	3	

## ANNEX – 8

### Questionnaire for General Details (Existing and Proposed)

**(Details provided should be only with reference to Training of Marine Engineering Apprentices Under Approval of D G Shipping)**

TOPIC	REMARKS
1. Name of the Workshop / Training institution	
2. Address of Workshop / Training Institution with Telephone No., E-Mail, Fax, Telex Etc.	
3. Whether Public Sector or Private Sector	
4. Name , Telephone Nos., E-mail, Fax No. of Management Representative (Quality, Training)	
5. General Description of various Types of Work being carried out / or products manufactured : (Give details of slipways, dry-docks, port vessels repaired annually, other company vessels repaired annually, designated shops with specialized works etc..)	
6. Annual Turnover : (Last Year)	
7. Details of various departments engaged in Training and nature of work (in brief)	
8. No. of personnel Technical / Non Technical; Skilled / Non Skilled in Each Department / shop [Attach the necessary Documents]	
9. Name and Qualification of person in-charge of each department[Attach the necessary Documents]	
10. List of important items of machinery and equipments (not including Tools, and only Marine related) [Attach the necessary Documents]	
11. No. of apprentices trained in each category such as Marine Engineering Apprentices, Trade Apprentices (General Category)	
12. No. of General Apprentices you are authorized to train under Apprentices Act :	
13. Details of Marine Engineering Apprentices Training : State separately for 10+2 entry, Diploma, Degree holders, & MERI (# Existing / Proposed)	
(a) Designation and Qualification of the Person in charge of Training (# Existing / Proposed)	
(b) No. of Apprentices being taken every year and mode of Selection – ( for mode of selection, state the norms or attach copies of norms) (# Existing / Proposed)	
(c) Duration of apprenticeship including the schedule of training in various Departments including afloat training: (# Existing / Proposed)	

(d) Particulars of actual time spent in Workshop and afloat Training (Shop wise distribution, Vessel wise distribution) ( # Existing / Proposed)	
(e) Particular of hours/ weekly off for related class room work and for attending Technical Institutions (Matrix of work hours distribution) ( # Existing / Proposed)	
(f) The grade of Diploma / Certificate Awarded, if any – a copy of the final Document issued should be attached. ( # Existing / Proposed)	
14. Number of supervisory staff in the apprenticeship Training Scheme and their Qualification : (Specifically mention if they have under gone “Training for Trainers: course.) ( # Existing / Proposed)	
15. DGS letter approving Marine Engineering Training after compliance with STCW-95 and Quality accreditation.	

# Existing – For Workshops with a training scheme already approved from DGS as on date

Proposed – For Workshop who are applying for the *First time* with a Training scheme for DGS approval

## ANNEX – 9

### STATUS OF TAR BOOKS

SR. NO.	TYPE	CODE
1.	Training Manual (in compendium with T.A.R. Books for 10+2 Entry / A.T.S./GME/DME & DSE)	001
2.	Graduate Mechanical Engineer Scheme A (1 yr. Shore Based Training)	002
3.	Diploma in Mechanical Engineer / Ship Building Tech. (2 years shore based training)	003
4.	Graduate Mechanical Engineers Scheme B (6 months ashore + 6 months at Sea)	004
5.	10 + 2 Alternate Training Scheme (Phase I, II, III)	005
6.	10+2 Entry Candidates (4 years Ashore Based Approved Training)	006
7.	<i>MERI or Equivalent</i>	<i>007</i>
8.	<i>On Board T.A.R. Book for Officer In-charge of an Engineering Watch (FG)</i>	<i>008</i>
9.	<i>On Board T.A.R. Book for Officer In-charge of an Engineering Watch (NCV)</i>	<i>009</i>

## **ANNEX – 10**

**This is a general list of equipment which must be in the possession of all Engineering Institutions conducting a 4 years degree program in D.G. approved and MERI equivalent Marine Engineering Training. These equipment must be also available in workshops which compliment a 4 years degree program as stated above**

### **LIST OF EQUIPMENT IN THE MECHANICAL HYDRAULIC LABORATORY**

1. Gear pump, reciprocating pump, centrifugal pump test rigs.
2. Series and parallel pump test rig.
3. Cavitation test rig.
4. Mitchell tilting pad test rig.
5. Ball bearing test rig.
6. Brake lining test rig.
7. Static and dynamic balancing.
8. Impressed current system.
9. Calibration of pressure gauge.
10. Metacentric height measurement.
11. Governor apparatus.
12. Heat exchanger test rig.

### **FIRE FIGHTING SYSTEM EQUIPMENTS**

1. Comprehensive fire detection, alarm, operation system using KIDDE's System.
2. CO<sub>2</sub> Fire Fighting System using compressed air.

### **LIST OF EQUIPMENT IN COLLEGE WORKSHOP**

1. Journal Bearing testing apparatus.
2. Pipe surge and water hammer apparatus.
3. Diesel engine test rig.
4. Steam turbine test rig with boiler.
5. Oily bilge separator.
6. Fuel Oil purifier.
7. Refrigeration and air conditioning tutor.
8. Gas turbine test rig.
9. Steering test rigs.
10. Welding equipment.
11. Lathe, drilling machine, grinding machine, power hacksaw, pipe handing press.
12. Turbo charges, cylinder liner, piston, turbine parts etc.

## **LIST OF EQUIPMENT IN COMPUTER LABORATORY :-**

1. Approved software package and marine 4-stroke medium speed diesel engine , two stroke diesel engine , auxiliaries simulator.
2. Simulator packages for refrigeration, hydraulics, pneumatics
3. Self study computer application in subject matters which has been indicated in course material :

The following are essential topics of competence which needs to be imparted to the trainees and which forms an essential part of the Marine Engineer Trainees curriculum .

**1) Safety, Health and Environment.**

Electrical safety

- Basics of Electrical Safety.
- Lockout and Tagging.
- Exposed Energized parts.
- Use of Equipement.
- Safety Training.

Fire Extinguisher Basics.

- Introduction to Fire Extinguishers.
- Classes of Fires.
- Fire Prevention.
- Fire Extinguisher.

Respiratory Equipment.

