# NATIONAL BOARD OF ACCREDITATION

## SELF ASSESSMENT REPORT (SAR)
## FOR ACCREDITATION OF
## UG ENGINEERING PROGRAMMES
## (TIER-I)

# METALLURGICAL AND MATERIAL ENGINEERING DEPARTMENT


**NATIONAL BOARD OF ACCREDITATION**

**4th Floor East Tower, NBCC Place**
**Bhisham Pitamah Marg, Pragati Vihar**
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**(January, 2013)**

# Contents

# Self Assessment Report (SAR)
# Part A
# 1. Institutional Information

1.1. **Name and address of the institution and affiliating university:**
VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY (VNIT),
SOUTH AMBAZARI ROAD, NAGPUR 440010

1.2. **Name, designation, telephone number, and e-mail address of the contact person for the NBA:**

Dr. Narendra S. Chaudhari, Director VNIT.
Ph : 0712-2801363
Email : director@vnit.ac.in

Dr. K D Kulat, Professor, Department of Electronics Engineering
Ph : 0712-2801345
Email : kdkulat@ece.vnit.ac.in / kishor_kulat@yahoo.com

1.3. History of the institution (including the date of introduction and number of seats of various programmes of study along with the NBA accreditation, if any) in a tabular form:

### 1.3.1 Historical Background

The VNIT, Nagpur is one of the thirty National Institutes of Technology in the country. The Central Government by Act of Parliament (National Institutes of Technology Act, 2007 (29 of 2007)) declared VNIT Nagpur as an Institute of National Importance. The Act was brought into force from 15th August 2007. VNIT Nagpur was conferred the Deemed to be University status (under University Grants Commission Act, 1956 (3 of 1956)) with effect from 26th June 2002 by the Central Government.

Earlier, the Institute was known as Visvesvaraya Regional College of Engineering (VRCE). It was established in the year 1960 under the scheme sponsored by Government of India and Government of Maharashtra. The college was started in June 1960 by amalgamating the State Government Engineering College functioning at Nagpur since July 1956. In the meeting held in October 1962, the Governing Board of the college resolved to name it after the eminent engineer, planner, and statesman of the country Sir M. Visvesvaraya.

### 1.3.2 Location

Nagpur known as Orange City is centrally located and well-connected to all the parts of the country by air, rail and road. It is also the second capital of Maharashtra. Nagpur is the largest city in central India and the winter capital of the state of Maharashtra. It is a fast growing metropolis and is the third most populous city in Maharashtra after Mumbai and Pune, and also one of the country's most industrialized cities. With a population of 2,405,421, Nagpur is the 13th most populous city and 13th largest urban agglomeration in India. It is the 154$^{th}$ largest agglomeration and 164$^{th}$ largest contiguous urban areas in the world.

Nagpur is the seat of the annual winter session of the Maharashtra state assembly, "Vidhan Sabha". Nagpur is a major commercial and political centre of the Vidarbha

region of Maharashtra. In addition, the city derives political importance from being the headquarters for the Hindu nationalist organisation RSS and an important location for the Dalit Buddhist movement.

According to a survey by ABP News-Ipsos, Nagpur has been identified as the best city in India by topping the liveability, greenery, public transport, and health care indices. It is famous for the Nagpur Orange and is known as the "Orange City" for being a major trade center of oranges cultivated in the region.

The city was founded by the Gonds and later became a part of the Maratha Empire under the royal Bhonsale dynasty. The British East India Company took over Nagpur in the 19th century and made it the capital of the Central Provinces and Berar. After the first reorganisation of states, the city lost its status as the capital. Following the informal "Nagpur Pact" between political leaders, it was made the second capital of Maharashtra.

Nagpur is also called the "Tiger Capital of India" as it connects many tiger reserves in India to the world. It is among the important cities for the Information Technology Sector in Maharashtra. Nagpur lies at the dead center of the country with the Zero Mile marker indicating the geographical center of India. City of Nagpur is considered as geographic centre of India with its famous Zero Mile stone. Major National highways and rail networks connecting Delhi with Hyderabad/ Bangalore/Kanyakumari and Mumbai with Kolkata pass through the city. It is now recognized as Tiger Capital of India with major Tiger National parks around in the city. It s popularly known as "Orange City". Nagpur is second capital of Maharashtra State.

VNIT is located in the heart of Nagpur city on sprawling campus of 214 acres. The campus can be located on Google maps as VNIT, N $21^0$, 7' 28",E $79^0$, 3' 8". The official website address for VNIT is: *www.vnit.ac.in*.

### 1.3.3 Regular Academic Programmes*:*

## Academic Programmes

The Institute offers 9 Under-Graduate programs viz., B. Tech. in Chemical, Civil, Computer Science, Electrical and Electronics, Electronics and Communication, Mechanical, Metallurgical and Materials, and Mining Engineering and Bachelor of Architecture.

The Institute also offers 18 Post-Graduate Full time programs (2 years duration) viz., M. Tech. in Industrial Engg., Heat Power Engg, CAD-CAM, Materials Engg, VLSI Design, Communication System Engineering, Computer Science Engg., Integrated Power System, Power Electronics and Drives, Structural Engineering, Structural Dynamics and Earthquake Engineering, Environmental Engineering, Water Resources Engineering, Construction Technology and Management, Transportation Engineering, Excavation Engineering, Chemical Engineering and Urban Planning. The Institute also offers M.Tech. by research program in all engineering departments, Ph D (Full/Part Time). Institute has stared M.Sc. programs in Chemistry, Mathematics and Physics from current year. The Doctoral Research is done in all Engineering and Sciences departments. Institute is a recognized centre under QIP scheme for Ph.D. program in Electrical and Metallurgical & Materials Engineering department and for M. Tech. program in Electrical and Civil Engineering departments.

| Sr.No. | Program Name | Year | Intake Capacity |
|---|---|---|---|
| **Under Graduate Program : B. Arch/B. Tech.** | | | |
| 01. | Architecture | 1960 | 62 |
| 02 | Chemical Engineering | 2006 | 92 |
| 03. | Civil Engineering | 1960 | 92 |
| 04. | Computer Science Engg. | 1987 | 92 |
| 05. | Electronics and Communication Engineering | 1980 | 92 |
| 06. | Electrical And Electronics | 1960 | 92 |
| 07. | Mechanical Engineering | 1960 | 92 |
| 08. | Metallurgical and Materials Engineering | 1965 | 92 |
| 09. | Mining Engineering | 1982 | 40 |
| | **TOTAL** | | **738** |
| **Post Graduate & Research Programs : M. Tech.** | | | |
| 01. | Environmental Engineering | 1966 | 26 |
| 02. | Water Resources Engineering | 2011 | 22 |
| 03. | Construction Technology and Management | 2010 | 22 |
| 04. | Transportation Engineering | 2012 | 22 |
| 05. | VLSI Design | 2007 | 26 |
| 06. | Communication System Engineering | 2012 | 26 |
| 07. | Computer Science Engineering | 2007 | 24 |
| 08. | Industrial Engineering | 1989 | 23 |
| 09. | Heat Power Engineering | 2002 | 23 |
| 10. | CAD-CAM | 2007 | 23 |
| 11. | Integrated Power System | 1968 | 25 |
| 12. | Power Electronics & Drives | 2010 | 25 |
| 13. | Materials Engineering | 2005 | 22 |
| 14. | Structural Dynamics and Earthquake Engineering | 2003 | 22 |
| 15. | Structural Engineering | 1991 | 25 |
| 16. | Excavation Engineering | 2012 | 20 |
| 17. | Urban Planning | 1988 | 22 |
| 18. | Chemical Engineering | 2015 | 24 |
| | **TOTAL** | | **422** |
| **M Sc.** | | | |
| 01. | M Sc Chemistry | 2013 | 20 |
| 02. | M Sc Mathematics | 2013 | 20 |
| 03. | M Sc Physics | 2013 | 20 |
| | **TOTAL** | | **60** |

### 1.3.4 Accreditation Status:

National Board of Accreditation granted accreditation to the various eligible programs in 2009 wide letter No. F.No. NBA/ACCR-44 (II)/2002, Dated 2nd March 2009. The details are given below:

The Accreditation Status of the programme(s) are:

| Sr.No. | Name of UG & PG Programme(s) | Accreditation Status | Period |
|---|---|---|---|
| 01. | B.Tech. Electronics & Comm. Engg. | Accredited | 5 years |
| 02. | B.Tech. Mechanical Engg. | Accredited | 2 years |
| 03. | B.Tech. Civil Engg. | Accredited | 5 years |
| 04. | B.Tech. Computer Science & Engg. | Accredited | 2 years |
| | B.Tech. Chemical Engg. | Accredited | 2 years |
| 05. | B.Tech. Mining Engg. | Accredited | 5 years |
| 06. | B.Tech. Metallurgical & Materials Engg. | Accredited | 5 years |
| 07. | B.Tech. Electrical & Electronics Engg. | Accredited | 5 years |
| 08. | M.Tech. Integrated power System | Accredited | 3 years |
| 09. | M.Tech. Structural Dynamics & Earth Quate Engg. | Accredited | 3 years |
| 10. | M.Tech. Environmental Engg. | Accredited | 3 years |
| 11. | M.Tech. Structural Engg. | Accredited | 3 years |
| 12. | M.Tech. VLSI Design | Accredited | 3 years |
| 13. | M.Tech. Industrial Engg. | Accredited | 3 years |
| 14. | M.Tech. Computer Science & Engg. | Accredited | 5 years |
| 15. | M.Tech. Structural Engineering | Accredited | 5 years |
| 16. | M.Tech. Integrated Power System | Accredited | 2 years |
| 17. | M.Tech. Materials Engineering | Accredited | 5 years |
| 18. | M.Tech. Environmental Engineering | Accredited | 2 years |
| 19. | M.Tech. Ferrous Process Metallurgy | WITHDRAWN | |
| 20. | M.Tech. Ferrous Process Metallurgy | WITHDRAWN | |

(Total number of programmes Accredited vide this letter – Twelve and Withdrawn –Two)

**New M.Tech. Programs started (year)**

| Sr.No. | Title of Program | Intake |
|---|---|---|
| 01. | Transportation Engineering (2011) | 20 |
| 02. | Communication System Engineering (2012) | 20 |
| 03. | Water Resources Engineering (2011) | 20 |
| 04 | Construction Technology and Management | 20 |
| 05 | Excavation Engineering (2012) | 20 |
| 06 | Chemical Engineering (2015) | 20 |
| | **Total Increased Intake** | **120** |

**Institute has following ranked in various ranking surveys 2015:**

- 11th Best Engineering Institute in India and the first among NITs in i3RC Times Engineering survey.

- 14th Top Engineering College in India and 2nd in Western India as per EDU-RAND rank.
- 25th Top Engineering College in India and 3rd in Western India as per digital LEARNING India.
- 27th Top Engineering College in India as per Outlook magazine.

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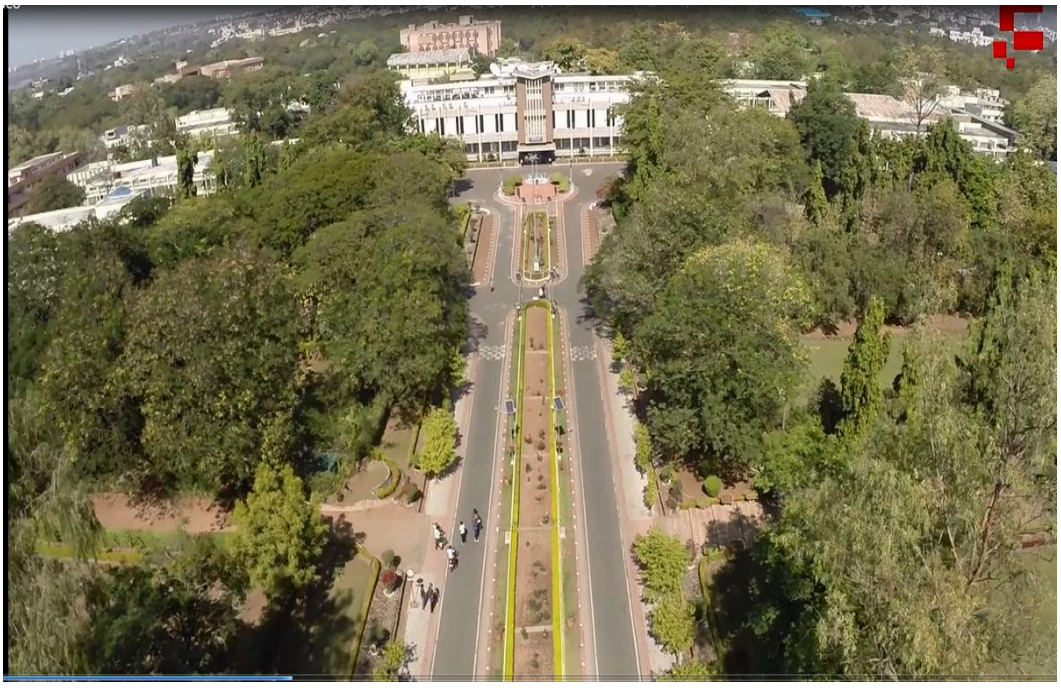
## Campus

VNIT Campus is spread over an area of 214 acres near Ambazari lake. It presents a panorama of harmony in architecture and natural beauty.



The campus has been organized in three functional sectors; ,l ,

- Hostels for students, Health centre, sports complex
- Academic Buildings, Administrative Building, and Library
- Residential Sector for family & staff

The academic buildings are located fairly in close proximate, to the hostels and the staff quarters. The campus has a full-fledged computerized branch of State Bank of India with ATM facility, Canara Bank, Post office as well as courier services and other needs of students, residents and office are nearby.

The Institute has its own fully fledged Health Center with a full time residential Medical Officer. The specialized medical services of a Psychological Counsellor, Dietician, Physiotherapist, Pathology lab, Yoga centre, and also medical consultants in Ayurveda and Homeopathy are available. Patients suffering from serious illness / requiring intensive care are referred to the Govt. Medical College and Hospital and other Health

care centres duly approved under the CGHS. A full time dedicated Ambulance service in available at the dispensary.

Spacious and multicuisine canteen is located close to the instruction zone and hostels. Two more cafeterias exist on the campus. The Institute has a well equipped Gymkhana apart from various playgrounds for Tennis, Badminton, Volley Ball, Foot Ball, Hockey, and Cricket. NCC unit is also located on campus. There are very well used by students and campus residents of quarters.

**1.4. Ownership status: Govt. (central/state) / trust / society (Govt./NGO/private) /private/other:**

**CENTERAL GOVT. MHRD**,

Declared as Institute of National Importance by NIT Act of 2007 (29 of 2007)

**1.5. Mission and Vision of the Institution:**

## Mission

The Mission of VNIT is to achieve high standards of excellence in generating and propagating knowledge in engineering and allied disciplines. V.N.I.T. is committed to providing an education that combines rigorous academics with joy of discovery. The Institute encourages its community to engage in a dialogue with society to be able to effectively contribute for the betterment of humankind.

## Vision

To contribute effectively to the national endeavour of producing quality human resource of world class standard by developing a sustainable technical education system to meet the changing technological needs of the Country, incorporating relevant social concerns and to build an environment to create and propagate innovative technologies for the economic development of the Nation.