- Introduction to Respiratory Equipment.
- Negative Respirators.
- Positive Respirators.
- Respirator Maintenance.

**2) Industrial Process Fundamentals.**

-Fire Fighting (Tactics & Strategy).

- Basic Hose Handling.
- Preventing Hose Damage.
- Positioning.
- Small Hose Tactics.
- Large Hose Tactics.
- Supplemental Streams.
- Interior Fires.
- Dry Chemical Tactics.
- Fighting Tank Fires.
- Tank Fire Strategy.

-AC Motors.

- Magnetism.
- Types of Motors.
- Motor Control Section.

**3) Process Operations.**

-Centrifugal Pumps.

- Introduction.

- Types of Motors.
  - Pump Parts.
  - Pump Performance.
  - Pump Control.
  - Historical Troubleshooting.
  - Analytical Troubleshooting.
  - Pump Safety.
- Heat Exchangers.
- The Role of Heat Exchangers.
  - Heat Transfer.
  - Operating Heat Exchangers.
- Reciprocating Compressors.
- Introduction.
  - Equipment Description.
  - How the Equipment Works.
  - Controlling the installation.
  - Operating Procedure.
- Valves.
- Introduction to Valves.
  - Control Valves.
  - Quick Opening Valves.
  - More Valves.
  - Maintenance Tips.

4) Operator Performed Maintenance.

-Basic Skills.

- Cleaning Filters.
- Cleaning Strainers and Lines.

5) Millwright.

Pumps

- Identification of Pumps.
- How Pumps Work.
- Troubleshooting Pumps.

6) **Instrument Specialist.**

Control Valves and Actuators.

- Control Valves and Applications.
- Types of Control Valves Actuators.

7) **list of equipments in boiler chemistry and fuel oil lab**

- Portable boiler water test kits, fuel test kits, lub. Oil test kits.
- Ph meter to test boiler water.

- Flash point apparatus.
- VISGAGE for viscosity of diesel oil.
- Fuel oil gauge for viscosity of furnace oil.
- Hydrogauge for water content in liquids.

8) **list of seamanship lab equipment**

- Different types of anchors.
- Different types of slips.
- Life saving and survival appliances :-
  - Life raft.
  - Life Boat radio equipment.
  - Life Jackets, Life buoys.
  - Search light.
  - Saxtent.
  - Navigational lights, etc.

9) **Fire Fighting Equipment :-**

- Portable Diesel Engine Fire Fighting Pump.
- Fire Suit.
- Breathing apparatus.
- Different types of nozzles.
- Fire Hydrants and adaptors.
- Fire Hoses.
- Portable fire fighting extinguishers of different kinds.

10) **Models**

- Working model of breaches buoy.
- Model of knots, bends and hitches.

## **IMO MODEL COURSES**

The programme of model training courses developed out of suggestions from a number of IMO Member Governments, following the adoption of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978.

Assisted by contributions from various Governments, IMO has designed the series of courses to help implement this Convention and, further, to facilitate access to the knowledge and skills demanded by increasingly sophisticated maritime technology.

The courses are flexible in application: maritime institutes and their teaching staff can use them in organizing and introducing new courses or in enhancing, updating or supplementing existing training material.

The model courses each include a course framework (detailing the scope, objective, entry standards, and other information about the course), a course outline (timetable), a detailed teaching syllabus (including the learning objectives and competences that should have been achieved when the course has been completed by students) and guidance notes for the instructor. Many courses include background information for students in a compendium. For some titles these compendia are sold separately from the course.

New courses, relating to the 1995 amendments to the 1978 STCW Convention, are currently in the process of preparation.

### **TANKER FAMILIARIZATION (*Model course 1.01*) (2000 edition)**

This course is for officers and key ratings who have not previously served on board an oil tanker. It supersedes Model Courses 1.03 and 1.05. In covering precautions and procedures for basic safety and pollution prevention, layouts of different types of tankers, types of cargo, their hazards and their handling equipment, general operational sequence and oil tanker terminology, it meets the mandatory minimum training requirements prescribed by regulation V/i of STCW 1978, as amended in 1995.

### **TRAINING FOR OIL TANKERS (*Model course 1.02*) (1999 edition)**

This course provides advanced, specialized training for those (e.g., masters and officers) on board oil tankers who have immediate responsibility for loading, discharging and care in transit or handling of oil cargoes. The coverage of oil tanker safety, fire safety measures and systems, prevention and control of pollution, operational practice and obligations under applicable laws and regulations complies with the mandatory minimum training required by regulation V/i of STCW 1978, as amended in 1995, and the course also includes such training as is needed to apply the provisions of Annex I of MARPOL 73/78.

## **SPECIALIZED TRAINING FOR CHEMICAL TANKERS (*Model course 1.04*) (1999 edition)**

Masters, officers and others on board chemical tankers who have immediate responsibilities for the loading, discharging and care in transit or handling of cargo will fulfil the mandatory minimum requirements of regulation V/1 of STCW 1 978, as amended in 1995, by successfully completing this course. In addition to the coverage of chemical tanker safety, fire safety measures and systems, prevention and control of pollution, operational practice and obligations under applicable laws and regulations, the course covers all training necessary to apply the provisions of Annex II of MARPOL 73/78.

## **SPECIALIZED TRAINING FOR LIQUEFIED GAS TANKERS**

*(Model course 1.06) (1999 edition)*

Those masters, officers and others who have immediate responsibility for the loading, discharging and care in transit or handling of liquefied gases will need to successfully complete this advanced programme of training in safety on a liquefied gas tanker, fire safety measures and systems, pollution prevention and control, operational practice and obligations under applicable laws and regulations if they are to attain the mandatory minimum training requirements prescribed by regulation V/1 of STCW 1978, as amended in 1995.

## **DANGEROUS , HAZARDOUS AND HARMFUL CARGOES (*Model course 1. 10 plus compendium*) (1999 edition)**

The course is intended for:

- seafaring personnel responsible for the handling of packaged dangerous, hazardous and harmful cargoes aboard ships; and
- shore-based personnel, including Competent Authority and similar personnel responsible for dealing with the transport of dangerous goods by a mode of transport (national or international) whose requirements are based on the United Nations Recommendations on the Transport of Dangerous Goods.
- The course includes, but is not limited to, classification, packaging, consignment procedures, loading and segregation.