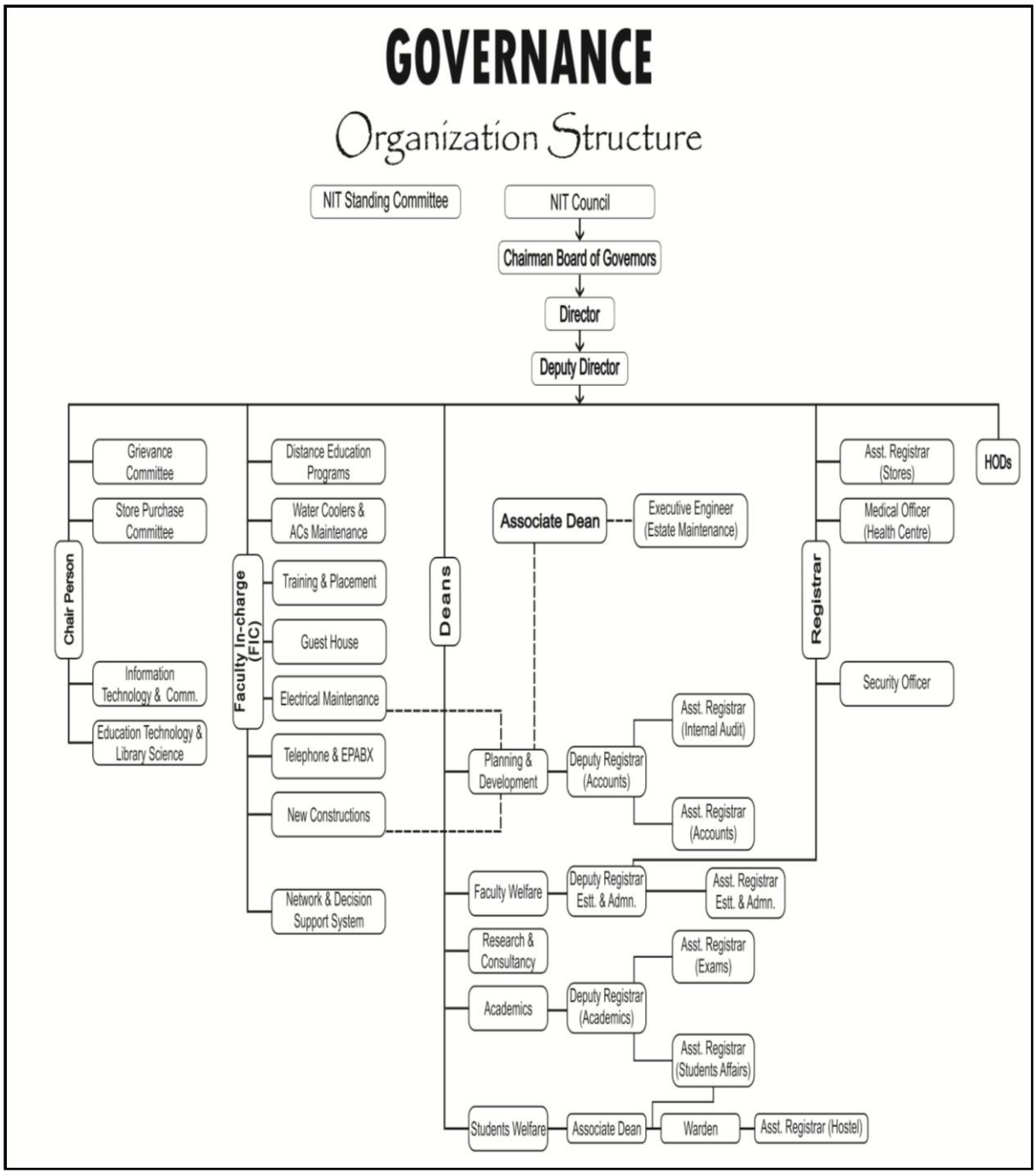
**1.6. Organisational Structure:**

1.6.1 **Administration**

As per the provisions of the NIT Act, the Board of Governors (BoG) is responsible for superintendence, direction, and control of the Institute. Thus, the BoG is vested with full powers of the affairs of administration / management and finances of the Institute. Members of the Board represent Government of India, Government of Maharashtra, Industries, and faculty of the Institute. The Director is the principal academic and executive officer of the Institute. Besides the BoG, the Senate, the Finance Committee (FC) and the Building and Works Committee (BWC) are statutory committees and therefore, authorities of the Institute.

Apart from the above statutory committees, the Board has the power to constitute various sub-committees for smooth and efficient administration. Thus, the Board has constituted the Stores Purchase Committee (SPC), Grievance Committee (GC), and Special Cell. The SPC administers the centralized procurement of equipment and material whereas the GC provides a platform to hear the views of staff and faculty on grievances. The Special Cell functions to protect the interest of backward-class candidates through procedural, institutional, and other safeguards.

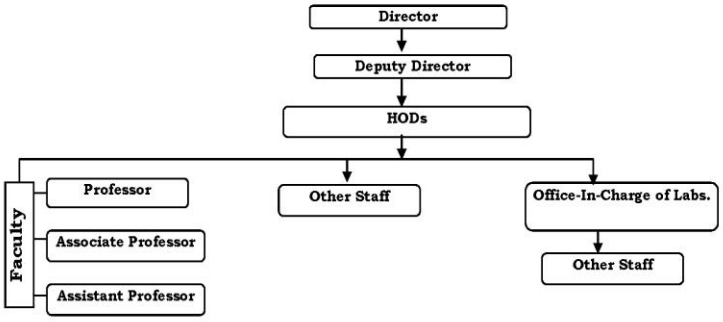
### 1.6.2 Flow Chart showing Institutional Administration



## 1.6.3 Flow Chart showing the hierarchy of Academic Departments

Figure - 2

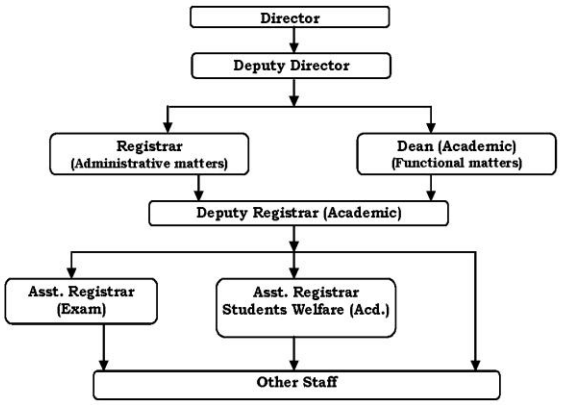
**1. ACADEMIC DEPARTMENTS**




| | Reporting Officer | Reviewing Officer |
|---|---|---|
| Professor | Director | Director |
| Associate Professor / Assistant Professor | HoD | Director |
| Group – A other than above | HoD | Deputy Director/ Director |
| Group – C/Other Staff | Lab-In-Charge / HoD | HoD |

**Note:** i) In case Associate Professor is HoD, Director shall also be Reporting Officer for all the Associate Professor in that Departments.
ii) In case, Assistant Professor is HoD, Director shall also be Reporting Officer for all faculty.

**2. ACADEMIC SECTION**




| | Reporting Officer | Reviewing Officer |
|---|---|---|
| Group – A | Registrar * | Deputy Director /Director |
| Group – C/Other Staff | Section Head | Registrar |

* In consultation with Dean (Academic)

**1.7. Financial status: Govt. (central/state) / grants-in-aid / not-for-profit / private self-financing / other:**

(Instruction: Financial status of the institute has to be mentioned here.)

**CFI (Centrally funded institution)**

**1.8. Nature of the trust/society**:

Also list other institutions/colleges run by the trust/society

(Instruction: Way of functioning and activities of the trust/society have to be listed here.)

| Name of the Institution | Year of establishment | Location |
|---|---|---|
| NA | - | - |

**1.9**. **External sources of funds**: (Rs. in Lacs)

| Name of the External Source | CFY 2015-16 | CFY 2014-15 | 2zCFY 2013-14 |
|---|---|---|---|
| Plan | **4487.84** | **7207.29** | **8730.90** |
| Non Plan | **5720.71** | **6460.53** | **4441.53** |

(Instruction: The different sources of the external funds over the last three financial years are to be listed here.)

**1.10 Internally acquired funds:** (In Rupees)

| Name of the Internall Source | CFY 2015-16 (as on 31 Dec. 2015) | CFY 2014-15 | CFY 2013-14 |
|---|---|---|---|
| Students' fee | **3056.44** | **2536.51** | **1614.58** |
| Interest & Other Income | **1189.56** | **752.54** | **486.44** |

(Instruction: The different sources of the internal funds over the last three financial years are to be listed here.)

**1.11 Scholarships or any other financial assistance provided to students?**

VNIT Nagpur is making available to it's students and research scholars several avenues for receiving assistance towards scholarships, free ships etc. some of the several scholarships available to VNIT students are :

[1] Indian Oil Corporation Scholarship, Indian Oil Corporation has announced 2600

Scholarships for students of 10+/ITI, MBBS, Engineering & MBA on merit basis.

[2] NTPC Scholarship, NTPC is offering 35 scholarships to students belonging to SC/ST/PC categories persons who are pursuing 4 years full time degree course in engineering on a competitive basis for applicant from NIT.

[3] ONGC Engineering Scholarships ONGC offers 75 Scholarships for SC/ST students who are pursuing higher education in Engineering, Geology, Geophysics and MBA.

[4] GATE stipend for qualified post graduate students.

[5] AICTE PG Scholarship 2013 for M.E./M.Tech/M.Pharma Students AICTE PG Scholarship 2013 for M.E./M.Tech/M.Pharma second year students.

[6] AICTE Scholarships for GATE Qualified Candidates 2013 For GATE Qualified Candidates 2013 for M.E./M.Tech/ second year students.

[7] Cargill Global Scholarships Program for Undergraduate Students 2013 Cargill Global Scholarships Program for Undergraduate Students 2013 is the global scholarship program for India, Brazil, Russia, China and the USA countries.

[8] North South Foundation Scholarships 2014 (NSF) Scholarships 2014 for those doing BE/BTech.

[9] NATIONWIDE EDUCATION AND SCHOLARSHIP TEST (N.E.S.T.) 2013 Natinalwide education and scholarship test (n.e.s.t.) 2013 For Degree Students of Science Engg. Courses.

[10] Scholarship for Physically Handicapped Students National Handicapped Finance and Development Corporation (NHFDC).

[11] MOMA scholarship–Annually government of India offers 20000 scholarships that distributed among the students of minority communities throughout the country, to eligible students from this institute.

[12] State Government Scholarships from Social Welfare Department for eligible students from this institute.

The aggregate amount of Scholarship amount in (Rs.) year wise is indicated below:

| **Details** | **CFY 2015-16** | **CFY 2014-15** | **CFY 2013-14** | **CFY 2012-13** | **CFY 2011-12** | **CFY 2010-11** |
|---|---|---|---|---|---|---|
| Scholarship Assistance | Various sources given in **1.11** | | | | | |
| Amount | **407.32** | **234.49** | **328.06** | **174.86** | **177.64** | **237.27** |

**1.12 Basis/criterion for admission to the institution:**

All India entrance/state- level entrance/ university entrance/12th standard mark sheet / others:

(Instruction: The basis/criterion for student intake has to be listed here.)

**1.13 Total number of engineering students:**

| | **CFY 2015-16** | **CFY 2014-15** | **CFY 2013-14** | **CFY 2012-13** | **CFYm1 2011-12** | **CFYm2 2010-11** | **CFYm3 2009-10** |
|---|---|---|---|---|---|---|---|
| Total no. of boys | 3099 | 3235 | 3199 | 2868 | 2636 | 2398 | 2142 |
| Total no. of girls | 1154 | 1052 | 918 | 708 | 583 | 500 | 457 |
| Total no. of students | 4253 | 4287 | 4117 | 3576 | 3219 | 2898 | 2599 |

Total number of other students, if any

(Instruction: Total number of engineering students, both boys and girls, has to be listed here. The data may be categorised in a tabular form under graduate or post graduate engineering, or other programme, if applicable.)

**1.14 Total number of employees**:

(Instruction: Total number of employees, both men and women, has to be listed here. The data may be categorised in a tabular form as teaching and supporting staff.)

Minimum and maximum number of staff on roll in the engineering institution, during the CAY and the previous CAYs (1st July to 30th June):

**A. Regular Staff**

| Items | GENDER | CAY 2015-16 | | CAY 2014-15 | | CAY 2013-14 | | CAY 2012-13 | | CAY 2011-12 | | CAY 2010-11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Teaching staff in engineering | M | | 133 | | 118 | | 131 | | 122 | | 123 | | 119 |
| | F | | 25 | | 34 | | 23 | | 20 | | 20 | | 19 |
| Teaching staff in sciences & humanities | M | | 23 | | 24 | | 24 | | 15 | | 17 | | 16 |
| | F | | 9 | | 10 | | 7 | | 7 | | 7 | | 7 |
| Sports Activity Center | M | | 2 | | 2 | | 2 | | - | | - | | - |
| Non teaching staff | M | | 163 | | 160 | | 9 | | 10 | | 10 | | |
| | F | | 39 | | 39 | | 3 | | 3 | | 3 | | 3 |

**B. Contract Staff**

| Items | GENDER | CAY 2015-16 | | CAY 2014-15 | | CAYm1 2013-14 | | CAYM2 2012-13 | | CAYM3 2011-12 | | CAYM4 2010-11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Min | Max | Max | Min | Max | Min | Max |
| Teaching staff in engineering | M | | 13 | | 19 | | 01 | | 01 | | 02 | | 00 |
| | F | | 5 | | 13 | | 00 | | 00 | | 00 | | 00 |
| Teaching staff in sciences & humanities | M | | 5 | | 5 | | 01 | | 00 | | 00 | | 00 |
| | F | | 3 | | 3 | | 00 | | 00 | | 00 | | 00 |
| Non teaching staff | M | | 59 | | 45 | | 73 | | 75 | | 77 | | 76 |
| | F | | 36 | | 32 | | 19 | | 19 | | 19 | | 19 |

# End of Part A

# II. Departmental Information

II.1. Name and address of the department:

**Department of Metallurgical & Materials Engineering,**
**Visvesvaraya National Institute of Technology,**
**South Ambazari Road, Nagpur – 440 010 (Maharashtra State), India.**

II.2. Name, designation, telephone number, and e-mail address of the contact person for the NBA:

**Dr. D. R. Peshwe, Professor & Head**
**Telephone – 91 – 712 – 280 1385, Mob. 09372802996**
**drpeshwe@rediffmail.com**

II.3. History of the department including date of introduction and number of seats of various programmes of study along with the NBA accreditation, if any:

| Program | Description |
|---|---|
| UG in Metallurgical Engineeing | Started with 20 seats in 1965<br>Intake increases to 30 in 1966<br>Intake increases to 40 in 1980<br>Intake increase to 60 in 2007<br>Intake increase to 70 in 2008<br>Intake increase to 80 in 2009<br>Intake increase to 90 in 2010 |
| PG in Materials Engineering | Intake increase to 25 in 2006 |

II.4. Mission and Vision of the Department

(The department is required to specify its Mission and Vision).

**VISION:**

A department, growing at pace matching with global trends, emerging as a world's one of the leading academic organizations for its advanced knowledge base and cutting edge research contributions**.**

**MISSION:**

The mission of the department is:

- To link the human resource with the knowledge base in the filed of metallurgical and materials engineering in such a way that the challenges faced by the mankind in optimum utilization of the materials resources are successfully met with.
- To stride on every front of knowledge dissemination through teaching learning process , research and development and offering expert solutions to technological problems.

To integrate human resource with highest attainable level of knowledge on materials with various channels functioning for its efficient dissemination for welfare of mankind

II.5. List of the programmes/ departments which share human resources and/or the facilities of this programmes/ departments (in %):
(Instruction: The institution needs to mention the different programmes being run in the department which share the human resources and facilities with this department/programme being accredited.)

- Mechanical Engg. – Theory and Lab course on Metallurgy shared by faculty
- Mining Engg. – Theory course on Mineral Dressing shared by faculty member
- Chemical engg., Applied Physics, Applied Chemistry utilize various testing and characterization facilities of this department

II.6. Total number of students:

UG: 247

PG: 25

II.7 Minimum and Maximum number of staff on roll during the current and three previous academic years (1st July to 30th June ) in the department:

| **Item** | **CAY** | | **CAYm1** | | **CAYm2** | | **CAYm3** | |
|---|---|---|---|---|---|---|---|---|
| | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min** | **Max.** |
| Teaching Staff in the department | 15 | 15 | 17 | 17 | 17 | 17 | 17 | 17 |
| Non-teaching Staff | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Total | **24** | | **26** | | **26** | | **26** | |

II.7.1. Summary of budget for the CFY and the actual expenditure incurred in the CFYm1, CFYm2 and CFYm3 (for the Department):

| **Items** | **Budget in CFY** | **Actual expenses in CFY** | **Budgeted in CFYm1** | **Actual Expenses in CFYm1** | **Budgeted in CFYm2** | **Actual Expenses in CFYm2** |
|---|---|---|---|---|---|---|
| Laboratory Equipments | 50 lacs | | 30 | | 20 | |
| Software purchase | 5 lacs | | Nil | | Nil | |
| Laboratory consumables | 2 lacs | | 2.5 | | 2 | |
| Maintenance and spares | 2 lacs | | 2 | | 2 | |
| Travel | 3 lacs | | 2.5 | | 2 | |
| Miscellaneous expenses for academic activities | 1 lacs | | 0.5 | | 0.5 | |
| **Total** | **63 lacs** | | | | | |

# III. Programme Specific information

**III.1**. Name of the Programme

UG in Metallurgical and Materials Engineering

(List name of the programme, as it appears on the graduate's certificate and transcript, and abbreviation used for the programme.)

**III.2.** Title of the Degree

(List name of the degree title, as it appears on the graduate's certificate and transcript, and abbreviation used for the degree.)

**Bachelor of Technoloyg in Metallurgical and Materials Engieering**

**III.3**. Name, designation, telephone number, and e-mail address of the

Programme coordinator for the NBA:

**Dr. D. R. Peshwe, Professor & Head**
**Telephone – 91 – 712 – 280 1385, Mob. 09372802996**
**drpeshwe@rediffmail.com**

**III.4**. History of the programme along with the NBA accreditation, if any:

| **Program** | **Description** |
|---|---|
| UG in Metallurgical Engineeing | Started with 20 seats in 1965<br>Intake increases to 30 in 1966<br>Intake increases to 40 in 1980<br>Intake increase to 60 in 2007<br>Intake increase to 70 in 2008<br>Intake increase to 80 in 2009<br>Intake increase to 90 in 2010 |

**III.5**. Deficiencies, weaknesses/concerns from previous accreditations:

To improve increase in number of Research & Development projects.

**III.6.** Total number of students in the programme:

247 students

**III.7** Minimum and maximum number of staff for the current and there previous academic year (1st July to 30th June) in the programme:

| Item | CAY | | CAYm1 | | CAYm2 | | CAYm3 | |
|---|---|---|---|---|---|---|---|---|
| | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min** | **Max.** |
| Teaching Staff with the program | 15 | 15 | 17 | 17 | 16 | 16 | 16 | 16 |
| Non-teaching Staff | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |

**III.8.** Summary of budget for the CFY and the actual expenditure incurred in the CFYm1, CFYm2 and CFYm3 (exclusively for this programme in the department):

| **Items** | **Budget in CFY** | **Actual expenses in CFY** | **Budgeted in CFYm1** | **Actual Expenses in CFYm1** | **Budgeted in CFYm2** | **Actual Expenses in CFYm2** |
|---|---|---|---|---|---|---|
| Laboratory Equipments | 50 lacs | | 30 | | 20 | |
| Software purchase | 5 lacs | | Nil | | Nil | |
| Laboratory consumables | 2 lacs | | 2.5 | | 2 | |
| Maintenance and spares | 2 lacs | | 2 | | 2 | |
| Travel | 3 lacs | | 2.5 | | 2 | |
| Miscellaneous expenses for academic activities | 1 lacs | | .5 | | .5 | |
| **Total** | **63 lacs** | | | | | |

# PART B

## 1. Vision, Mission and Programme Educational Objectives (100)

### 1.1. Vision and Mission (5)

1.1.1. State the Vision and Mission of the institute and department (1)
(List and articulate the vision and mission statements of the institute and department)

**VISION (Institute)**

To contribute effectively to the National Endeavour of producing quality human resource of world class standard by developing a sustainable technical education system to meet the changing technological needs of the Country incorporating relevant social concerns and to build an environment to create and propogate innovative technologies for the economic development of the Nation.

**MISSION (Institute)**

The mission of VNIT is to achieve high standards of excellence in generating and propagating knowledge in engineering and allied disciplines. V.N.I.T. is committed to providing an education that combines rigorous academics with joy of discovery. The Institute encourages its community to engage in a dialogue with society to be able to effectively contribute for the betterment of humankind**.**

**VISION:**
A department, growing at pace matching with global trends, emerging as a world's one of the leading academic organizations for its advanced knowledge base and cutting edge research contributions.

**MISSION:**
The mission of the department is:

- To link the human resource with the knowledge base in the filed of metallurgical and materials engineering in such a way that the challenges faced by the mankind in optimum utilization of the materials resources are successfully met with.
- To stride on every front of knowledge dissemination through teaching learning process , research and development and offering expert solutions to technological problems.

To integrate human resource with highest attainable level of knowledge on materials with various channels functioning for its efficient dissemination for welfare of mankind

1.1.2. Indicate how and where the Vision and Mission are published and disseminated (2)
(Describe in which media (e.g. websites, curricula books) the vision and mission are published and how these are disseminated among stakeholders)

Institute website (www.vnit.ac.in) and Notice boards.

1.1.3. Mention the process for defining Vision and Mission of the department (2)
(Articulate the process involved in defining the vision and mission of the department from the vision and mission of the institute.)

While the institute vision attaining relates the development of technical education with world class standards for creation of human resource. The departmental vision provides the inputs to attain institute vision through the vision set for discipline of metallurgical and materials engineering. Complimentary to the institute vision the short term and long term vision of the institute envisages national and international visibility on dissemination of knowledge and acquiring status of centre of excellence in area of materials at National and International level.

In tune with institute mission, the mission of the department is focused on the linkage between human resource and highest attainable levels of knowledge in the area materials to be utilized for facing the challenges in the field at National and International level.

Both the institute and departmental vision and mission have been carefully worked out on the past experience of five decades and the constructive and creative feedback from the stake holders.

## 1.2. Programme Educational Objectives (15)

**1.2.1.** Describe the Programme Educational Objectives (PEOs) (2)

**PEO1:** To develop scientific concepts and analytical capabilities
**PEO2:** To define and understand the engineering concepts involved in any problem in metallurgical and materials: production, processing, working and failure.
**PEO3:** To create and improve various communication skill and acquaint with social and economic aspects of technology related to metal and materials.
**PEO4:** To acquainted with details of the science and engineering involved in production, processing, function, failure of materials of various ferrous, non ferrous systems.
**PEO5:** To prepare research capability for advancement of the subject.

**1.2.2.** State how and where the PEOs are published and disseminated (2)
(Describe in which media (e.g. websites, curricula books) the PEOs are published and how these are disseminated among stakeholders)

The PEO are published at

1. Department website http://www.mme.vnit.ac.in
2. College website http://www.vnit.ac.in
3. Curriculum books
4. Notice boards

Apart from this, Program outcomes are made accessible to all the stakeholders of the program through education, faculty workshops, student awareness workshops, programs, student induction programs and faculty meetings.

**1.2.3.** List the stakeholders of the programme (1)

(List stakeholders of the programme under consideration for accreditation and articulate their relevance)

(a) Students (b) Alumni (c) Employers (Government and Private) (d) Higher educational institutions (e) Parents of Students (f) Various research funding agencies.

**1.2.4.** State the process for establishing the PEOs (5)

(Describe the process that periodically documents and demonstrates that the PEOs are based on the needs of the programme's various stakeholders. )

(a) Feedback from undergraduate students of current batch.
(b) Feedback and discussion session with Alumni.
(c) Suggestions received from companies regularly coming for campus placements.
(d) Discussions at various forum of research funding (DST, AR&DB, NRB, DRDO, BRNS)
(e) Interaction with national level organization like IGCAR, NAL, NML, ARCI on M.Tech projects/ research leading to Ph.D. degree

**1.2.5.** Establish consistency of the PEOs with the Mission of the institute (5)

(Describe how the Programme Educational Objectives are consistent with the Mission of the department.)

**MISSION**

The mission of VNIT is to achieve high standards of excellence in generating and propagating knowledge in engineering and allied disciplines. V.N.I.T. is committed to providing an education that combines rigorous academics with joy of discovery. The Institute encourages its community to engage in a dialogue with society to be able to effectively contribute for the betterment of humankind.

## 1.3. Achievement of Programme Educational Objectives (30)

**1.3.1.** Justify the academic factors involved in achievement of the PEOs (15)
(Describe the broad curricular components that contribute towards the attainment of the Programme Educational Objectives.)

The designed curriculum is one of the main tools to prepare students in achieving PEOs. The description of Metallurgical and Materials Engineering Program broad curriculum components relevant to PEOs is shown below.

| **Course Component** | **PEO** | **Curriculum Content (% of total number of percent of credit of the programme)** |
|---|---|---|
| Mathematics and Basic Sciences | To develop scientific concepts and analytical capabilites | 40 |
| Basic Engineering course | To define and understand the engineering concepts involved in any problem in metallurgical and materials: production, processing, working and failure. | 80 |
| Humanities | To create and improve various communication skill and acquaint with social and economic aspects of technology related to metal and materials. | 40 |
| Core subjects | To acquainted with details of the science and engineering involved in production, processing, function, failure of materials of various ferrous, non ferrous systems. | 200 |
| Electives | To prepare research capability for advancement of the subject. | 80 |

**1.3.2**. Explain how administrative system helps in ensuring the achievement of the PEOs (15)

(Describe the committees and their functions, working process and related regulations.)

VNIT is governed by an autonomous board of governors which comprises of members nominated by Government of India, Government of Maharashtra, and other represented by people from academia, industry and institute faculty. The chairman is nominated by MHRD, Government of India. The Director of the Institute is member secretary of the board. The Senate, Finance committee and building and works committee are the statutory committees of the Institute. Committee above formed interacts and maintains liaison via Department Head and Deans:

- For monitoring and reviewing the activities of each year in program.
- Scheduleing program work plan in accordance with specifications of program objectives and outcomes.
- Daily operations and coordinates activities of program with interrelated activities of other programs, departments or staff to ensure optimum efficiency and compliance with appropriate policies, procedures and specifications given by HOD.
- Conducts and interprets various surveys required to assess POs and PEOs

## 1.4. Assessment of the achievement of Programme Educational Objectives (40)

**1.4.1.** Indicate tools and processes used in assessment of the achievement of the PEOs (25)

Describe the assessment process that periodically documents and demonstrates the degree to which the Programme Educational Objectives are attained. (10)

Include information on: (15)

a) A listing and description of the assessment processes used to gather the data upon which the evaluation of each programme educational objective is based. Examples of data collection processes may include, but are not limited to, employer surveys, graduate surveys, focus groups, industrial advisory committee meetings, or other processes that are relevant and appropriate to the programme;

b) The frequency with which these assessment processes are carried out.

- Feedback of immediate pass out batch
- Board of studies meeting which has representation of one academic professional from IIT and representing industry/ national organization. BOS meeting is organized two meeting per year.

**1.4.2.** Provide the evidences for the achievement of the PEOs (15)

a) The expected level of attainment for each of the program educational objectives;

b) Summaries of the results of the evaluation processes and an analysis illustrating the extent to which each of the programme educational objectives is being attained; and

c) How the results are documented and maintained.

The courses offered at undergraduate and PG programme are subjected to peer reviewed and the outcome of the peer reviewed is incorporated in order to establish the link between programme outcome and program education objective. The first peer review as per the guidelines of senate is in progress.

**1.5. Indicate how the PEOs have been redefined in the past (10)**

(Articulate with rationale how the results of the evaluation of PEOs have been used to review/redefine the PEOs)

The PEOs defined here are based on the teaching learning experience of last five decades of the department. First review of this will be taken at the time of next accreditation as the outcome based education in being formalised now the first time.

# 2 Programme Outcomes (225)

## 2.1. Definition and Validation of Course Outcomes and Programme Outcomes (30)

2.1.1. List the Course Outcomes(COs) and Programme Outcomes (POs) (2)

(List the course outcomes of the courses in programme curriculum and programme outcomes of the programme under accreditation)

**Programme Outcomes(POs):**

1. an ability to apply knowledge of mathematics, science, and engineering to the discipline
2. an ability to design, formulate and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to collaborate with multidisciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. An understanding of engineering and management principles and apply these

    to one's own work, as a member and leader in a team, to manage projects.

**Course Outcomes:**

On completion of these courses, the students will be able to:

| Course | Course Outcomes |
|---|---|
| **MML 201- Introduction to Material Science & Engineering** | CO1- To familiarize with the concept of material science and engineering of different metals, ceramics and composites.<br>CO2- To understand the basic structures of metals and alloys<br>CO3- To develop the ability of analyzing complex engineering problems associated with different materials<br>CO4- To be competent in designing components and processes for particular engineering applications. |
| **MML203- Engineering Physical Metallurgy** | CO1- To be able to identify the materials from their structures<br>CO2- To understand the science behind nucleation and growth of particular phase in material.<br>CO3- To understand the mechanism behind different allotropic transformations during heating/cooling.<br>CO4- To familiarize with the interpretation of microstructures of different metals, alloys using optical microscopy. |
| **MML 205- Testing of Materials** | CO1-familiarize with the different characterization techniques being performed to check the competency of materials used for particular application.<br>CO2- able to analyze the data generated using different tests.<br>CO3- understand the sample preparation techniques for particular test.<br>CO4- able to correlate the structure-property relationship. |
| **MML 207- Mineral Dressing** | CO1- able to identify different ores and minerals of different metals.<br>CO2-acquainted with the different processing of ores<br>CO3- to understand the mechanism behind comminution of ores and minerals.<br>CO4- to be able to separate metal efficiently and effectively from processed ores and minerals. |
| **MAL 205- Numerical Methods & Probability Theory** | CO1-To be acquainted with different numerical methods and theory.<br>CO2-To understand numerical solutions of ordinary differential equations.<br>CO3-To acquire knowledge regarding different deviation methods.<br>CO4- understanding about correlation with different functions. |
| **MML202- Polymeric Materials** | CO1-familarize with different structures and properties of polymers.<br>CO2- to understand synthesis of polymeric materials.<br>CO3- able to characterize materials with different techniques.<br>CO4-to develop competency in analyzing test data of characterized materials and structure-property correlation. |

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| **MML204- Transport Phenomena** | CO1- to understand fundamentals of heat and mass transfer phenomenon about metallurgical processes.<br>CO2- to be acquainted with different heat transfer phenomenon like radiation, conduction and convection.<br>CO3- able to plan the heat treatment in accordance with the design parameter of components.<br>CO4- to understand basic rules and mechanism behind heat and mass transfer. |
| **MML206 - Metallurgical Thermodynamics & Kinetics** | CO1- understand fundamental laws of thermodynamics<br>CO2- able to apply thermodynamics in understanding allotropic and phase changes in the metal and alloys<br>CO3- competent to predict feasibility of various chemical reactions associated with synthesis of alloys and composites.<br>CO4- able to comment on structural changes in alloys based on nucleation, and kinetics. |
| **MML208Ceramic & Refractory Materials** | CO1- familiarize with the structural aspects of various ceramic and refractory materials.<br>CO2- able to synthesize various refractory materials.<br>CO3- competency in characterization of ceramic materials.<br>CO4- to understand various applications of ceramic and refractory material. |
| **MML210 Chemical Characterization of Materials** | CO1- familiarize with various techniques of analysis.<br>CO2- to understand principles of various methods of analysis.<br>CO3- able to titrate the material to know its chemical composition.<br>CO4- to know the significance of oxidation and reduction involved in chemical reactions. |
| **MML 371Mechanical Processing of Materials** | CO1- understand various mechanical processing techniques of materials.<br>CO2- competent to know principles in different mechanical processing of materials.<br>CO3- able to correlate structure-property correlation associated with different mechanical processing of materials.<br>CO4- competent to comment on selection of specific process for material to be used for particular application. |
| **MML 372 Principles of Non-Ferrous Extraction Metallurgy** | CO1- overview of various processes involved in extraction of non ferrous metals from their ores.<br>CO2- develop understanding to know the associated principles of different processes of extraction.<br>CO3- able to identify economical extraction process selection.<br>CO4- to be able to perform mass balance calculations associated with various extraction processes. |
| **MML 373 Ferrous Extraction Metallurgy** | CO1- Understand physic-chemical aspects, thermodynamics and kinetics of reactions and processes.<br>CO2- Appreciate techno-economic indices, productivity and consumption norms.<br>CO3- Appreciate the design and operations of various processes<br>CO4- Gather critical knowledge of alternative Iron making technologies |

| | |
|---|---|
| **MML 378-Wear of Engineering Materials** | CO1- understand to know the industrial importance of wear and classification of wear processes.<br>CO2- able to know mechanisms, factors influencing wear rate, Wear behaviour of engineering material under sliding wear and fretting wear etc.<br>CO3- competent to apply the fundamental understanding of mechanism of wear to material selection for wear resistance.<br>CO4- Understand techniques used for characterization of worn out surfaces. |
| **MML 377-Chemical characterization of Materials** | CO1- familiarize with various techniques of analysis.<br>CO2- to understand principles of various methods of analysis.<br>CO3- able to titrate the material to know its chemical composition.<br>CO4- to know the significance of oxidation and reduction involved in chemical reactions. |
| **PHL305 Electrical & Magnetic Materials** | CO1- understand concept of magnetism.<br>CO2- able to understand use of magnetic material for specific application.<br>CO3- to understand fundamental laws of electrical and magnetic conduction in materials.<br>CO4- understand the concept of Lasers and its applications. |
| **MML380-Particulate Technology** | CO1- to understand the different methods of powder preparation.<br>CO2- able to decide application specific powder compaction method.<br>CO3-application of powder compaction components.<br>CO4- to know specific environmental control during powder manufacturing. |
| **MML 381-Metallurgy of Nuclear Materials** | CO1- to understand the properties of nuclear materials.<br>CO2- to get acquainted with the extraction processes of various nuclear materials.<br>CO3- to understand various refining and ultrapurification processes of the nuclear materials.<br>CO4- to understand the thermodynamics of extraction. |
| **MMP 371Mechanical Processing of Materials Lab.** | CO1- understand various mechanical processing techniques of materials.<br>CO2- competent to know principles in different mechanical processing of materials.<br>CO3- able to correlate structure-property correlation associated with different mechanical processing of materials.<br>CO4- competent to comment on selection of specific process for material to be used for particular application. |
| **MMP 372Principles of Non-Ferrous Extraction Metallurgy Lab** | CO1-To develop clear understanding of various unit processes viz calcination, oxidation and sulphatization roasting, lime scavenged direct reduction, carbo-thermic reduction, leaching, cementation and electro-wining.<br>CO2-To perform mass balance calculations. |
| **MMP 378 Wear of** | CO1- to understand use of various wear testing equipments.<br>CO2- to know the Sliding wear test of ferrous and non- |

| | |
|---|---|
| **Engineering Materials Lab** | ferrous metals using pin on disc apparatus.<br>CO3- to know Dry sand rubber wheel abrasion testing of metallic materials.<br>CO4- To understand the effect of operational variables on slurry erosion of steels. |
| **MMP 377 Chemical characterization of Materials Lab** | CO1- to know about determination of Carbon and Sulphur in Ferrous Materials by "Stroheleins Apparatus"<br>CO2- to understand determination of Manganese in steel by sodium Bismuthate method.<br>CO3- to know determination of Chromium in steel by ammonium Persulphate method.<br>CO4- to know determination of Phosphorus in steel by ammonium Nitromolybdate method. |
| **PHP 306 Electrical & Electronic Materials Lab** | CO1-To know the temperature variation of resistivity for a semiconductor and find its band gap by Four – Probe method.<br>CO2-To understand the mobility and carrier concentration in the sample (metal or semiconductor) using Hall effect setup.<br>CO3-To know the conductivity of given sample by Kelvin's Bridge Method.<br>CO4-To understand the coefficient of Thermal Conductivity of a bad conductor by Lee's disc method. |
| **MML 374 Characterization of Materials** | CO1- to understand the basics of crystallography.<br>CO2- To get acquainted with microstructural characterization basics and techniques.<br>CO3- significance of thermal characterization methods and IR spectroscopic techniques.<br>CO4- to understand the applications of each technique and its limitations. |
| **MML 375Steel Making Technology** | CO1-Understand physic-chemical aspects, thermodynamics and kinetics of reactions and processes.<br>CO2- Gather critical knowledge of alternative Iron making technologies<br>CO3- Appreciate techno-economic indices, productivity and consumption norms.<br>CO4- Appreciate and evaluate Mass balance, thermodynamic parameters, kinetics etc of reactions and processes and understand the design and operations of various processes. |
| **MML 382Solidification Processing & Advance Foundry Technology** | CO1-To understand solidification process of metals and alloys.<br>CO2-To know heat transfer calculations in metal casting.<br>CO3-To understand various molding processes.<br>CO4-To know mould designing for casting various metals and alloys. |
| **MML 383 Light Metal Alloys** | CO1- to understand various light metal alloys and their applications.<br>CO2- to know principles of casting these alloys.<br>CO3- to know various mechanical processing techniques.<br>CO4- to understand failure analysis of these alloys. |
| **MML 471 Structural** | CO1- to understand crystallography of metals.<br>CO2- to know various plastic deformation methods. |