## **MARPOL 73/78 - ANNEX I (*Model course 1. 11*)**

## **MARPOL 73/78 - ANNEX II (*Model course 1.12*)**

## **ELEMENTARY FIRST AID (*Model course 1. 13 plus compendium*) (2000 edition)**

This model course provides training in elementary first aid at the support level and is based on the provisions of table A-VI/1-3 Of the STCW Code.

## **MEDICAL FIRST AID (*Model course 1. 14 plus compendium*) (2000 edition)**

This model course provides training in elementary first aid at operator's level and is based on the provisions of table A-VI/4-1 of the STCW Code.

**MEDICAL CARE** (*Model course 1. 15 plus compendium*) (2000 edition)

This model course provides training in elementary first aid at management level and is based on the provisions of table A-VI/4-2 of the STCW Code.

**PERSONAL SURVIVAL TECHNIQUES** (*Model course 1. 19*) (2000 edition)

This course should be taken by every prospective seafarer. It covers training in personal survival techniques and is based on the provisions of table A-VI/1-1 of the STCW Code.

**FIRE PREVENTION AND BASIC FIRE FIGHTING** (*Model course 1.20*) (2000 edition)

This course provides mandatory minimum training in fire prevention and fire fighting and is based on the provisions of section A-VI/1-2 of the STCW Code.

**PERSONAL SAFETY AND SOCIAL RESPONSIBILITIES** (*Model course 1.21*) (2000 edition)

This course provides mandatory minimum training in personal safety and social responsibility and is based on the provisions of section A-VI/1-4 of the STCW Code.

**PROFICIENCY IN SURVIVAL CRAFT AND RESCUE BOATS (OTHER THAN FAST RESCUE BOATS)** (*Model course 1.23*) (2000 edition)

This course covers training in the mandatory minimum requirements for the issue of certificates of proficiency in survival craft as specified in section VI/1-1 of the STCW Code.

**PROFICIENCY IN FAST RESCUE BOATS** (*Model course 1.24*) (2000 edition)

This course provides training in fast rescue boats and is based on the provisions of table A-VI/2-2 of the STCW Code.

**CROWD MANAGEMENT, PASSENGER SAFETY AND SAFETY TRAINING FOR PERSONNEL PROVIDING DIRECT SERVICES TO PASSENGERS**

**IN PASSENGER SPACES** (*Model course 1.28*) (2000 edition)

This course covers the mandatory minimum training requirements for personnel on passenger and ro-ro ships and is based on the provisions of section A-V/2 of the STCW Code.

**PROFICIENCY IN CRISIS MANAGEMENT AND HUMAN BEHAVIOUR TRAINING INCLUDING PASSENGER SAFETY, CARGO SAFETY AND HULL INTEGRITY TRAINING** (*Model course 1.29*) (2000 edition)

This course covers the mandatory training requirements for masters, chief mates, chief engineer officers, second engineer officers and every person assigned immediate responsibility for embarking and disembarking passengers, loading, discharging or securing cargo or closing hull openings on board passenger and ro-ro ships. It is based on the provisions of section A-V/2 and table A-V/2 of the STCW Code.

## **ON-BOARD ASSESSMENT (Model course 1.30) (2001 edition)**

This course is intended for masters, chief mates, chief engineer officers, second engineer officers and other persons involved in assessing the level of competence of seafarers undergoing training on board ships, in accordance with the provisions of the STCW Convention and Code.

## **MAINTENANCE PLANNING AND MAINTENANCE EXECUTION**

*(Model course 2.01 and compendium) (1990 edition)*

This highly specialized course is intended for officers, ratings and other personnel who have specific duties in connection with the planning and execution of maintenance work on board. One part of the course contains relevant topics for those who supervise and plan maintenance and the other part is for personnel who carry out work under supervision. There is a separate compendium of extracts from publications dealing with maintenance planning and control, with corrosion, paints and hull protection, ship repair administration and welding. This compendium will be needed by trainees completing either part of the course.

Revised edition in p, - available later

## **MARITIME SEARCH AND RESCUE CO-ORDINATOR SURFACE SEARCH**

*(Model course 2.02 and compendium)*

Out of print.

Revised edition in preparation — available later.

## **ADVANCED FIRE FIGHTING (Model course 2.03 plus compendium) (2000 edition)**

This course covers training in fire fighting and is based on the provisions of table A-VI/3 of the STCW Code.

## **MARITIME LAW FOR SHIPS' OFFICERS (Model course 2.04 plus compendium) (1992 edition)**

This course is intended for masters and ships' officers, and covers that part of maritime law (public and private) which directly concerns their powers, rights, duties and responsibilities in the commercial operation of seagoing merchant ships. It supplements and broadens the legal knowledge that is required for certification as master and chief mate, and which is contained in model course 7.01.

**ON-BOARD SHIP ADMINISTRATION** (*Model course 2.05 plus compendium*) (1992 edition)

This course offers training in on-board ship administration for all categories of officers who are in charge of day-to-day matters on board a ship. It includes definitions for operations management, ship management and ship administration. The compendium includes articles about liner trade agreements, UNCTAD, fleet and ship management, particular average and general average and also examples of checklists and certificates.

**CARGO AND BALLAST HANDLING SIMULATOR** (*Model course 206*) (1990 edition)

This practical course for officers and ratings aboard oil tankers provides relevant support to the shore-based training in Model Courses 1.01 and 1.02. It consists of exercises structured around the operation of the cargo and ballast installation of an oil tanker and carried out, under the supervision of instructors, in conjunction with a simulator.

**ENGINE ROOM SIMULATOR** (*Model course 207*)

Revised edition in preparation - available later
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**SURVEY OF SMALL CRAFT** (*Model course 3.02 plus compendium*) (1992 edition)

This course provides practical guidance on the conduct of surveys of small craft constructed of wood or glass-reinforced plastic to determine their general condition and their compliance with applicable international requirements and recommendations. The course includes classroom instruction, supported by laboratory demonstration or activity and observation of the construction or repair of small craft.

**SURVEY OF MACHINERY INSTALLATIONS** (*Model course 3.03 and compendium*) (1989 edition)

This course is for chief engineers, naval architects or surveyors of other disciplines who wish to become surveyors of the machinery of ships, to verify compliance with the requirements in IMO conventions regarding the safety of ships, navigation and life at sea. It covers the requirements of initial, annual, intermediate and periodical surveys, as specified in SOLAS 74 and related documents, but does not cover the survey of chemical tankers, gas carriers, special-purpose ships or mobile offshore units. There is a separate compendium which includes extensive information on preparation for surveys, methods of machinery surveys, non-destructive testing, survey of machinery systems, of boilers and pressure vessels, of steam turbines, of diesel engines, of gearing arrangements, of shafting arrangements and of steering gear systems.

## **SURVEY OF ELECTRICAL INSTALLATIONS (*Model course 3.04 and compendium*) (1989 edition)**

This course is for chief engineers, or for others who are suitably qualified and have practical experience related to the operation of electrical systems and equipment, who wish to become surveyors of the electrical installations of ships, to verify that they comply with the requirements of IMO conventions regarding the safety of ships, navigation and life at sea. It covers the requirements of initial, annual, intermediate and periodical surveys, as specified in SOLAS 74 and related documents, but does not cover the survey of chemical tankers, gas carriers, special-purpose ships or mobile offshore units. The separate compendium contains information on preparation for surveys, electrical installations, electrical hazard in zones with high risk of fire and explosions, unattended machinery spaces and procedures for survey of electrical installations.

## **SURVEY OF FIRE APPLIANCES AND PROVISIONS**

*(Model course 3.05 plus compendium) (1991 edition)*

This course is for master mariners, chief engineers or naval architects who wish to become surveyors of the fire appliances and provisions of ships, to verify that they comply with the requirements of IMO conventions regarding the safety of ships, navigation and life at sea. It covers the requirements of initial, annual, intermediate and periodical surveys, as specified in SOLAS 74 and related documents, but does not cover the survey of chemical tankers, gas carriers, special-purpose ships or mobile offshore units. The compendium includes information on preparation for surveys and for the survey of inert gas systems, fixed CO systems, fixed halon systems and fixed deck foam systems.

## **SURVEY OF LIFE-SAVING APPLIANCES AND ARRANGEMENTS**

*(Model course 3.06 plus compendium) (1991 edition)*

This course is for master mariners, chief engineers or naval architects who wish to become surveyors of the appropriate appliances and arrangements, to verify that they comply with the requirements of IMO conventions regarding the safety of ships, navigation and life at sea. It covers the requirements of initial, annual, intermediate and periodical surveys, as specified in SOLAS 74 and related documents, but does not cover the survey of chemical tankers, gas carriers, special-purpose ships or mobile offshore units. The compendium includes information on preparation for surveys and survey copy.

## **HULL AND STRUCTURAL SURVEYS (*Model course 3.07 plus compendium*) (1992 edition)**

The main concern of this course is the verification of compliance with the requirements in IMO conventions regarding the safety of ships, navigation, environment and life at sea. It covers the requirements for hull structures at initial, annual, intermediate, periodical and renewal and additional surveys as specified in SOLAS 74 (as amended up to the 1988 Protocol) and in the 1966 Load Lines Convention and amendments thereto, including the Protocol of 1988.

## **SURVEY OF NAVIGATIONAL AIDS AND EQUIPMENT**

*(Model course 3.08 plus compendium) (1990 edition)*

This course is for deck officers, or for those who hold an equivalent qualification and have experience related to the repair or survey of navigational aids and equipment of ships, who need to be able to verify compliance of these aids and equipment with the requirements of MO conventions regarding the safety of ships, navigation and life at sea. It covers the requirements for initial, annual, intermediate and periodical surveys, as specified in SOLAS 74 and other related documents, but does not cover the survey of chemical tankers, gas carriers, special-purpose ships or mobile offshore units. The compendium includes information on preparation for surveys and on the survey, testing and type approval of navigational equipment, with details of relevant survey training.

## **PORT STATE CONTROL** *(Model course 3.09) (2001 edition)*

This course is for officers, whether they have been ship surveyors, masters, chief officers or chief or second engineer officers, who are to be authorized by their Governments to execute port State control in accordance with regulation 19 of chapter I and regulation 4 of chapter XI of SOLAS 74, as amended, with article 21 of Load Lines 66, with articles 5 and 6 and regulations /4, 11/10, 111/8 and V/8 of MARPOL 73/78, with article X and regulation 4 of chapter I of STCW 78 and with article 12 of Tonnage 69. Those who 'successfully complete the course will be able to identify the responsibilities of a flag State to exercise control over its ships and explain the role of a port State in supplementing such control, to identify and correctly use those instruments available for port State control and to correctly identify and properly report any deficiencies to the flag State and to

## **MARINE ACCIDENT AND INCIDENT INVESTIGATION** *(Model course 3.11 and training manual) (2000 edition)*

The course is designed to introduce students to the purpose and objectives of the investigation of a marine accident or incident, using the Code for the Investigation of Marine Casualties and Incidents (resolution A.849(20), as amended by resolution A.884(21)) as guidance for actions to be undertaken. An instructor manual and a separate training manual are available.

## **ASSESSMENT, EXAMINATION AND CERTIFICATION OF SEAFARERS**

*(Model course 3.12 plus compendium) (2000 edition)*

The objectives of the course are to provide knowledge and skills for trainees to administer, supervise and monitor training and assessment of seafarer competence in accordance with the provisions of section A-1/6 of the STCW Code. It includes introductory classroom instruction on the assessment, examination and certification of seafarers (in particular masters, mates, chief engineers and engineer officers), covering the international

provisions for training, assessment, examination and certification of masters, officers and ratings; the implementation of these provisions under national law; the selection of assessment methodologies; the organization of assessments; and the issue and control

**MARITIME SEARCH AND RESCUE ADMINISTRATOR** (*Model course 3. 13 p/us compendium*)

Out of print. Revised edition in preparation - available later.
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**MARITIME SEARCH AND RESCUE MISSION CO-ORDINATOR**

(*Model course 3. 14 plus compendium*)

There are two sections in the model course for Maritime English: core section 1 and core section 2, both of which contain a separate syllabus. This system allows trainees to enter the course at a point which suits their level of English. It is recommended that instructors carry out a pre-course appraisal in order to assess the existing language level of each trainee. The syllabus in core section 1 is designed for trainees who have an elementary or lower intermediate level of English while the syllabus in core section 2 is designed for trainees who have lower intermediate or intermediate levels of English. The definitions of these language levels and the basic entry requirements for the trainee target groups are given in Part A of both sections of the course.