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|---|---|
| **Metallurgy** | CO3- to understand the mechanism of X-ray diffraction.<br>CO4- to know diffusion principles and techniques. |
| **MML 472 Environmental Degradation of Metallic Materials** | CO1- able to understand theoretical basis of environmental degradation of metallic materials.<br>CO2- to know various anodic and cathodic reactions and their thermodynamic feasibility.<br>CO3- to understand forms of corrosion and their mechanisms.<br>CO4- to understand methods used for corrosion testing. |
| **MML 474 XRD & SEM** | CO1- able to know basics of crystallography.<br>CO2- able to understand point groups, space groups.<br>CO3- to know diffraction from materials.<br>CO4- to understand Transmission electron microscopy (imaging and diffraction). |
| **MML 479 Selection of Materials** | CO1- apply the fundamental understanding of fracture toughness and fatigue to relevant material selection situations.<br>CO2- apply the fundamental understanding of creep to relevant material selection situations<br>CO3- analyze and solve numerical related to design for fracture toughness, fatigue and creep life estimation.<br>CO4-Understand different modes of wear, variables affecting wear modes and apply the concepts to material selection for different wear situations. |
| **MML 379 Non-Destructive Testing** | CO1- to understand various NDT methods.<br>CO2- to know the applicability of these methods.<br>CO3- to know the principles of various NDT techniques.<br>CO4- to understand radiographic and ultrasonic methods. |
| **MML 477 Secondary & Special Steel Making** | CO1- develop clear understanding of the concept of clean steels – their characteristics and importance.<br>CO2-Understand the fundamentals and practices of secondary steel making processes<br>CO3-To perform thermodynamic and kinetic calculations<br>CO4-To appreciate the science and technology of stainless steel making. |
| **MML 480 Fracture Mechanics** | CO1 – to understand the fracture mechanics.<br>CO2- to understand different theories of fracture mechanics.<br>CO3- to understand the mechanism of stresses developed in notches specimens.<br>CO4- able to design stress free parts. |
| **MMP 471 Structural Metallurgy Lab** | CO1- to understand analytical part of Crystallography<br>CO2- to understand analytical part of X-ray diffractions<br>CO3- to understand analytical part of Diffusion<br>CO4- to understand analytical part of Phase transformation and Rate of reaction |
| **MMP 472 Environmental Degradation of Metallic Materials** | CO1- able to know conduction of various tests for corrosion rate determination.<br>CO2-competent in preparation of samples for various tests.<br>CO3- to know methods used for corrosion testing. |

| | |
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| **Lab** | CO4- to understand measures for corrosion control. |
| **MML 473 Composite Materials** | CO1-to understand different types of composite materials.<br>CO2-to know the applications of composites.<br>CO3-to understand characterization of composites.<br>CO4-to know the various failures of composites. |
| **MML 481 Deformation Behavior** | CO1- to know the different types of material behaviour under mechanical loading.<br>CO2-to understand different types of material failure under load.<br>CO3- to understand high temperature deformation of materials.<br>CO4- to know different mechanisms involved in loading. |
| **MML 487 Continuous Casting of Steels** | CO1- To develop clear understanding of strand casting process.<br>CO2-To appreciate the role of heat transfer and control, turbulence, mold operations, EMS and mold fluxes.<br>CO3-To develop clear understanding of the theory and practice of segregation control and tundish metallurgy.<br>CO4-To critically assimilate the relation between operating practice – scientific parameters and quality of cast products. |
| **MML 486 Failure Analysis** | CO1- to understand various failures in metals.<br>CO2- to know the failure analysis technique.<br>CO3- to understand mechanics behind fracture.<br>CO4- to know mechanism in high temperature failure. |
| **MML 488 Nano Materials** | CO1- to understand various physical, mechanical and chemical properties of nanomaterials.<br>CO2- to know the characterization techniques.<br>CO3- to understand various synthesis methods.<br>CO4- to know safety issues associated with nanomaterials |
| **MM 516 Bio Materials** | CO1- to understand structure and properties of bioomaterials.<br>CO2- to know the various issues associated with implant materials.<br>CO3- to understand characterization of biomaterials.<br>CO4- to understand applications of biomaterials. |
| **MML 489 Surface Engineering** | CO1- to know various surface engineering methods.<br>CO2- to understand difference between surface coating and surface treatment.<br>CO3- to understand cleaning process used for ferrous and non-ferrous metals and alloys.<br>CO4- to know various plating practices depending upon the base metal. |
| **MML 376 Industrial Metallurgy** | CO1- to understand various foundry practices.<br>CO2- to know principles of casting alloys and various casting defects.<br>CO3- to know various welding techniques.<br>CO4- to understand powder metallurgy methods for various alloys. |
| **MMP 383 Light** | CO1- to understand structures of various light metal alloys.<br>CO2- to know principles of casting these alloys. |

| | |
|---|---|
| **Metal Alloys Lab.** | CO3- to know various mechanical processing techniques.<br>CO4- to understand failure analysis of these alloys. |

2.1.2. **State how and where the POs are published and disseminated (3)**

(Describe in which media (e.g. websites, curricula books) the POs are published and how these are disseminated among stakeholders)

The Program Outcomes are published at

1. Department website http://www.mme.vnit.ac.in
2. College website http://www.vnit.ac.in
3. Curriculum books
4. Notice boards

Apart from this, Program outcomes are made reachable to all the stakeholders of the program through education, faculty workshops, student awareness workshops, programs, student induction programs and faculty meetings.

**2.1.3. Indicate processes employed for defining of the POs (5)**

The main constituents for the program are current students, alumni, and the industry, having representation in different departmental meetings. Input from current students is obtained on all aspects of the program representing *undergraduate forum*. The forum is held during academic year and is attended by students representative, key faculty members.

**2.1.4. Indicate how the defined POs are aligned to the Graduate Attributes prescribed by the NBA (10)**

The Graduate Attributes of NBA and the Program Outcomes defined for the program are aligned to each other as shown below

Graduate Attributes prescribed by NBA:

i. Engineering Knowledge

ii. Problem Analysis

iii. Design & Development of Solutions

iv. Investigation of Complex Problem

v. Modern Tools Usage

vi. Engineer and Society

vii. Environment & Sustainability

viii. Ethics

ix. Individual & Team work

x. Communication

xi. Lifelong Learning

xii. Project management & Finance

| PO / GA | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| i. | √ | √ | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| ii. | √ | √ | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| iii. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| iv. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| v. | √ | √ | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| vi. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| vii. | | √ | √ | √ | | √ | | √ | √ | √ | √ | √ |
| viii. | | | √ | √ | | √ | | √ | √ | √ | √ | √ |
| ix. | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ |
| x. | | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ |
| xi. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| xii. | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

**2.1.5**. Establish the correlation between the POs and the PEOs (10)

(Explain how the defined POs of the program correlate with the PEOs)

| PO / PEO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PEO1** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **PEO2** | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

## 2.2. Attainment of Programme Outcomes (40)

**2.2.1.** Illustrate how course outcomes contribute to the POs (10)

The program outcomes are achieved through curriculum that offers a number of mandatory courses as well as elective courses. Each course has defined course outcomes that are mapped to the program outcomes and a set of performance criteria that are used to provide quantitative measurement of how well course outcomes are achieved.

| | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| MML 201- Introduction to Material Science & Engineering | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML203- Engineering Physical Metallurgy | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 205- Testing of Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 207- Mineral Dressing | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MAL 205- Numerical Methods & Probability Theory | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ |
| MML202- Polymeric Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | |
| MML204- Transport Phenomena | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | |
| MML206 - Metallurgical Thermodynamics & Kinetics | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | |
| MML208Ceramic & Refractory | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Materials | | | | | | | | | | | | |
| MML210Chemical Characterization of Materials | √ | √ | √ | √ | | √ | √ | √ | √ | √ | | |
| MML 371Mechanical Processing of Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 372Principles of Non-Ferrous Extraction Metallurgy | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 373Ferrous Extraction Metallurgy | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 378-Wear of Engineering Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| PHL305 Electrical & Magnetic Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML380-Particulate Technology | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 381-Metallurgy of Nuclear Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MMP 371Mechanical Processing of | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Materials Lab. | | | | | | | | | | | | |
| MMP 372Principles of Non-Ferrous Extraction Metallurgy Lab | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MMP 378 Wear of Engineering Materials Lab | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MMP 377 Chemical characterization of Materials Lab | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| PHP 306 Electrical & Electronic Materials Lab | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 374Characterization of Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 375Steel Making Technology | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 382Solidification Processing & Advance Foundry Technology | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 383 Light Metal Alloys | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 471 Structural Metallurgy | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 472 Environmental Degradation of | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metallic Materials | | | | | | | | | | | | |
| MML 474 XRD & SEM | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 479 Selection of Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 379 Non-Destructive Testing | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 477 Secondary & Special Steel Making | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 480 Fracture Mechanics | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MMP 471 Structural Metallurgy Lab | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MMP 472 Environmental Degradation of Metallic Materials Lab | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 473 Composite Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 481 Deformation Behavior | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| MML 487 Continuous Casting of Steels | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 486 Failure Analysis | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 488 Nano Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MM 516 Bio Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 489 Surface Engineering | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| MML 376 Industrial Metallurgy | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MMP 383 Light Metal Alloys Lab. | √ | √ | √ | √ | √ | √ | | √ | √ | √ | | |

The linkage among program outcomes and course outcomes is shown below.

**2.2.2.** Explain how modes of delivery of courses help in attainment of the POs (10)

(Describe the different course delivery methods/modes (e.g. Lecture interspersed with discussion, asynchronous mode of interaction, group discussion, project etc.) used to deliver the courses and justify the effectiveness of these methods for the attainment of the POs. This may be further justified using the indirect assessment methods such as course-end surveys.)

The following are the various other alternative content delivery methods used to deliver the courses:

M1: Lecture interspersed with discussions
M2: Lecture with a quiz
M3: Tutorial
M4: Demonstration ( Such as model, laboratory, field visit )
M5: Group Discussion
M6: Group Assignment/ Project
M7: Presentations
M8: Asynchronous Discussion

In addition to the syllabus mentioned in the curriculum, the students are exposed themselves as they are provided with the e-content through national and international portals such as: NPTEL http://nptel.iitm.ac.in

**2.2.3.** Indicate how assessment tools used to assess the impact of delivery of course/course content contribute towards the attainment of course outcomes/programme outcomes (10)

(A) Home Assignment-Each and every student is assigned with course related tasks during every course work once or twice and assessment will be done based on their performance. Grades are assigned depending on their innovation in solving/deriving the problems.

(B) Assignment-The assignment is a qualitative performance assessment tool designed to assess students' knowledge of engineering practices, framework, and problem solving. An analytic rubric was developed to assess students' knowledge with respect to the learning outcomes associated with the scenario tool.

(C) Sessional-This type of performance assessment is carried out during the examination sessions which are held twice a semester. Each and every sessional is focused in attaining the course outcomes.

**2.2.4.** Indicate the extent to which the laboratory and project course work are contributing towards attainment of the POs (10)

The laboratory and project works tasks which are performed for the curriculum are tabulated in

| **Laboratory and Project course work with tasks** | **Type** | **Program Outcomes** |
|---|---|---|
| Physical Metallurgy Lab | Laboratory and Project | PO1 to PO11 |
| Mechanical Testing Lab | Laboratory and Project | PO1 to PO11 |
| Corrosion Lab | Laboratory and Project | PO1 to PO11 |
| Heat Treatment Lab | Laboratory and Project | PO1 to PO11 |
| Creep Lab | Laboratory and Project | PO1 to PO11 |
| Polymer lab | Laboratory and Project | PO1 to PO11 |
| Mineral Dressing Lab | Laboratory | PO1 to PO11 |

## 2.3. Evaluation of the attainment of the Programme Outcomes (125)

**2.3.1.** Describe assessment tools and processes used for assessing the attainment of each PO (25)

Describe the assessment process that periodically documents and demonstrates the degree to which the Programme Outcomes are attained.

Include information on: (50)

a) A listing and description of the assessment processes used to gather the data upon which the evaluation of each the programme educational objective is based. Examples of data collection processes may include, but are not limited to, specific exam questions, student portfolios, internally developed assessment exams, senior project presentations, nationally-normed exams, oral exams, focus groups, industrial advisory committee;

b) The frequency with which these assessment processes are carried out.

2.3.2. Indicate results of evaluation of each PO (50)

c) The expected level of attainment for each of the program outcomes;

d) Summaries of the results of the evaluation processes and an analysis illustrating the extent to which each of the programme outcomes are attained; and

e) How the results are documented and maintained.

The department has not attempted this exercise yet but the results will be incorporated in the SAR for the next accreditation

## 2.4. Use of evaluation results towards improvement of the programme (30)

### 2.4.1. Indicate how the results of evaluation used for curricular improvements (5)

By analyzing the results of program outcome assessment in terms of direct and indirect assessments, necessary actions are recommended to improve the program curriculum. After each semester, faculty analyzed and evaluated the collected data from each course and from all other sources(surveys). The Module coordinators discuss the results with faculty to identify the need for improvement. Prepare an action plan accordingly. Once the action has been completed, data for that performance indicator should again be collected, analyzed, and evaluated by the program assessment committee to see the performance. This process continues until the performance improve to the target value The results are

discussed with Department Advisory Board  The same procedure is followed for alumni surveys, employer surveys, rubrics etc

**2.4.2. Indicate how results of evaluation used for improvement of course delivery and assessment (10)**

With the implementation of specified delivery methods, the effectiveness of the courses is enhanced.

**2.4.3. State the process used for revising/redefining the POs (15)**

The need for revise / redefine of existing POs is identified with the help of the assessment results of PO attainment from direct/indirect assessment methods. Since this is the first time that outcomes based teaching learning process is operationalized, the results of the feedback from stake holders will be reflected in the SAR for next accreditation cycle.