Core section 1 is intended to prepare trainees for entry to core section 2. However, it is possible for trainees to enter directly to core section 2 without following core section, provided that they can satisfy the entry requirements.

**MARITIME LAW** (*Model course 6128 plus compendium*) (*1993 edition*)

This course presents an outline of contemporary maritime law, from the perspective of both public and private law, for senior Government officials serving in general maritime administration and maritime safety administration and for senior technical managers of shipping companies, of port authorities and of other commercial maritime enterprises, organizations and institutions.

**TRAINING COURSE FOR INSTRUCTORS** (*Model course 6.09 plus compendium*)

Out of Print Revised edition in preparation - available later.
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## **CHIEF AND SECOND ENGINEER OFFICER (MOTOR SHIPS)**

*(Model course Z02) (1999 edition)*

This course covers the mandatory requirements of regulation 111/2 of STCW 1978, as amended in 1995, for the training requirements of chief and second engineer officers. It is based on the minimum knowledge required for certification of chief and second engineer officers on ships powered by main propulsion machinery of 3,000 kW propulsion power or more, as set out in section A-III/2 of the STCW Code.

## **ENGINEER OFFICER IN CHARGE OF A WATCH** *(Model course Z04) (1999 edition)*

This course covers the mandatory requirements of regulation III/i of STCW 1978, as amended in 1995, for the training requirements of engineer officers in charge of a watch in a manned engine room or designated duty engineers in a periodically unmanned engine-room. It is based on the minimum knowledge required for certification of engineer officers in charge of a watch in a manned engine room or designated duty engineer officers in a periodically unmanned engine-room as set out in section A-III/i of the STCW Code.

**ANNEX – 13**  
**(Level - 3 )**

**The following operational tasks that have to be complied with during workshop and of loads training at level – 3 by all institutions engaged in Marine engineering training.**

**Marine Oriented Work Shop**

1. Dismantling, overhauling, inspection & assembling of Centrifugal Pump.
2. Dismantling, overhauling, inspection & assembling of a gear pump & screw pump
3. Dismantling, overhauling, inspection & assembling of a reciprocating pump
4. Dismantling, overhauling, inspection & assembling of variable displacement pump (swash plate)
5. Dismantling, overhauling, inspection & assembling of sludge pump
6. Dismantling, overhauling, inspection & assembling of a A/E Cyl. Head
7. Dismantling, overhauling inspection & assembling of Cylinder liner, piston & piston ring
8. Dismantling, overhauling, inspection & assembling of main bearing & bottom end bearing.
9. C/Shaft deflection & inspection of C/case
10. Dismantling overhauling & testing of fuel injector.
11. Dismantling & overhauling of M/E exhaust valve.
12. Dismantling & overhauling of M/E cylinder head relief v/v, Air starting v/v.
13. Dismantling & overhauling of Turbochargers.
14. Dismantling, overhauling, inspection & & assembling of Air Compressor.
15. Dismantling , overhauling, inspection & assembling of purifier.
16. Inspection & overhauling of air bottle, mountings.
17. Working principles & demonstration of working of a hydraulic steering gear system, safety checks & routine inspection
18. Dismantling , overhauling, inspection & assembling of shell & tube type cooler.
19. Dismantling , overhauling, inspection & assembling of plate type cooler.
20. Operation & working principles of F.W. Generator & Reverse osmosis system.
21. Operation & working principles of oily water separator
22. Overhauling inspection & assembling of Boiler safety v/v.
23. Overhauling inspection & assembling of feed check v/v
24. Overhauling inspection & assembling gauze glass.
25. To fabricate & weld a pipe with given pipe length & flanges.
26. To repair a leaks pipe by fitting a dubblet.
27. To make a pipe line with bends (welding)
28. To dismantle, inspection & overhaul a hydraulic pp for deck crane.
29. Practice of welding.
30. Practice of Brazing & Soldering
31. Detection of cracks & dealing with cracked pieces
32. L.O. & fuel oil testing
33. Tracing of pipelines.

Using Turbo Diesel the Following experiments are to be performed

1. To start and stop the engine,
2. To change engine's load and speed
3. To change ambient operating conditions
4. To simulate engine faults in varying degrees
5. To mix different simulations
6. To watch engine operation parameters
7. To watch functions inside the cylinder
8. To simulate the engine sound which varies with speed
9. To carry out maintenance and repairs
10. To try out different maintenance strategies
11. To print engine data
12. To use lesson facility





3. Full Name of Candidate.
4. Age of the Candidate on the day of commencement of course.
5. Seat/Slot No. of Batch
6. Duration of Apprenticeship.
7. Anticipated date of joining.
8. Full name of College/ Institution from which the candidate has passed the degree/ diploma/ SSC/ 10+2
9. AICTE approval year and page No. (1993-1994 and 1997-1998 lists at present and new list whenever included).
10. Final percentage of marks / grade.

**CHECK LIST FOR PROFORMA 'A'**

Name of the Institute/Workshop :

Name of the Course : Approved Marine Engineering Apprenticeship  
under 10+2 Schemes/ATS/4 years Degree  
Course as Marine Engineer

Date of Commencement of course :

Sr. No.	Name of the candidate	Marks in PCM					Age limit below 20 years			% of Marks in		Remarks  [to be filled by DGS]
		Phy	Chem	Ma-ths	Tot al	%	Date of birth	Age as on Y M D			<u>Eng HSC</u> <u>SSC</u>	

All the above information has been verified by me and found to be true.