# 3. Programme Curriculum (125)

## 3.1. Curriculum (20)

### 3.1.1. Describe the Structure of the Curriculum (5) :

Table 1.1: Structure of the curriculum. (Till May 2016)

| Course Code | Course title | Total number of contact hours | | | | Credits |
|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical# (P) | Total Hours | |
| | **3rd Semester** | | | | | |
| MML 201 | Introduction to Material Science & Engineering | 3 | 0 | 0 | 3 | 6 |
| MML203 | Engineering Physical Metallurgy | 3 | 0 | 2 | 5 | 8 |
| MML 205 | Testing of Materials | 3 | 0 | 2 | 5 | 8 |
| MML 207 | Mineral Dressing | 3 | 0 | 2 | 5 | 8 |
| MAL 205 | Numerical Methods & Probability Theory | 3 | 0 | 0 | 3 | 6 |
| HAL 201 | Humanities | 3 | 0 | 0 | 3 | 6 |
| | **4th Semester** | | | | | |
| MML202 | Polymeric Materials | 3 | 0 | 2 | 5 | 8 |
| MML204 | Transport Phenomena | 3 | 0 | 2 | 5 | 8 |
| MML206 | Metallurgical Thermodynamics & Kinetics | 3 | 0 | 0 | 3 | 6 |
| MML208 | Ceramic & Refractory Materials | 3 | 0 | 0 | 3 | 6 |
| MML214 | Theory and Technology of Heat Treatment | 3 | 0 | 2 | 5 | 8 |
| | HM | 3 | 0 | 0 | 3 | 6 |
| | **5th Semester** | | | | | |
| MML 371 | Mechanical Processing of Materials | 3 | 0 | 0 | 3 | 6 |
| MML 372 | Principles of Non-Ferrous Extraction Metallurgy | 3 | 0 | 0 | 3 | 6 |
| MML 373 | Ferrous Extraction Metallurgy | 3 | 0 | 0 | 3 | 6 |
| MML 378<br>PHL 305 | Wear of Engineering Materials/<br>Electrical & Magnetic Materials | 3 | 0 | 0 | 3 | 6 |
| MML387<br>MML388 | Operation Research Techniques<br>Chemical Characterization of Materials | 3 | 0 | 0 | 3 | 6 |
| MML366<br>MML368 | Process Optimization<br>Industrial Metallurgy | 3<br>3 | 1<br>0 | 0<br>0 | 4<br>3 | 8<br>6 |
| MMP 372 | Principles of Non-Ferrous Extraction Metallurgy Lab | 0 | 0 | 2 | 2 | 2 |
| MMP 378<br>PHP 306 | Wear of Engineering Materials Lab.<br>Electrical & Electronic Materials Lab. | 0 | 0 | 2 | 2 | 2 |
| | **6th Semester** | | | | | |
| MML 374 | Characterization of Materials | 3 | 0 | 0 | 3 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MML 375 | Steel Making Technology | 3 | 0 | 0 | 3 | 6 |
| MML 382 | Solidification Processing & Advance Foundry Technology | 3 | 0 | 0 | 3 | 6 |
| MML 475<br>MML 383 | Joining of Materials /<br>Light Metal Alloys | 3 | 0 | 0 | 3 | 6 |
| MML 384<br>MML355 | Alloy Steels & High Temperature Alloys<br>Particulate Technology | 3 | 0 | 0 | 3 | 6 |
| MML 386<br>MML 385 | Semiconductor Technology/<br>Hydro & Electro Metallurgy | 3 | 0 | 0 | 3 | 6 |
| MMP 374 | Characterization of Materials Lab. | 0 | 0 | 2 | 2 | 2 |
| MMP 382 | Solidification Processing & Advance Foundry Technology Lab. | 0 | 0 | 2 | 2 | 2 |
| MMP 475<br>MMP 383 | Joining of Materials Lab/<br>Light Metal Alloys Lab. | 0 | 0 | 2 | 2 | 2 |
| | **7th Semester** | | | | | |
| MML 471 | Structural Metallurgy | 3 | 0 | 0 | 3 | 6 |
| MML 472 | Environmental Degradation of Metallic Materials | 3 | 0 | 0 | 3 | 6 |
| MML 474<br>MML 463<br>MML 443 | XRD & SEM/<br>Microstructural Engineering<br>Metallurgy of Nuclear Materials | 3<br>3<br>3 | 1<br>0<br>0 | 0<br>0<br>0 | 4<br>3<br>3 | 8<br>6<br>6 |
| MML 479<br>MML 379 | Selection of Materials/<br>Non-Destructive Testing | 3 | 0 | 0 | 3 | 6 |
| MML 477<br>MML 480<br>MML 445 | Secondary & Special Steel Making<br>Fracture Mechanics<br>Adhesive Technology | 3 | 0 | 0 | 3 | <br>6 |
| MMP 471 | Structural Metallurgy Lab. | 0 | 0 | 2 | 2 | 2 |
| MMP 472 | Environmental Degradation of Metallic Materials Lab. | 0 | 0 | 2 | 2 | 2 |
| MMD 401 | Project Phase – I | | | | | 4 |
| | **8th Semester** | | | | | |
| MML 473 | Composite Materials | 3 | 1 | 0 | 4 | 8 |
| MML 481<br>MML 487 | Deformation Behavior/<br>Continuous Casting of Steels | 3 | 0 | 0 | 3 | 6 |
| MML 486<br>MML 488 | Failure Analysis/<br>Nano Materials | 3 | 0 | 0 | 3 | 6 |
| MM 516<br>MML 489 | Bio Materials/<br>Surface Engineering | 3 | 0 | 0 | 3 | 6 |
| MMD 402 | Project Phase – II | | | | | 8 |

# : Seminars, project work may be considered as practical

Table 1.2: Structure of the curriculum. (From July 2016 onwards)

| Course Code | Course Title | Total Number of contact hours | | | | Credits |
|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | Total Hours | |
| MML 211 | Introduction to Material Science & Engineering | 3.00 | 1.00 | 0.00 | 3.00 | 6.00 |
| MML210 | Engineering Physical Metallurgy | 3.00 | 0.00 | 2.00 | 5.00 | 8.00 |
| MML 224 | Testing of Materials | 3.00 | 0.00 | 2.00 | 5.00 | 8.00 |
| MML 212 | Mineral Dressing | 3.00 | 0.00 | 2.00 | 5.00 | 8.00 |
| | Numerical Methods & Computation | 3.00 | 1.00 | 0.00 | 3.00 | 6.00 |
| MML213 | Polymeric Materials | 3.00 | 0.00 | 2.00 | 5.00 | 8.00 |
| MML215 | Transport Phenomena | 3.00 | 0.00 | 2.00 | 5.00 | 8.00 |
| MML216 | Metallurgical Thermodynamics & Kinetics | 3.00 | 1.00 | 0.00 | 3.00 | 6.00 |
| MML218 | Ceramic Materials | 3.00 | 1.00 | 0.00 | 3.00 | 6.00 |
| MML214 | Theory and Technology of Heat Treatment | 3.00 | 0.00 | 2.00 | 5.00 | 8.00 |
| MML 220<br>MML 221<br>MML 222<br>MML 223 | Elective I (ANY ONE)<br>Fundamentals of defects in Materials<br>Fuels & Furnaces<br>Cast Iron Metallurgy<br>Structure of Materials<br>HM/OC Courses | 3.00 | 0.00 | 0.00 | 5.00 | 8.00 |
| MML 371 | Metal Working Processes | 4.00 | 1.00 | 0.00 | 3.00 | 6.00 |
| MML 372 | Principles of Non-Ferrous Extraction Metallurgy | 3.00 | 0.00 | 2.00 | 3.00 | 6.00 |
| MML 373 | Ferrous Extraction Metallurgy | 3.00 | 0.00 | 0.00 | 3.00 | 6.00 |
| MML 378/<br>PHL 305 | Elective II (Any One)<br>Wear of Engineering Materials/<br>Electrical & Magnetic Materials | 3.00 | 0.00 | 2.00 | 3.00 | 6.00 |
| MML 351<br>MML 368<br>MML 576<br>MML 388 | Elective III (SELECT ANY TWO )<br>Process Optimization<br>Industrial Metallurgy<br>Bio Materials<br>Chemical Characterization of Materials HM/OC Courses | 3.00 | 0.00 | 0.00 | 3.00 | 6.00 |
| | | | | | | |
| MML 374 | Characterization of Materials | 3.00 | 0.00 | 0.00 | 3.00 | 6.00 |
| MML 365 | Steel Making Technology | 3.00 | 1.00 | 0.00 | 3.00 | 6.00 |
| MML 382 | Solidification Processing & Advance Foundry Technology | 3.00 | 0.00 | 2.00 | 3.00 | 6.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MML375<br>MML 383 | Elective IV (ANY ONE)<br>Joining of Materials /<br>Light Metal Alloys | 3.00 | 0.00 | 2.00 | 3.00 | 6.00 |
| MML 384<br><br>MML 335<br>MML 386<br>MML 385<br>MML 389 | Elective V (SELECT ANY TWO )<br>Alloy Steels & High Temperature Alloys<br>Particulate Technology<br>Semiconductor Technology<br>Hydro & Electro Metallurgy<br>Financial Engineering or Any HM/OC Course | 3.00 | 0.00 | 0.00 | 3.00 | 6.00 |
| | | | | | | |
| MML 471 | Structural Metallurgy | 3.00 | 0.00 | 2.00 | 3.00 | 3.00 |
| MML 472 | Environmental Degradation of Metallic Materials | 3.00 | 0.00 | 2.00 | 3.00 | 3.00 |
| MML 474<br>MML 443<br>MML 479<br>MML 469<br>MML 477<br>MML 477<br>MML 480<br>MML 445<br>MML 490 | Elective VI (SELECT ANY FOUR )<br>X ray Diffraction & Electron Microscopy<br>Metallurgy of Nuclear Materials<br>Selection of Materials/<br>Non-Destructive Testing<br>Secondary & Special Steel Making<br>Fracture Mechanics<br>Adhesive Technology<br>Quality Control & Specifications<br>OC/HM Courses | 3.00 | 1.00 | 0.00 | 4.00 | 8.00 |
| | | | | | | |
| | Project Phase –I | 3.00 | 0.00 | 0.00 | 3.00 | 6.00 |
| MML 453 | Composite Materials | 3.00 | 1.00 | 2.00 | 4.00 | 8.00 |
| MML 481<br>MML 487<br>MML 486<br>MML 488<br>MML 490<br>MML 489 | Elective VII (SELECT ANY FOUR)<br>Deformation Behavior/<br>Continuous Casting of Steels<br>Failure Analysis/<br>Nano Materials<br>High Temperature Corrosion<br>Surface Engineering<br>OC/HM Courses | 3.00 | 0.00 | 0.00 | 3.00 | 6.00 |
| MMD 402 | Project Phase – II | 0.00 | 0.00 | 0.00 | 0.00 | 8.00 |
| **Total** | | 108.00 | 3.00 | 28.00 | 139.00 | 256.00 |

### 3.1.2. Give the Prerequisite flow chart of courses (5)

After first year of the programme, remaining courses are graded as first level, second level and advanced courses as indicated in the Table below. Efforts are made to keep first level courses in 3rd and 4th semester, second level courses in 5th and 6th semester and advanced level courses in 7th and 8th semester, as far as possible. Since the courses are mapped semester-wise and students have to take these courses semester-wise, it is assumed that students are taking these courses sequentially. Faculty Advisers also

counsel students in the matter. Therefore presently pre-requisites are not defined meticulously. Pre-requisite courses shown in the Table below, therefore, indicate that these courses actually prepare foundation for the said course.

**Table 2: Classification of courses**

| **3.1.2** | **Course** | Pre-requisite | **Course** | Pre-requisite |
|---|---|---|---|---|
| **First level courses** | **MML201** | PHL101 | **MML 388** | CHL101 |
| | **MML203** | PHL101 | **MML 366** | |
| | **MML205** | | **MML 387** | |
| | **MML207** | | **MML 355.** | |
| | **MML202** | CHL101 | | |
| | **MML204** | | | |
| | **MML206** | | | |
| | **MML208** | | | |
| | **MML368** | | | |
| | | | | |
| **Second level courses** | **MML210** | MML203 | **MML 384** | MML 203/210 |
| | **MML381** | MML379/203 | **MML 475** | MML 203 |
| | **MML372** | MML206 | **MML 383** | MML 203 |
| | **MML373** | MML206 | **MML 385** | MML 207 |
| | **PHL305** | MML201/ PHL 101 | **MML 386** | MML 201 |
| | **MML374** | MML201/203 | | |
| | **MML375** | MML206 | | |
| | | | | |
| **Advance level courses** | **MML378** | MML203/371 | | |
| | **MML382** | MML 203/ 210 | **MML480.** | MML 203/205/371 |
| | **MML374** | MML 201/203/374 | **MML 481** | MML 203/205/371 |
| | **MML472** | CHL101, EEL101 MML 201/203 | **MML 487** | MML 375/382 |
| | **MML471** | MML 203/205/210 | **MML 488** | MML 201/374 |
| | **MML463** | MML 201/371 | **MML 516** | MML 203/383 |
| | **MML443** | MML 372/385 | **MML 489** | MML 203/205/368 MML 210/374/382 |
| | **MML479** | MML 203/205/371/ MML 383/384 | **MML 486** | MML 203/205/371 MML 374/378/382 MML 472/471/480 |

**3.1.3. Justify how the programme curriculum satisfies the program specific criteria (10)**

First level courses introduce students to Engineering and Technology aspect of the courses. So students learn the relevance of the courses and learn necessary skills required for higher level courses. In the second level courses the level of complexity and difficulty is even more. Students are also introduced to industrial practices. Course at this level also create awareness in students as to how new knowledge is created and research is carried out to tackle industrial problems. In the advanced level courses students learn as to how knowledge is created in research activities and from

observation in industries and, as to how knowledge used to analyse and solve industrial problems. These courses also include numericals and design problems. During their final year project (MMD401 and MMD402) students work on either industrial problems or research problems, plan testing and other studies; this give them exposure to the way industrial or research problems are tackled. These courses together impart students necessary skills needed in industries and encourage them for higher studies, R&D and teaching profession.

**3.2. State the components of the curriculum and their relevance to the POs and the PEOs (15)**

**Table 3: Programme curriculum grouping based on different components (Till May 2016)**

| Course Component | Curriculum Content (% of total number of credits of the program) | Total number of contact hours | Total number of credits | POs | PEOs |
|---|---|---|---|---|---|
| Mathematics | 6.875 % | 8 hrs/week | 22 | 1 | 1,2 |
| Sciences | 5 % | 8 hrs/week | 16 | 1 | 1,2 |
| Computing | 2.5 % | 4 hrs/week | 8 | 5 | 1,2 |
| Humanities | 3.125 % | 5 hrs/week | 10 | 6,8,10 | 1,2 |
| Professional core | 82.5 % | 137 hrs/week | 264 | 1,2,3,4,5,7,9, 10,12 | 1,2 |

**Table 3.1: Programme curriculum grouping based on different components (From July 2016 onwards)**

| Course Component | Curriculum Content (% of total number of credits of the program ) | Total number of contact hours (per week X 14 Weeks) | Total number of credits | POs | PEOs |
|---|---|---|---|---|---|
| Basic Sciences | 9.4% | 16X14=224 | 16 | 1 | 1,2 |
| Engineering Sciences | 10.60% | 18X14=252 | 18 | 1 | 1,2 |
| Humanities and Social Sciences | 3.53% | 6X14=84 | 6 | 6,8,10 | 1,2 |
| Program Core | 44.70% | 76X14=1064 | 76 | 1,2,3,4,5,7,9 10,12 | 1,2 |
| Program Electives | 21.2% - 26.5% | 36to 45X14=504 to 650 | 36 to 45 | 7,9, 10,12 | 1,2 |

| | | | | | |
|---|---|---|---|---|---|
| Open Electives | 0% - 3.53% | 0 to 6X14=0 to 84 | 0 to 6 | 4,5,7 | 1,2 |
| Project(s) | 3.53% | 6X14=84 | 6 | 1,2,3,4,5,7,9 10,12 | 1,2 |
| Internships/Seminars | -- | -- | -- | | |
| Any other (Please specify) | -- | -- | -- | | |
| **Total number of Credits** | | | **170** | | |

**3.3. State core engineering subjects and their relevance to Programme Outcomes including design experience (10)**

(a) List of core subject is given in Table 2. These courses impart basic engineering knowledge, teach them analysis of the problem and way to tackle those. In advanced level courses they learn to analyse complex engineering problems apply basic knowledge and find solutions. During project work they learn to conduct investigation of complex problems. They also learn to use equipments, which are computer controlled and use modern IT tools for communication, date processing and presentation. These courses also focus on environmental issue related to depletion of mineral resources and effect of metal production on environment. During project work they learn to take instructions from supervisor, work in team, prepare reports and present their findings. This is how the courses

**(b) Describe how the core engineering subjects in the curriculum are giving the learning experience with the complex engineering problems (50)**

There many courses which introduce students to complex engineering problems in field of Metallurgical and Materials Engineering. Few important ones are highlighted here. MML 214: Theory and Technology of Heat-treatment students learn about complexities of heat-treatment and quality control involved in heat-treatment of metals and alloys, and learn to solve them. In MML373: Ferrous extraction metallurgy, MML375:Steeel making technology, MML 477: Secondary and special steel making processes, and MML487: Continous casting of steels, the complexities involved in production as well as in quality control are discussed and taught. In MML203: Engineering Physical metallurgy, MML383: Light metals and alloys, Alloy steel and high temperature alloys and MML471: Structural metallurgy, they are taught the basics as well as complications that may arise in structure of metals and alloys and subsequent loss of properties and failure. In MML 382: Solidification processing and advanced foundry technology, MML475:Joining of materials, and MML489: Surface engineering they learn as to how complex situation arise during solidification and undesirable microstructure is produced. Then they learn to analyse it and solve the problems. In courses like MMP378:Wear of engineering materials and MML472 Environmental degradation of metallic materials they learn as to how complex operating conditions make it difficult to predict life of components and how to deal with it. In courses like, MML480: Fracture mechanics and MML486: Failure Analysis, they learn as to how failure take place and as to how to analyse them. In all above mentioned course industrial situation and operating conditions are discussed and need for research is highlighted.