[ Signature of Head of institut

## CHECK LIST FOR PROFORMA 'A'

Name of the Institute/Workshop :

Name of the Course : One year pre-sea training in Marine Engineering  
for Graduate Engineers

Date of Commencement of course :

Sr. No.	Name of the candidate	Educational Qualification [Specify degree]	% of marks	Date of birth	Age not exceeding 24 yrs			% Marks in English			College approved by AICTE or not	Remarks	
					Y	M	D	1.1.1.1.1	SS	C			HS
	1.2												
	1.3												

All the above information has been verified by me and found to be true.

[ Signature of Head of institut

## CHECK LIST FOR PROFORMA 'A'

Name of the Institute/Workshop :

Name of the Course : Two years pre-sea training in Marine Engineering for Diploma holders

Date of Commencement of course :

Sr. No.	Name of the candidate	Educational Qualification [Specify diploma]	% of marks	Date of birth	Age not exceeding 22/23 yrs			% Marks in English			College approved by AICTE or not	Remarks
					Y	M	D	SSC	HSC	DIP		

All the above information has been verified by me and found to be true.

**Letter Head of Workshop / Institution**

**PROFORMA "B"**

Date of Dispatch : \_\_\_\_\_

Workshop : \_\_\_\_\_

Apprentice category :

<b>AP-1 (MERI)</b>	<b>AP-2 ( 10+2)</b>	<b>AP-3 (GME/GEE)</b>	<b>AP-4 (DME)</b>	<b>AP-5 (ATS)</b>	<b>AP-6 (other category)</b>
--------------------	---------------------	---------------------------	-----------------------	-------------------	------------------------------

Year of Entry	Batch No.1	Batch No.2	No.of candidates / batch	Approval Letter No.
	Month of Start of Training			

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)


**Note :** This Form if forwarded in sextuplicate to ADG(trg) within one month of commencement of training of the candidates.

Signature(In-charge Training) :

\_\_\_\_\_

Name :

\_\_\_\_\_

Designation :

\_\_\_\_\_

Date :

\_\_\_\_\_

\_\_\_\_\_

DGS approval No. of Pro-forma 'A' \_\_\_\_\_

Date : \_\_\_\_\_

Approved

Asstt. Director General of Shipping.(Training)

**Instructions for Pro-forma "B"**

- 1. S.No.
  - 2. Full Name.
  - 3. Seat / Slot No.
  - 4. Duration of Apprenticeship
  - 5. Actual Date of Joining.
  - 6. Full Name of College/ Institution from which the Candidate has passed the Degree / Diploma.
  - 7. AICTE Approval year and Page No. (1993-1994 and 1997-1998 lists at present and new list whenever included.)
  - 8. Final Percentage of Marks/Grade of qualifying examination.
  - 9. Report on general conduct and sobriety on a scale of A, B, C.
- Where **A- Good**  
**B- Satisfactory**  
**C- Poor**

**ANNEX – 15**

**Mandatory Guidelines to obtain approval from Director General of Shipping for the Institutes and for the conduct of Course for Pre-Sea Training for Merchant Navy**

**Check list for approval of Institute by Director General of Shipping (Encl : 1)**

**Ref : DGS Order No. 1 of 2003 issued vide No. 3-TR(58)/2002 dated 15-01-2003**

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**CHECKLIST FOR APPROVAL OF COURSE**  
**BY DIRECTOR GENERAL OF SHIPPING**

Sr. No.	Subject	Description	Submitted	
			Yes	No
1.	Name of the Institute			
2.	INDos No.			
3.	Address			
4.	Telephone / Fax	Tel:  Fax:		
5.	E-Mail			
6.	Name of the Proprietor / All Directors / Trustees			
7.	Name of the Company / Firm / Trust / Registered Intuitute			
8.	ISO 9000:2000 Certificate			
	(a) Accreditation Body			
	(b) Last Internal Audit			
	(c) Last External Audit			
	(d) Any Major non-conformance found in the Audit			
	(e) Management Representative			
9.	Course for which approval is sought			
	(a) Course ID.			
	(b) Course Fees	DD : Date:		
	(c) Duration of Course			
	(d) Frequency of the course in year			
	(e) Proposed No. of Trainee / Course			
	(f) Eligibility Criteria for Candidates			
	(i) 10			
	(ii) 10 + 2			
	(iii) Diploma			
	(iv) B. E.			
	(v) ATS			
	(vi) Any Other			
10.	Name of the head of the Institute			
	(a) Qualification			
	(b) Experience			
	(c) Teaching Experience			

11.	<b>Name of the Principal / Director</b>				
12.	<b>Location where Course is Conducted.</b>				
13.	<b>Are the premises owned or leased. If leased, duration of lease available from date of this application. Proof of ownership / lease to be produced. (Minimum Lease should be five years)</b>				
14.	<b>Course in Charge</b>				
	<b>(a) Name</b>				
	<b>(b) DGS Faculty Approval No. and Date</b>				
	<b>(c) Designation</b>				
	<b>(d) Qualification</b>				
	<b>(e) Experience</b>				
	<b>(f) Phone (Res.)</b>				
15(a)	<b>(a) Instructor – 1</b>				
	<b>(i) Name</b>				
	<b>(ii) DGS Faculty Approval No. &amp; Date</b>				
	<b>(iii) Designation</b>				
	<b>(iv) Qualification</b>				
	<b>(v) Experience</b>				
15(b)	<b>Instructor – 2</b>				
	<b>(i) Name</b>				
	<b>(ii) DGS Faculty Approval No. &amp; Date</b>				
	<b>(iii) Designation</b>				
	<b>(iv) Qualification</b>				
	<b>(v) Experience</b>				
15(c)	<b>Instructor – 3</b>				
	<b>(i) Name</b>				
	<b>(ii) DGS Faculty Approval No. &amp; Date</b>				
	<b>(iii) Designation</b>				
	<b>(iv) Qualification</b>				
	<b>(v) Experience</b>				
16.	<b>Support Staff</b>				
(a)	<b>Support Staff – 1</b>				
	<b>(i) Name</b>				
	<b>(ii) Designation</b>				
(b)	<b>Support Staff – 2</b>				
	<b>(i) Name</b>				
	<b>(ii) Designation</b>				
(c)	<b>Support Staff – 3</b>				
	<b>(i) Name</b>				
	<b>(ii) Designation</b>				
17.	<b>List of Equipment &amp; Publication</b>				
18.	<b>Whether the Publication &amp; Equipment are being shared with other courses or exclusively for this course. Give Details</b>				
19.	<b>Infrastructure Facilities</b>				
(a)	<b>Class Room</b>				
	<b>(i) Number</b>				
	<b>(ii) Area</b>				
	<b>(iii) Ventilation – A/C, Natural</b>				