**3.4. Industry interaction/internship (10) :**

(Give the details of industry involvement in the programme such as industry-attached laboratories and partial delivery of courses and internship opportunities for students)

The industry especially our alumni in industry are actively involved. Currently the system of internship is not operational.

**3.5. Curriculum Development (15)**

3.5.1. State the process for designing the programme curriculum (5)

1. The program curriculum is designed based on the kind of job a MME student shall have to do in industry. To begin with various MME industries are enlisted then their knowledge and skill requirements are enlisted and then the curriculum is designed
2. It also takes into account, syllabus of GATE, so that our students are encouraged to undertake higher studies and research.
3. Inputs are also taken informally from alumni.
4. A member from industry is nominated the BOS in MME, so that his inputs are considered in framing and modifying syllabus.
5. A Professor from IIT is also nominated to BOS in MME so that his inputs are taken in framing and modifying syllabus of courses and to know any changes they have made.

This is how all stake holders are consulted to decide the curriculum and syllabus.

(Describe the process that periodically documents and demonstrates how the programme curriculum is evolved considering the PEOs and the POs)

3.5.2. Illustrate the measures and processes used to improve courses and curriculum (10)

The course coordinators identify new portion to be included and obsolete portion to be dropped by continuously updating themselves. They visit industries and refer various publications to know about new technologies/industrial practices developed.

The curriculum is periodically updated by course coordinators. The updated curriculum is discussed in Board of Studies of Metallurgical and Materials Engineering and accepted. Then it is submitted to Senate for approval.

(Articulate the process involved in identifying the requirements for improvements in courses and curriculum and provide the evidence of continuous improvement of courses and curriculum)

**3.6. Course Syllabi (5)**

(Include, in appendix, a syllabus for each course used. Syllabi format should be consistent and shouldn't exceed two pages.)

The syllabi format may include:

- Department, course number, and title of course
- Designation as a required or elective course
- Pre-requisites

- Contact hours and type of course (lecture, tutorial, seminar, project etc.,.)
- Course Assessment methods(both continuous and semester-end assessment)
- Course outcomes
- Topics covered
- Text books, and/or reference material

A sample course outline below. Details of all subjects included in Annexure 1

**MML201 INTRODUCTION TO MATERIALS SCIENCE & ENGINEERING (3-0-0) 6 credits**

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MML-201 | Basic Science: | 2 |
| Course Title: | Introduction to Material Science & Engineering | Engineering Topics: | 6 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. M.M.Thawre | Compliant: | Course Book 2012-2013 |

I. Catalog Description:

Introduction of different types of materials & their processing, structure & property relationship. Atomic structure, bonding diffusion, various processing methods for metals, ceramics, composites various property studies like optical, electrical thermal etc, of all materials.

II. Course Coordinator: Dr. M.M.Thawre, Room No. F8, First Floor, Materials Engineering Centre

III. Pre-requisites and Co-requisites: None

IV. Textbook and /or Other Required Material

a. Materials Science and Engineering - A First Course - V. Raghavan. (PHI)
b. Introduction to Materials Science – A. Guy, McGraw Hill
c. The Science & Engineering of Materials - Askeland & Phule
d. The Science of Engineering Materials – Lamster

V. Course Objectives:

Upon successful completion of this course, each student should be able to understand :

a. Concept of Material Science and Engineering, Classification of Materials
b. Levels of Structure and Basic of Structure Property Relationship.
c. Atomic structures, bonding & crystal imperfections
d. Equilibrium and Kinetics diffusion and phase transformation
e. Applications & processing of various material types.
f. Material degradation - oxidation and corrosion.
g. Conducting, Insulating Material, Semiconductors, Magnetic, Dielectric materials.
h. Advanced materials for specialty applications

VI. Expanded description of the course

Introduction, concept of Material Science and Engineering, Classification of Materials, Levels of Structure and Basic of Structure Property Relationship.

Atomic Structure and Chemical Bonding Crystal Geometry and Crystal Structure, Structure of Solids, Crystalline Imperfections.

Diffusion , thermal, optical and magnetic properties of materials.Equilibrium and Kinetics diffusion and phase transformation. Material degradation - oxidation and corrosion. Processing and applications of metals, ceramics , composites & polymers.

Conducting, Insulating Material, Semiconductors, Magnetic, Dielectric materials. Advanced materials for specialty applications.

VII. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week

VIII. Contribution of Course to Professional Component

a. Lecture: Students get acquainted with various types of materials, their properties, applications processing methods etc.

IX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

X. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|
| a | X | X | | | X | | | |
| b | X | X | | | X | | | |
| c | X | X | | X | X | | | |
| d | X | X | | X | X | | X | X |
| e | X | X | | | X | X | X | X |
| f | X | X | | X | X | X | X | X |
| g | X | X | | | X | X | | |
| h | X | X | | | X | X | X | X |

**********END OF PART B3**********

# 4. Students' Performance (75)

**Admission intake in the programme**

| Item | CAY 2015-16 | CAYm1 | CAYm2 |
|---|---|---|---|
| Sanctioned intake strength in the program (N) | 92 | 92 | 92 |
| Total number of admitted students in first year minus number of students migrated to other programs at the end of 1st year (N1) | 84 | 83 | 85 |
| Number of admitted students in 2nd year in the same batch via lateral entry (N2) | - | - | - |
| Total number of admitted students in the program (N1+N2) | 84 | 83 | 85 |

**4.1 Success Rate (20)**

| Year of entry (in reverse | Number of Students admitted in 1st year + admitted via lateral entry in 2nd year (N1+N2) | Number of students who have successfully completed* | | | |
|---|---|---|---|---|---|
| | | 1st year | 2nd year | 3rd year | 4th year |
| CAY 2015-16 | 84 | 72 | | | |
| CAYm1 | 83 | 71 | 63 | | |
| CAYm2 | 85 | 64 | 63 | 62 | |
| CAYm3 (LYG) | 88 | 76 | 75 | 74 | - |
| CAYm4(LYGm1) | 90 | 71 | 71 | 71 | 66 |
| CAYm5(LYGm2) | 87 | 74 | 74 | 74 | 68 |

*: Successfully completed implies zero backlogs

Success rate = 20 × mean of success index (SI) for past three batches

SI= (Number of students who graduated from the programme in the stipulated period of course duration)/(Number of students admitted in the first year of that batch and admitted in 2nd year via lateral entry)

| Item | LYG (CAYm3) 2014-15 | LYGm1 (CAYm4) | LYGm2 (CAYm5) |
|---|---|---|---|
| Number of students admitted in the corresponding First year + laterally admitted via lateral entry in 2nd year | 88 | 90 | 87 |
| Number of students who have graduated in the stipulated period | 62 | 66 | 68 |
| Success Index (SI) | 0.70 | 0.73 | 0.78 |

Average SI = 0.74

Success Rate = 20* Average SI = 14.8

## 4.2. Academic Performance (20)

| | | |
|---|---|---|
| API | = | Academic Performance Index |
| | = | Mean of Cumulative Grade Point Average of all successful Students on a 10 point CGPA system |
| Or | = | Mean of the percentage of marks of all successful students / 10 |

| Approximating The API by the following mid-point Analysis | LYG | LYGm1 | LYGm2 |
|---|---|---|---|
| 9<Number of Students with CGPA<10 | 08 | 09 | 08 |
| 8<Number of Students with CGPA<9 | 12 | 13 | 15 |
| 7<Number of Students with CGPA<8 | 23 | 17 | 22 |
| 6<Number of Students with CGPA<7 | 15 | 11 | 10 |
| 5<Number of Students with CGPA<6 | 8 | 4 | 7 |
| Total | 66 | 55 | 62 |
| | | | |
| Mean of Cumulative Grade Point Average of all successful Students on a 10 point CGPA system | 7.13 | 7.09 | 7.21 |
| Assessment = 2 x API | 14.26 | 14.18 | 14.42 |
| Avg. Assessment for three years | **14.28** | | |

**4.2.1.** Placement and Higher Studies (20)

Assessment Points = $20 \times (x + 1.25y)/N$

where, x = Number of students placed

y =Number of students admitted for higher studies with valid qualifying scores/ranks, and

N = Total number of students who were admitted in the batch including lateral entry subject to maximum assessment points = 20.

| Item | LYG | LYGm1 | LYGm2 |
|---|---|---|---|
| Number of admitted students corresponding to LYG including lateral entry (N) | 81 | 77 | 76 |
| Number of students who obtained jobs as per the record of placement office (x1) | 33 | 40 | 38 |
| Number of students who found employment otherwise at the end of the final year (x2) | 12* | 13* | 13* |
| x = x1 + x2 | 45 | 53 | 51 |
| Number of Students who opted for higher studies with valid qualifying scores/ranks (y) | 10* | 10* | 10* |
| | | | |
| Assessment Point | 14.19 | 17.013 | 16.71 |

* data based on feedback of students and faculty

Average assessment points = 15.97

### 4.3. Professional Activities (15)

4.3.1. Professional societies / chapters and organising engineering events (3)
(Instruction: The institution may provide data for past three years).

| Sr. No. | Name of Faculty | Details of Events Organized | Date | Organized by |
|---|---|---|---|---|
| 1. | Mr. Udyan Pathak AGM, Tata Motors | 1. Expert lectures on Failure Analysis<br>2. Transportation Materials, Industry needs, current status and trends | 06-04-2015 | MME (TEQIP II) |
| 2. | Dr S L Mannan, Former Group Director, IGCAR, Kalpakkam | Creep deformation and fracture<br>Fatigue deformation and fracture | 12.4.2016<br>13.4.2016 | (TEQIP II) & IIM Nagpur Chapter |
| 3. | ME Vijat Petley, GTRE Bangalore | Metal joining aspects and advanced materials in aero engine | 15.4.2016 | (TEQIP II) & IIM Nagpur Chapter |
| 4. | Dr M D Mathew, Former Head Mech Met Div IGCAR kalpakkam | Creep deformation and fracture | 16.4.2016 | (TEQIP II) & IIM Nagpur Chapter |
| 5. | Mr Kartik Prasad | Thermo mechanical fatigue behaviour of near alpha Titanium alloy for defense applications | 16.4.2016 | (TEQIP II) & IIM Nagpur Chapter |
| 6. | Dr. B. S. Murty IIT Madras | Characterization of Nano Materials | 27.10.2014 | MME |

| | | | | |
|---|---|---|---|---|
| 7. | Mr. Udyan Pathak AGM, Tata Motors | Failure Analysis of Automotive Components | 09.04.2014 | MME (TEQIP II) |
| 8. | Mr. Udyan Pathak AGM, Tata Motors | Failure Analysis and transportation materials | 06.04.2016 | MME |
| 9. | Dr. B. S. Murty IIT Madras | Research oppurtubities at IIT Madras | 30.09.2016 | MME |
| 10. | Dr. N B Ballal, IIT Bombay | 1. Modeling of blast furnace process<br>2. Fundamentals of Mass Transfer | 08.03.2013 | MMES VNIT, Nagpur |
| 11. | Dr. Ashish Garg, Prof. , IIT, Kanpur | Expert lecture on Solar Polymer Materials | 05.10.2012 | IIM Nagpur Chapter |
| 12. | Dr. C. M. Manjunath, Sr. Scientist & Head, SID, NAL, Bangalore | Enhancement of life in aircraft structures | 12.10.2012 | IIM Nagpur Chapter |
| 13. | Dr. S G Sapate<br>Dr. D R Peshwe<br>Dr. R K Khatirkar<br>Dr. A R Ballal | All Indian Metallurgical Quiz Competition 22nd Oct. 2012. | October 2012 | Met and Mat Engg. Society, IIM Nagpur Chapter |
| 14. | Dr. D R Peshwe<br>Shri Y Y Mahajan<br>Dr. J G Bhatt<br>Dr. A A Likhite<br>Dr. R K Paretkar<br>Dr. S U Pathak | Workshop on Failure Analysis of Engineering Materials | 18-20 April 2012 | TEQIP II and IIM Nagpur Chapter |
| 15. | Prof. A S Khanna, IIT Bombay | 1. Critical issues in paint coatings<br>2. From steels to super alloys | 25.01.2012 | MMES VNIT Nagpur |
| 16. | Dr. N B Ballal, IIT Bombay | Modeling of blast furnace process | 05.03.2012 | MMES VNIT Nagpur |
| 17. | Dr. B S Murty | Nano composites<br>High entropy alloys<br>Quasi crystals<br>Thermodynamics of phase and phase transformation | 20-23 December 2011 | IIM Nagpur Chapter |
| 18. | Dr. B S Murty | Characterization of Materials<br>SEM and TEM | 23-26 December 2011 | IIM Nagpur Chapter |
| 19. | Prof DipakMazumdar, Materials Science and Engineering IIT Kanpur | Knowledge base of steelmaking: are graduating engineers truly empowered?<br>Ladle Metallurgy | 13-14th October 2011 | MMES VNIT Nagpur |

**4.3.2**. Organisation of paper contests, design contests, etc. and achievements (3) (Instruction: The institution may provide data for past three years).

| | | | |
|---|---|---|---|
| 1. | Student's Symposium | 30/10/2015-01/11/2015 | Met and Mat Engg Society , IIM Nagpur Chapter |
| 2. | All Indian Metallurgical Quiz Competition 22nd Oct. 2012. | October 2012 | Met and Mat Engg Society , IIM Nagpur Chapter |

The students of the department Bagged First and second prize in All Indian Metallurgical Quiz Competition held on 22nd Oct. 2012

**4.3.3**. Publication of technical magazines, newsletters, etc. (3)
(Instruction: The institution may list the publications mentioned earlier along with the names of the editors, publishers, etc.).

| Sr. No. | Name of Students | Achievements & Details | Remarks |
|---|---|---|---|
| 1. | Kaivalya Deo | RWTH Aachen University, Germany (15 May 2016 -15 July 2016) | Summer Internship |
| 2. | Sudhanshu Kuthe | First Prize Award in Advance Material Section. Paper presented on "Processing & Characterization of Ni-Ti shape Memory Alloy" (March 4-6, 2016) | Event: - : "Composite" organised by Metallurgical and Materials Engineering Society IIT, Kharagpur. |
| 3. | Tejas Umale, Amarjit Singh, Y Reddy, R K Khatirkar and S G Sapate | Abrasive wear behavior of copper – SiC and copper – $SiO_2$ composites, International Conference on Ceramics, Bikaner, India International Journals of Modern Physics: Conference Service Vol. 22(2013) 416- 423 | Publication in International Journals |
| 4. | Shreyash Hadke, Madhu T Kalimila, Shashwat Rathkanthiwar, Shivani Gour, Reshma Sonkusare, A R Ballal | Role of fuel and fuel-t-oxidizer ratio in combustion synthesis of nano-crystalline nickel oxide powders | Ceramics International, Volume 41, Issue 10, Part B, December 2015, pp. 14949-14957[Impact Factor – 2.605] |
| 5. | Shreyash Hadke, Madhu T Kalimila, Shashwat Rathkanthiwar, Shivani Gour, Reshma Sonkusare, A R Ballal | Monoclinic to Cubic Phase Transformation in Combustion Synthesized Gadolinium Oxide | Materials Today: Proceedings Volume 2, Issues 4-5, 2015, pp. 1276-1281[SNIP] |

**4.3.4**. Entrepreneurship initiatives, product designs, and innovations (3)
(Instruction: The institution may specify the efforts and achievements.)

NIL

**4.3.5.** Publications and awards in inter-institute events by students of the programme of study (3)
(Instruction: The institution may provide a table indicating those publications, which fetched awards to students in the events/conferences organised by other institutes. A tabulated list of all other student publications may be included in the appendix.)

| Sr No | Name of student | Achievement & deatils | Remarks |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Shri Harshal Agrawal, Pranshu Sharma, Piyush Tiwari | Won first prize in TMS meet for the paper Evaluation of Sensitization and Self-healing Behaviour of AISI 304 Stainless Steel using Electrochemical Techniques" TMS Best Paper Contest-Undergraduate Division-First place.2013 | This award will be presented at the TMS 2014 Annual Meeting and Exhibition in San Diego, California. The Minerals, Metals and Materials Society (TMS) |
| 2 | Tejas Umale, Amarjit Singh, Y Reddy, R K Khatirkar and S G Sapate | Abrasive wear behavior of copper –SiC and coper –$SiO_2$ composites, International Conference on Ceramics, Bikaner, India International Journal of Modern Physics: Conference Series Vol. 22 (2013) 416–423 | Publication in International Journal |
| 3 | Nikita, K Malvika, S. Anand, B. Sai Prakash, S.G. Sapate and R.K. Khatirkar | Presented a poster on Abrasive wear behavior of Copper-SiC and Copper- $SiO_2$ composites at National Conference on Advanced Functional Materials, 20-22 Feb 2013 | Paper presentation at National conference organized by Chemistry Dept. VNIT Nagpur |
| 4 | Shri Priyanshu Bajaj, Vinayak Poddar, Piyush Patil, K Anirudh | Paper titles Effect of Austempering temperature on microstructure and wera properties of low carbon equivalent ductile iron , accepted for publication in Indian Foundry Journal | Paper to be published in Indian Foundry Journal, October 2013 issue |
| 5 | Ms Shivani Guar | Presented a paper on Synthesis, characterization and study of corrosion behavior of Hf based Bulk Metallic Glasses | Paper presentation at International Conference on Powder Metallurgy, 13, February 2013 |

| | | | |
|---|---|---|---|
| 6 | Shri Ajinkya Gohad | Presented a paper on anode supported solid oxide fuel cell by tape casting approach | International l Conference on Powder Metallurgy 13, February 2013 |
| 7 | Ms Surabhi Bisen, Shashwat Rathkantiwar | Awarded Best Poster for Characterization of Cu-SiC brazed Titanium Joint | 5th National Symposium for Materials Research Scholars (MR 13) at IIT Bombay, May 2013 |
| 8 | S. Narkhede, P.Bhoyar, S. Dhone, R.K.Khatirkar & Dr. S.G. Sapate | Effect of inter-critical annealing on microstructure and wear behavior of En-8 steel" Int. J. Theo. Appl. Res. Mech. Engg., 1 (2012), 113. | Publication in International Journal |
| 9 | Shri Ashish Kulkarni Ajinkya Gohad, III Yr students | Presented paper on Evolution of β-$FeSi_2$ thermoelectric phase by mechanical alloying at International conf on Powder Metallurgy 12 held at Mumbai from 2-4 Feb 2012 | Paper presentation at International Conference |
| 10 | A.Kashiwar, N.Phani Vennela, S.L.Kamath and R.K.Khatirkar | Effect of solution annealing temperature on precipitation in 2205 duplex stainless steel" Materials characterization 74,(2012) 55. | Publication in SCI Journal |
| 11 | Sumit Goenka and Jatin Bhatt | Antibacterial nanosized Silver substituted hydroxyapatite with enhanced mechanical properties | Best presentation award in TMS 2011Annual Meeting and Exhibition in San Diego, California. The Minerals, Metals and Materials Society (TMS)February 27-March 3, 2011 – San |

| | | | |
|---|---|---|---|
| | | | Diego, California |
| 12 | Shri Ankush Kashiwar, Final year student | Awarded summer internship at KIT at Germany; May – July 2011<br>Selected for Summer research fellowship in 2011 and 2012 offered by Indian Academy of Science<br>Fourth All India Rank in Gate 2012 exam. | Summer research fellowship in Germany |

## 5. Faculty Contributions (200)

List of Faculty Members: Exclusively for the Programme / Shared with other Programmes

| Name of the faculty member | Qualification university, and year of graduation | Designation and date of joining the institution | Distribution of teaching load(%) | | | Number of research publication in journals and conferences since joining | IPRs | R & D and consultancy work with amount | Holding an incubation unit | Interaction with outside world |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1st year | UG | PG | | | | | |
| R.K.Paretkar | B.Tech (Nagpur Univ.) 1970<br>M.Tech. (Nagpur Univ.)<br>Ph.D. (VNIT, Nagpur) | Asso. Lect. 1972<br>Professor | - | 60% | 40% | Journal-20<br>Conferences-20 | | MHRD 10 Lacs<br>MHRD 5 lacs<br>MHRD 10 lacs<br>KVIC 60 lacs<br>MHRD 40 lacs<br>ADOR 12 lacs AR & DB 6.14 lacs<br>AR & DB 7.45 lacs<br>NRB 27 lacs<br>DST 50 lacs<br>BRNS 82.14 lacs<br>ACECOST 167.3 lacs<br>UGCDAE 4 lacs,<br>UGCDAE 4 lacs | - | SHU Manchester university, MUS, IIT Chennai, Kanpur, Bombay, Delhi. NIT Raurkela, Surat, Trichy, Warangal. COEP, MIT, SJS Plastiblends, Aurangabad, Nelcost, ACC-Nihon casting, ICCAR, ARCI, NAL, ADA, BARC, DMR, DRDO, JNARDDC, CPRI. |
| D.R.Peshwe | B.Tech (Nagpur Univ.)1983<br>M.Tech. (Nagpur Univ.)<br>Ph.D. (VNIT, Nagpur) | Lecturer: 3 July 1984<br>Professor | | 50%<br>2L | | Journal-70<br>Conferenes-85 | | MHRD 10 Lacs<br>MHRD 5 lacs<br>MHRD 10 lacs<br>KVIC 60 lacs<br>MHRD 40 lacs<br>ADOR 12 lacs AR & DB 6.14 lacs<br>AR & DB 7.45 lacs<br>NRB 27 lacs<br>DST 50 lacs<br>BRNS 82.14 lacs<br>ACECOST 167.3 lacs<br>UGCDAE 4 lacs<br>UGCDAE 4 lacs | - | SHU Manchester university, MUS, IIT Chennai, Kanpur, Bombay, Delhi. NIT Raurkela, Surat, Trichy, Warangal. COEP, MIT, SJS Plastiblends, Aurangabad, Nelcost, ACC-Nihon |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | casting, ICCAR, ARCI, NAL, ADA, BARC, DMR, DRDO, JNARDDC, CPRI. |
| A.P.Patil | B.Tech (Nagpur Univ.)1983 M.Tech. (Nagpur Univ.)1985 Ph.D. (VNIT, Nagpur)2005 | Lecture 19th Sept. 1985 Assist. Prof. 1/07/1996 Prof. 1/07/2008 | - | - | - | Journals- 17 Conferences-28 | | 1) PI of NMD sponsored R&D project Rs.10lacs (2005-2008) 2) Co-I of NRB sponsored R&D project Rs.20lacs (2008-2010) 3) Many small consultancy assignment worth Rs2.8 lacs(all together ) | - | 1)Common wealth fellow ship at Manchester Univ. Oct.2008-March 2009 2) Visiting researcher at Sheffield Hallom Univ. May-June 2010 3) Research fellowship at Sheffield Hallom Univ. July 2005. 4) Technical training at Sheffield Hallom Univ. Feb.1996-July1996. |
| S.G. Sapate | B.Tech (Nagpur Univ.)1986 M.Tech. (Nagpur Univ.)1988 Ph.D. (VNIT, Nagpur)2001 | 01/07/1991 Professor | -- | 57% | 43% | 27 International 20 National/International Conf. | | | | |
| Dr. V.K.Didolkar | B.Tech. (1974 VRCE Nagpur) M.Tech. (1976 IISc Banglore) Ph.D. (1996) | 01/01/1977 Lecturer | | 50% | | 40 National/International/Journal Conference | | GOI 1.36Lac 3 Years, (1980-1984) , Infra Red Glass Commercialization (2008 –Till Date) | | 1) Ancient Technologies and Materials 2006-Till Retirement; 2) TCT fellowship at UK-REC exchange program at Sheffield Alum University UK 6 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Months, 1st Jan 1997'; 3)Pride of India(Two chapter) published by Sanskrit Bharti 2006, 4)Delhi Iron Pillar, (Publish by Sankskrit Bharti 2000), 5) Started Bhartiya Baudhik Samta Qtly Research Journal magazine , Since 1999, 6)Organizing Secretary Journal Vidya Bharti 1999-2005. 7)Organizing Secretary Bhartiya Vidnyan Samellan at MTCST Bhopal 1997 8)Proudeced 5 new materials Related to Ancient aviation engineering as per Bruhat Viman Shastra, Bharadwaj |
| D.V.Moghe | B.E.(Nagpur Univ.)1979 M.Tech (IIT Bombay)1981 | Associate Professor July 1984 | - | 100% | | 06 | | - | | 1) Joint projects with Institutes & Industry. 2) Training programmes for Industry 3) Training visits to Industry. |
| S.N.Paul | B.E. (Kolkata) M.Tech- IIT Kanpur Ph.D.-IIT, Bombay | Associate Professor 3rd July 1984 | - | | 30 | 40 | | 1) Material Technology & Development Centre (MHRD/) 10Lacs(1988) 2) development of | | 1) Member-ASM International 2) Life member – IIM |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Polymers (5lacs) 3) (10lacs) 4) Improvement in Technology Education -22lacs | | 3)International conference\ 4) Member- |
| Jatin Bhatt | B.E (NIT Raipur) 1996 M.Tech. (IIT BHU)2003 PhD. (IITM) 2008 | 25th May 2009, Asso. Professor | - | 50% 2L | 50% 2L | Journal-29 Conferences-69 | | Completed (1.51 Cr.)<br>ACECOST 167.00 lacs | | IITM, IITK,IGCAR, AMES Lab USA, Dalian University, China. NAL, Bangalore |
| Ajay Likhite | B.E.(Nagpur Univ.)1983 M.Tech(Nagpur Univ.) 1985 Ph.D. (VNIT)2008 | Asso. Professor 25th May 2009 | | 100% | | Journal – 10 Conference-01 | | DST sponsors project for Rs.50 lakhs | | MIT Aurangabad |
| R.C.Rathod | B.E. (Pune Univ.)1996, M.Tech (IIT Bombay) 2003, Ph.D (VNIT) 2013 | Asst. Professor 3rd Oct. 1998 | - | 60% | 40% | J+C = 19 | | - | - | IIT, Bombay |
| Atul Ballal | BE (Nagpur Univ) 2000, M.Tech (IIT Bombay)2002, Ph.D.(IIT Bombay) 2011 | Assistant Professor 26/5/2006 | | 66% (2 Core courses) | | Journals – 5 Conferences - 8 | | 1) BRNS – 82Lakhs 2) UGC-DAE 2 projects (20lakhs) | | Active collaboration with 1)IGCAR 2) ARCI 3) BARC |
| Rajesh Khatirkar | B.Tech (Nagpur Univ.)1998 M.Tech. (VNIT)2004 Ph.D. (IIT Bombay)2012 | Assistant Professor24th May 2006 | | 1) Char. Of Matls 2 L. per week 2) XRD & SEM 7L per week | Mtls. Chara. 7L per week | Journals -18 Conferences - 02 | | R&D Projects-Nil Failure Analysis consultancy 2 lakhs | | IIT Bombay, ISPAT Sunflag Industries, IIT Madras, IIScBangalore, Ghent university, Belgium |
| Yogesh Mahajan | B.Tech (Nagpur Univ.) 1993 M.Tech (VNIT)2013 | Assistant Professor 16th June 2006 | - | 100% | - | Conference - 02 | | 1)Retrogression & Reasing of 7010 Al (27.6 lakhs) 2) consultancy work for BCL, KTPS, Power Grid | | IIT Chennai, ADA, NRB, Industrial such as WCL, Aryan Power, BCL Spring, |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | CSIR, etc (6 lakhs) | | Power KTPS, etc. |
| R.V.Taiwade | B.Tech (Nagpur Univ.)1997 M.Tech. (Nagpur Univ.)2001 Ph.D. (VNIT, Nagpur)2013 | Assistant Professor 8th July 2008 | - | 5th Sem B.Tech ORT Th-03 5th Sem B.Tech Mining Engg. Th-03 & ED Pract.-04 Total-12 | | 10 | | Testing of Welded Joint M.S.Pipe, Pipri Meghe (Wardha) 9,500/- | | - |
| Manjusha Thawre | B.E COEP Pune (2000) M.Tech. (VNIT, Nagpur) 2007 Ph.D 2014 (VNIT, Nagpur) | 23/06/2009 Assist. Professor | | 50% 2L | 50% | J+C = 08 | | ACECOST 167.00 lacs | - | NAL, Bangalore |
| V Udhaya banu | B.E.(2001)GCE Salem TamilNadu, M.Tech (IIT Kharagapur) 2004, Ph.D (IIT Madras )2010 | 13/06/2016 Assist. Professor | - | 50% | 50% | 01 | | -- | -- | --- |
| Ajeet Kumar Srivastav | B. Tech, NIT Rourkela (2006), M.Tech, IIT Kanpur (2008), Ph.D, IIT Madras (2014) | 09/06/2015 Assist. Professor | - | 33% | 66% | Journal-06 Conferences-01 (Total: Journal-16, Conferences-05) | | -- | -- | DAAD Fellow (Germany), Life Member (MRSI), Affiliate Member (RSC, UK) |

(Instruction: The institution may complete this table for the calculation of the student-teacher ratio (STR). Teaching loads of the faculty member contributing to only undergraduate programme (2nd, 3rd, and 4th year) are

considered to calculate the STR.)

## 5.1. Student Teacher Ratio (STR) (20)

U1 = Number of Students in UG 2nd Year

U2 = Number of Students in UG 3rd Year

U3 = Number of Students in UG 4th Year

P1 = Number of Students in PG 1st Year

P2 = Number of Students in PG 2nd Year

N1 = Total Number of Faculty Members in the Parent Department

S=Number of Students in the Parent Department
= U1 + U2 + U3 + P1 + P2

Student Teacher Ratio (STR) = S / N1

Assessment = [20 x 13 /STR], subject to maximum of 20.

| Year | U1 | U2 | U3 | P1 | P2 | S | STR | Assessment |
|---|---|---|---|---|---|---|---|---|
| 2015-16 | 88 | 86 | 66 | 18 | 16 | 275 | 17.18 | 15.13 |
| 2014-15 | 89 | 66 | 63 | 17 | 17 | 250 | 14.7 | 17.68 |
| 2013-14 | 68 | 63 | 61 | 15 | 18 | 221 | 12.27 | 18.01 |

Average Assessment = 16.94

## 5.2. Faculty strength in PG programme (20)

X = Number of faculty members with Ph.D available for PG Programme
Y = Number of faculty members with Ph.D. / M.Tech. / M.E available for PG Programme

Assessment will be done on the basis of the number of faculty members with Ph.D./M.Tech./M.E., available for the PG programme. [ Minimum number suggested: 4]

| | X | Y | Assessment |
|---|---|---|---|
| 2013-14 | 13 | 16 | 16.25 |
| 2014-15 | 13 | 17 | 15.29 |
| 2015-16 | 13 | 18 | 14.44 |

Assessment = 20 x [X/Y]

Average Assessment = 15.32

## 5.3. Faculty Qualifications (30)

| | | |
|---|---|---|
| Assessment | = | 4 x FQI |
| Where FQI | = | Faculty Qualification Index |
| | = | $(10x + 6y+4 Z_0)/ N2$<br>Such that, $x + y+ z_0 \leq N2$; and $z_0 \leq z$ |
| Where x | = | Number of faculty members with PhD |
| y | = | Number of faculty members with ME/M. Tech |
| z | = | Number of faculty members with BE/ B. Tech/ M. Sc |

| | X | Y | N | FQI | Assessment |
|---|---|---|---|---|---|
| CAYm2 | 14 | 3 | 18 | 8.7 | 35 |
| CAYm1 | 16 | 2 | 18 | 9.5 | 38 |
| CAY | 14 | 2 | 18 | 8.4 | 34 |
| | | | | Average Assessment | **36** |

## 5.4. Faculty Competencies correlation to Programme Curriculum (15)

| **Name of faculty** | **Specialisation** |
|---|---|
| Ballal A R | Ceramic engineering, Mechanical Metallurgy |
| Bhatt JG | Metallurgical Thermodynamics and Kinetics, Nanostructured Materials, |
| Chopde A D | Physical Metallurgy, Structural & Chemical Characterization |
| Didolkar V K | Mineral Dressing & Processing |
| Khatirkar R K | Deformation, Texture |
| Mahajan Y Y | Physical Metallurgy, Welding |
| Moghe D V | Iron & Steelmaking, Direct Reduction, Clean Steelmaking |
| Paretkar R K | Ferro-alloy Technology, Mechanical & Wear Behavior |
| Pathak S U | Failure Analysis, Foundry Technology, Extractive Metallurgy. |
| Patil A P | Corrosion Engineering |
| Paul S N | Polymer Engineering |
| Peshwe D R | Physical Metallurgy, Composites & Solidification processing |
| Rathod R C | Corrosion Engineering |
| Sapate S G | Wear, Heat Transfer |
| Srivastav Ajeet | Fatigue Behaviour of Composites, Joining of Materials, |

| | |
|---|---|
| | Mechanical Metallurgy |
| Taiwade R V | Corrosion, Modeling & Simulation |
| Thaware M.M. | Composites, Testing of Materials |
| Udhayabanu V | Nanocomposites, Characterization of Materials, Advanced Materials |

## 5.5. Faculty as participants/resource persons in faculty development / training activities (15)

(Instruction: A faculty member scores maximum five points for a participation/resource person.)