(b)	<b>No. of Tables &amp; Chairs</b>				
(c)	<b>Toilet / Wash Rooms Facilities</b>				
	<b>(i) Gents Candidates</b>				
	<b>(ii) Ladies Candidates</b>				
	<b>(iii) No. of Toilets</b>				
	<b>(iv) No. of Wash Rooms</b>				
(d)	<b>Canteens / Catering Facilities</b>				
	<b>(i) Mess Room / Canteen Area</b>				
	<b>(ii) No. of Tables &amp; Chairs</b>				
(e)	<b>Teaching Aids (OHPs, White Board, CDs, Etc.</b>				
(f)	<b>Residential Facilities for Trainees</b>				
	<b>(i) No. of Candidates per room</b>				
	<b>(ii) No. of Toilets</b>				
	<b>(iii) Mess Room</b>				
	<b>(iv) Recreational Facilities</b>				
	<b>(v) Play Ground</b>				
(g)	<b>Library Facilities</b>				
	<b>(i) Space in sq.m.</b>				
	<b>(ii) Name of Books</b>				
	<b>(iii) Name of Journals</b>				
	<b>(iv) Seating Capacity</b>				
	<b>(v) Timings</b>				
(h)	<b>Recreational Facilities Duration / Working Hours</b>				
(i)	<b>Medical Facilities at the Institute / Near to the Institute</b>				
	<b>(i) Name</b>				
	<b>(ii) Address</b>				
	<b>(iii) Telephone</b>				
(j)	<b>Phone / STD Facility Available</b>				
20.	<b>Handouts to include</b>				
	<b>(a) Name, Address &amp; Telephone No. of Head of Institute and Course In-charge</b>				
	<b>(b) List of Instructor and Name &amp; telephone No. of Warden</b>				
	<b>(c) Guidelines for Instructors</b>				
	<b>(d) Course Objectives and Course Outline</b>				
	<b>(e) Teaching Syllabus and Time Table</b>				
	<b>(f) Course Material Topicwise</b>				
	<b>(g) Procedure for Evaluation, Criteria for Passing and Instructions for Resits</b>				
	<b>(h) Re-Examination</b>				
21.	<b>In case any short falls, Please specify and give Reasons</b>				
22..	<b>Any Other details not covered above</b>				
23.	<b>If the institute is approved for more than one course following information to be provided (see Matrix – 1)</b>				
24.	<b>No. of Hours each Faculty Member is engaged / Week</b>				
25.	<b>When was the Institute last inspected &amp;</b>				

	<i>by Whom</i>				
26.	<i>When was Surprise Inspection of Institute carried out &amp; by whom</i>				
27.	<i>Was any Course suspended.</i>				
	<i>(a) When</i>				
	<i>(b) Was it restored / when</i>				
28.	<i>Name of the Faculty Members who left the Institute in Last Year</i>				
29.	<i>Name of the Faculty Members who Joined the Institute in Last Year</i>				
30.	<i>Faculty (as per Matrix – 2)</i>				
31.	<i>Approved list of faculty for other courses Faculty drawn from other department (State Dept.)</i>				
	<i>(a) Name</i>				
	<i>(b) Qualification</i>				
32..	<i>Internal Facilities (As per Matrix -3)</i>				
33.	<i>External Facilities (As per Matrix -4)</i>				
34.	<i>Does the Academy have any other in-house courses not approved by DGS</i>				
35.	<i>Course Details (as per Matrix-5)</i>				
36.	<i>Publications / Books available to the Staff for Teaching</i>				
37.	<i>How is Knowledge of the Faculty Members / Staff Updated?</i>				
38.	<i>Certificate Details</i>				
	<i>(a) Sample of the Certificate to be issued submitted</i>				
	<i>(b) Numbering Procedure for Certificate</i>				
	<i>(c) Procedure laid down for dealing with forgeries</i>				
	<i>(d) Procedure for changing Format / Style of Certificate</i>				
	<i>(e) Record Keeping</i>				
39.	<i>Examination Assessment</i>				
	<i>(a) Appointment of Examiners</i>				
	<i>(b) Examination Process (Written, Orals etc.)</i>				
	<i>(c) Infrastructure Norms (to be attached)</i>				
40.	<i>Revision of Courses</i>				
	<i>(a) How are they Incorporated</i>				
	<i>(b) Any course where Revisions were made</i>				
41.	<i>Does Institute have tie up with any Foreign Flag for conducting courses recognized by their administration? If yes then name of Administration and course details</i>				
42.	<i>Functional Details of Institute</i>				
	<i>(a) No. of actual teaching days</i>				
	<i>(b) No. of working days lost due to strike,</i>				

	<i>etc.</i>				
	<i>(c) No. of hours class room is used (Day and Course details)</i>				
	<i>(d) Were all examinations conducted on time? If No why?</i>				
	<i>(e) Is there a grievance redressal machinery?</i>				
	<i>(f) Whether performance of teachers is assessed through annual appraisal</i>				
	<i>(g) Whether there is provision of assessing teachers based on student appraisals ?</i>				
43.	<i>Means of knowing the Latest Amendments</i>				

The Following Matrix to be used

**MATRIX – 1**

Name of course →				
Name of faculty ↓				

Name of course	DGS Approval No. (ID)	No. of candidates	Frequency (week/month/year)	Date of approval/inspection

**MATRIX – 2**

Faculty/lecture matrix

Subject →				
Faculty ↓				

Faculty/tutorial matrix

Subject →				
Faculty ↓				

Faculty/practical matrix

Subject →				
Faculty ↓				

**MATRIX – 3**

Use matrix(equipmentwise)

Name of course → Equipment ↓				

**MATRIX – 4**

External facilities Use matrix(equipmentwise)

Name of course → Equipment ↓				

**MATRIX – 5**

Course	Course date	No. of candidates	Passed	Failed

I certify that the information furnished above is correct and true to the best of my knowledge and belief. I understand that if any information is found false my application will be treated as cancelled and I shall also be liable for penal action initiated by the D.G. Shipping.

\_\_\_\_\_  
(Name & Signature of the Management Representative ~~Proprietor~~/Director)

Date : \_\_\_\_\_

Place : \_\_\_\_\_

Note:

1. The institutes have to fill up the description column giving the details/annexure no./page no. in which the information of the subject is provided.
2. The experience stated in the bio-data of the faculty members/instructors have to be supported by valid documents like CDC,COC,etc.
3. The training branch tick marks under “YES / NO” column “Submitted” and signs the “Submitted” column.
4. If any short comings are noticed/seen they have to be entered in “REMARKS” column.

**ANNEX – 16**

**FORMAT OF CERTIFICATE TO BE ISSUED BY INSTITUTIONS & TRAINING CENTRES  
(PRE SEA COURSES )**

INSTITUTE LOGO & NAME OF THE INSTITUTE  
(5" X 1.5")

PHOTO  
**(30mm X 40 mm)**

*This is to certify that*

(TAR Book No. \_\_\_\_\_) in compliance with Director General of Shipping letter No. \_\_\_\_\_ dated \_\_\_\_\_ and categories as mentioned in section M - III / I of META Manual (Volume I) at Sr. No. \_\_\_\_\_ \*, has been imparted training in **Name** **Of Institute.** covering the functions (as in paras 2.3, 2.4, 2.5 and 2.6 of Annexure 1 of STCW 1995 code) and competencies to the extent recorded in training & Assessment Record Book in accordance with the competencies as per Table A-III/I of STCW 1995 Code.

**The following is full and true statement of Workshop Practical Training undergone by above mentioned apprentice/trainee under our supervision in the under mentioned competencies**

**with effect from \_\_\_\_\_ for a period of \_\_\_\_\_**

Competencies covered	Shop Floor	Hours	Grade	Competencies covered	Shop Floor	Hours	Grade

**ABILITY :** \_\_\_\_\_ **CONDUCT :** \_\_\_\_\_

Signature of Official                      Signature of Apprentice/Trainee                      Signature of Training Officer  
for Marine Engineering

\* Insert as appropriate from disciplines mentioned on backside.

**BIO-DATA ( IN BRIEF )**

Date Of Birth :  
Entry Qualification:  
Identification Marks:

Nationality :

Place Of Birth :  
INDos No.

Competence No.	Description of Competency	Competence No.	Description of Competency
1.	Use of appropriate tools for fabrication repair operations typically performed on ships	8b	Maintain alternators generators & Control Systems
2.	Use of hand tools and measuring equipment for dismantling Maintenance, repair & reassembly of shipboard plant & equipments	9.	Maintain Marine Engineering systems including Control Systems.
3.	Use of hand tools electrical & electronic measuring & test equipment for locating & repairing faults & malfunction	10.	Ensure compliance with pollution prevention requirements
4.	Maintain s safe Engineering watch	11.	Maintain Sea worthiness of ship.
5.	Use of English in written and oral form (COURSE DELETED)	12.	Prevent Control and fight fires on board
6.	Operate main and auxiliary machinery and associated control system	13.	<b>1.4 <u>Operate life saving appliances</u></b>
7.	Operate pumping systems & associated Control Systems	14.	Apply Medical first aid on board
8.	Maintain alternators generators & Control Systems	15.	Monitor compliance with legislative requirements

**1.4.1.1.1 Detail description of Functions**

Function 2.3	Controlling the operation of the ship and care for persons on board at operation
Function 2.4	Marine Engineering at operational level
Function 2.5	Electrical, Electronic and Control Engineering
Function 2.6	Maintenance and Repair at the operational level

SR. NO.	1.4.1.2 DISCIPLINE	TRAINING PERIOD
4/2	Diploma in Mechanical Engg. / Diploma in Ship-building Engg.	24 Months
4/3	Graduate in Electrical Engg. / Graduate in Electrical and Electronic Engg.	18 Months
4/4	Graduate in Mechanical Engg. / Graduate in Naval Architecture.	12 Months
4/5	4 years workshop Training under 10+2 Scheme	48 Months

1.4.2 GRADES	
A	VERY GOOD
B	GOOD
C	FAIR
D	SATISFACTORY
E	POOR

If any grade mentioned in certificate is 'E', the competency of the candidate will be checked by MMD Prior applying for Class IV part A examination.

ANNEX – 17

FORMAT OF CERTIFICATE TO BE ISSUED BY INSTITUTIONS & TRAINING CENTRES  
(POST SEA COURSES )

Certificate No:

<Name of Institute>

<Address>

<Country name>

Tel:

Fax:

<Title>

This is to certify that

Date of Birth:

Nationality:

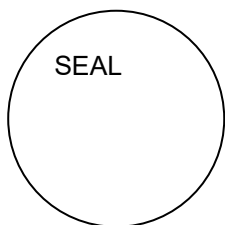
Passport No:

Discharge Book No:

Has satisfactorily completed a programme of training approved by the <Maritime Administration of <country's name>>, under the provisions of:

**· Regulation < number> of the <Title of national regulation/law>, and**  
**· Regulation <number> of the International Convention on Standards of Training,**  
**Certification and**  
**Watchkeeping for Seafarers, 1978, as amended, and Section A-<number paragraph> of**  
**the**

Signature of Holder: \_\_\_\_\_



\_\_\_\_\_  
**Training Co-ordinator**

\_\_\_\_\_  
**Director, Maritime**

**Academy**

**Date of Issue:** \_\_\_\_\_

**Date of Expiry:** \_\_\_\_\_