Participant/resource person in two week faculty development programme : 5 points
Participant/resource person in one week faculty development programme : 3 Points

| Name of the faculty | Max. 5 per faculty | | |
|---|---|---|---|
| | CAYm2 | CAYm1 | CAY |
| RK Paretkar | **5** | **5** | **5** |
| SU Pathak | **5** | **5** | **-** |
| DR Peshwe | **5** | **5** | **5** |
| DV Moghe | **5** | **5** | **5** |
| JG Bhatt | **5** | **5** | **5** |
| SG Sapate | **5** | **5** | **-** |
| AP Patil | **3** | **3** | **-** |
| SN Paul | **-** | **-** | **-** |
| RC Rathod | **-** | **-** | **-** |
| AR Ballal | **5** | **5** | **5** |
| AA Likhite | **5** | **-** | **-** |
| YY Mahajan | **5** | **5** | **5** |
| RK Khatirkar | **-** | **5** | **-** |
| RV Taiwade | **5** | **5** | **5** |
| MM Thaware | **3** | **3** | **3** |
| V Udhayabanu | **0** | **0** | **0** |
| Ajeet Srivastav | **0** | **0** | **0** |
| Sum | **56** | **56** | **38** |
| N(Number of faculty positions required for an STR of 15) | **16** | **17** | **18** |
| Assessment = 3 x Sum/N | **10.5** | **9.88** | **6.33** |
| | | Average Assessments | **8.9** |

## 5.6. Faculty Retention (15)

Assessment = $3 \times \text{RPI}/N$
where RPI = Retention point index
= Points assigned
to all faculty embers

where points assigned to a faculty member = 1 point for each year of experience at the institute but not exceeding 5.

| Item | CAYm2 | CAYm1 | CAY |
|---|---|---|---|
| Number of faculty members with experience of less than 1 year($x_0$) | **0** | **0** | **0** |
| Number of faculty members with 1 to 2 years experience ($x_1$) | **0** | **0** | **1** |
| Number of faculty members with 2 to 3 years experience ($x_2$) | **0** | **0** | **0** |
| Number of faculty members with 3 to 4 years experience ($x_3$) | **1** | **1** | **0** |
| Number of faculty members with 4 to 5 years experience ($x_4$) | **0** | **0** | **0** |
| Number of faculty members with more than years experience($x_5$) | **16** | **14** | **16** |
| N | **18** | **18** | **18** |
| RPI = $x_1$+ 2$x_2$+ 3 $x_3$+ 4 $x_4$+ 5 $x_5$ | **83** | **93** | **92** |
| Assessment | **13.83** | **15.5** | **15.33** |
| Average Assessment | | | **14.88** |

## 5.7. Faculty Research Publications (FRP) (30)

Assessment of FRP = 6 × (Sum of the research publication points scored by each faculty member)/*N*

(Instruction: A faculty member scores maximum five research publication points depending upon the *quality* of the research papers and books published in the past three years.)

The research papers considered are those (i) which can be located on Internet and/or are included in hard-copy volumes/proceedings, published by reputed publishers, and (ii) the faculty member's affiliation, in the published papers/books, is of the current institution.

Include a list of all such publications and IPRs along with details of DOI, publisher, month/year, etc.

| Name of faculty (controlling to FRP) | FRP points (max. 5 per faculty) | | |
|---|---|---|---|
| | CAYm2 | CAYm1 | CAY |
| RK Paretkar | **3** | **4** | **5** |
| SU Pathak | **5** | **5** | **5** |
| DR Peshwe | **5** | **5** | **5** |
| JG Bhatt | **5** | **5** | **5** |
| SG Sapate | **5** | **0** | **5** |
| AP Patil | **3** | **3** | **5** |
| SN Paul | **3** | **0** | **0** |
| RC Rathod | **3** | **0** | **0** |
| AR Ballal | **0** | **4** | **3** |
| AA Likhite | **3** | **3** | **5** |

| | | | |
|---|---|---|---|
| YY Mahajan | **0** | **3** | **4** |
| RK Khatirkar | **5** | **5** | **0** |
| RV Taiwade | **0** | **3** | **3** |
| MM Thaware | **0** | **3** | **3** |
| V Udhaya Banu | **1** | **2** | **1** |
| Ajeet Srivastav | **4** | **3** | **3** |
| Sum | **45** | **48** | **52** |
| N(Number of faculty positions required for an STR of 15) | **18** | **18** | **18** |
| Assessment of FRP = 6 x Sum/N | **15** | **16** | **17** |
| **Average Assessment** | | | **16** |

## 5.8. Faculty Intellectual Property Rights (FIPR) (10)

Assessment of FIPR = 2 × (Sum of the FIPR points scored by each faculty member)/N (Instruction: A faculty member scores maximum five FIPR points each year??. FIPR includes awarded national/international patents, design, and copyrights.)

| Name of faculty (contributing to FIRP) | FRP points (Max. 5 per faculty) | | |
|---|---|---|---|
| | CAYm2 | CAYm1 | CAY |
| In process of application of Patents | | | |
| | | | |
| Sum | | | |
| N | | | |
| Assessment FIPR = 2x Sum/N | | | |
| Average assessment | | | |

## 5.9 Funded R&D Projects and Consultancy (FRDC) Work (30)

Assessment of R&D and consultancy projects = 6 × (Sum of FRDC by each faculty member)//N
(Instruction: A faculty member scores maximum 5 points, depending upon the amount.) A suggested scheme is given below for a minimum amount of Rs. 1 lakh:

Five points for funding by national agency,Four points for funding by state agency, Four points for funding by private sector, and Two points for funding by the sponsoring trust/society.

| Name of faculty (controlling to FIPR) | FRP points (max. 5 per faculty) | | |
|---|---|---|---|
| | CAYm2 | CAYm1 | CAY |
| RKPARETKAR | **5** | **5** | **5** |
| SU PATHAK | **5** | **5** | **5** |
| DR PESHWE | **5** | **5** | **5** |
| JG BHATT | **5** | **5** | **5** |
| AR BALLAL | **5** | **5** | **5** |
| RAJESH KHATIRKAR | **0** | **0** | **5** |
| AA LIKHITE | **5** | **5** | **5** |
| YY MAHAJAN | **5** | **5** | **5** |
| MM THAWARE | **5** | **5** | **5** |
| Sum | **40** | **40** | **45** |
| N | **16** | **17** | **18** |
| Assessment of FRP = 6 x Sum/N | **15** | **14** | **15** |
| Average Assessment | | | **14.66** |

## 5.10. Faculty Interaction with Outside World (15)

FIP = Faculty interaction points

Assessment = 3 × (Sum of FIP by each faculty member)/*N*

(Instruction: A faculty member gets a maximum of five interaction points, depending upon the type of institution or R&D laboratory or industry, as follows)

Five points for interaction with a reputed institution abroad, institution of eminence in India, or national research laboratories,

Three points for interaction with institution/industry (not covered earlier).

Points to be awarded, for those activities, which result in joint efforts in publication of books/research paper, pursuing externally funded R&D / consultancy projects and/or development of semester-long course / teaching modules.

| Name of faculty (controlling to FIP) | FIP points (max. 5 per faculty) | | |
|---|---|---|---|
| | CAYm2 | CAYm1 | CAY |
| RK Paretkar | **5** | **5** | **5** |
| SU Pathak | **5** | **0** | **0** |
| DR Peshwe | **5** | **5** | **5** |
| DV Moghe | **5** | **5** | **5** |
| JG Bhatt | **5** | **5** | **5** |
| SG Sapate | **5** | **5** | **5** |
| AP Patil | **5** | **5** | **5** |
| SN Paul | **3** | **0** | **0** |
| RC Rathod | **5** | **0** | **0** |
| AR Ballal | **5** | **5** | **5** |

| | | | |
|---|---|---|---|
| AA Likhite | **5** | **5** | **5** |
| YY Mahajan | **5** | **5** | **5** |
| RK Khatirkar | **5** | **5** | **0** |
| RV Taiwade | **5** | **5** | **5** |
| MM Thaware | **5** | **5** | **3** |
| V Udhaya Banu | **0** | **0** | **0** |
| Ajeet Srivasta | **0** | **5** | **5** |
| Sum | **73** | **65** | **58** |
| N | **18** | **18** | **18** |
| Assessment of FRP = 3 x Sum/N | **12.16** | **10.83** | **9.66** |
| Average Assessment | | | **10.88** |

# 6. Facilities and Technical Support (75)

Description of classrooms, faculty rooms, seminar, and conference halls: (Entries in the following table are sampler entries)

| Room Description | Usage | Shared/Exclusive | Capacity | Rooms Equipped with PC, Internet, Book rack, meeting space... |
|---|---|---|---|---|
| No. of Class Rooms ( 05 ) | Second Year Room | Exclusive | 100 | Equipped with OHP, PA System As Above |
| | Third Year Room | Exclusive | 100 | Equipped with OHP As Above |
| | Final Year room | Exclusive | 90 | |
| | M. Tech Room | Exclusive | 30 | |
| | M. Tech. Room | Exclusive | 30 | |
| Tutorial Rooms ( 02 ) | Tutorial/Elective Room | Exclusive | 70 | Equipped with OHP |
| | Tutorial Room | Exclusive | 70 | As above |
| No. of Seminar Rooms (01) | Seminar Room | Shared | 30 | OHP & Multi Media Facility |
| No. of Meeting Rooms ( 01 ) | Meeting Room | Shared | 30 | As Above |
| No. of Faculty Rooms ( 18 ) | Faculty rooms | Exclusive | | All Rooms equipped with P C & Internet & LAN |

### 6.1. Classrooms in the Department (20)

6.1.1. An adequate number of class rooms for lectures (core/electives), seminars, tutorials are available in the department

6.1.2. All the above rooms are equipped with OHP facilities & the larger class rooms are equipped with P A Systems

6.1.3. The acoustics, size, state of furniture, air circulation, lighting, cleanliness, entry / exit & overall ambience is very good & fit for the purpose.

### 6.2. Faculty Rooms in the Department ( No of Rooms = 18 )

6.2.1. Individual rooms are available for each Faculty in the department.

6.2.2. All of these are equipped with computers, Internet & LAN & most have a white / black board.

(Instruction: Assessment based on the information provided in the preceding table)

6.2.3. Individual Faculty rooms as well as the Seminar / Meeting rooms are routinely used for interactions such as counselling / discussions with individual students or small groups.

The following table is required for the subsequent criteria.

| Lab Description in the Curriculum | Exclusive use/ Shared | Space, Number of Students | Number of Experiments | Qualify of Instruments | Lab Manuals |
|---|---|---|---|---|---|
| Engineering Physical Metallurgy | Exclusive | 22 students per batch | 10 - 11 | Good | Lab Manuals are ready |
| Testing of Materials | Exclusive | As Above | 10 | Good | As Above |
| Mineral Dressing | Exclusive | As Above | 8 / 9 | Good | As Above |
| Engineering Metallurgy( Mech. ) | Exclusive | 26 students per batch | 9 / 10 | Good | As above |
| Joining of Materials | Exclusive | 20 Students per batch | 9 / 10 | O K | As Above |
| Principles of Non Ferrous Metal Extraction | Shared | 20 Students per batch | 9 | OK | As Above |
| Characterization of Materials | Exclusive | 22 Students per batch | 9 / 10 | Good | As above |
| Light Metal Alloys | Exclusive | 18 Students per batch | 6 / 7 | OK | |
| Wear of Engineering Materials | Exclusive | 22 Students per batch | 8 / 9 | OK | Lab Manuals are ready |
| Environmental Degradation | Exclusive | 20 Students per batch | 9 / 10 | OK | As Above |
| Structural Metallurgy | Exclusive | 20 Students per batch | 10 | | Assignment Sheets are ready |
| Composite Materials | Exclusive | 22 Students per batch | 10 / 12 | | As Above |
| Materials Characterization Techniques | Exclusive | 20 Students per batch | 9 / 10 | Good | Manuals ready |
| Introduction to Metals & Alloys | Shared | 20 Students per batch | 8 / 9 | OK | As above |

### 6.3. Laboratories in the Department to meet the Curriculum Requirements and the POs

6.3.1. Adequate, well-equipped laboratories to meet the curriculum requirements and the P O's are available in the Department.

6.3.2. Good computing facilities are available in the department.

6.3.3. Availability of laboratories with technical support within and beyond working hours when needed.

6.3.4. Good Equipment & facilities to run experiments, their maintenance, number of student per experimental setup, size of the laboratories, overall ambience etc are all good / reasonable.

### 6.4. Technical Manpower Support in the Department (15)

| Name of the Technical Staff | Designation (Pay-Scale) | Exclusive/ Shared Work | Date of Joining | Qualification | | Other Technical skills gained | Responsibility |
|---|---|---|---|---|---|---|---|
| | | | | At joining | Now | | |
| Mrs M D Jawale | Senior Lab. Assistant Rs 2400 / Grade Pay | Shared | 02/ 02/ 1994 | SSC | SSC | Training in the areas of Physical Metallurgy & Heat Treatment | Conduct of Laboratory experiments, UG / PG & Research students, R & D projects, Testing & Consultancy work, maintenance of Lab. |
| Mrs V A Patankar | Laboratary Assistant SG II Rs 2400/ Grade Pay | Shared | 02/ 07 / 1991 | Diploma in Met. | Diploma in Met. | Advanced Training in the areas of Testing, Heat Treatment, Failure Analysis, Electrical Engg., Workshop practice. | As Above |
| Shri S L Gadge | Senior Technical Assistant Rs 4800/ | Shared | 16 / 07 / 1984 | Diploma in Met. | Diploma in Met. | Advanced Training in the areas of Corrosion, | As above |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Grade Pay | | | | | Testing, Heat Treatment, Rural Engineering, Failure Analysis. | |
| Mrs S R Naikwade | Laboratory Assistant Rs 2400 / Grade Pay | Shared | 02 / 08 1999 | B.Sc., PGD (Comp) | B.Sc., PGD (Comp) | ITI Training in Electrical Engg., C++ Language & Networking. | As Above |
| Mr. Rajik Shah | Technical Assistant Rs | Shared | 21/08/2014 | M.Sc., MPhil, B.Ed. | M.Sc., MPhil, B.Ed | Nil | As Above |
| Mr. Umesh P. Shende | Technician Rs 2000 Grade Pay | Shared | 21/08/2014 | Dip. Electrical Engg. | Dip. Electrical Engg | Nil | As Above |

6.4.1. Well qualified & Well Trained Technical supporting staff are available in the department. However the need is felt for more such staff members to run the labs more meaningfully.

6.4.2. The TEQIP & such other facilities are made use of for training & skill up-gradation of staff.

# 7. Academic Support Units and Teaching-Learning Process (75)

**7. Academic Support Units and Teaching-Learning Process (75)**

Students' Admission

Admission intake -UG (for information only)

| Item | CAY 2015-16 | CAYm1 2014-15 | CAYm2 13-14 | CAY CAYm3 12-13 |
|---|---|---|---|---|
| Sanctioned Intake Strength in the Institute (N) | 746 | 746 | 746 | 738 |
| Number of students admitted on merit basis (N1) | 708 | 722 | 701 | 713 |
| Number of students admitted on management quota / **otherwise** (N2) | 40 (DASA/ICCR/MEA) | 38 | 30 | 48 |
| Total number of admitted students in the Institute (N1+N2) | 748 | 760 | 731 | 761 |

Admission quality (for information only)

Divide the total admitted ranks (or percentage marks) into **five** or a few more meaningful ranges

| Sr. No. | Rank range (AIEEE Ranking) | 2015-16 | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 | 2009-10 |
|---|---|---|---|---|---|---|---|---|
| 01 | 1-20000 | 387 | 425 | 403 | 410 | 436 | 411 | 367 |
| 02 | 20000-40000 | 155 | 115 | 138 | 136 | 137 | 130 | 105 |
| 03 | 40000-60000 | 43 | 47 | 32 | 49 | 30 | 47 | 29 |
| 04 | 60000-80000 | 39 | 37 | 33 | 48 | 38 | 38 | 36 |
| 05 | 80000-100000 | 25 | 18 | 18 | 27 | 37 | 29 | 22 |
| 06 | 100000-150000 | 30 | 39 | 45 | 21 | 19 | 26 | 25 |
| 07 | 150000-200000 | 13 | 19 | 07 | 8 | 12 | 10 | 14 |
| 08 | 200000-300000 | 07 | 10 | 11 | 9 | 6 | 4 | 11 |
| 09 | 300000-400000 | 05 | 05 | 07 | 1 | 3 | 4 | 1 |
| 10 | 400000-500000 | 01 | 01 | 02 | 1 | 2 | 3 | 0 |
| 11 | 500000-600000 | 01 | 03 | 01 | 2 | 1 | 2 | 0 |
| 12 | 600000-700000 | 01 | 01 | 03 | 1 | 1 | 0 | 0 |
| 13 | Admitted without AIEEE ranks (foreign nationals) | 40 | 38 | 30 | 48 | 15 | 45 | 53 |
| | **Total** | **748** | **760** | **731** | **761** | **737** | **749** | **663** |

Tabular data for estimating student-teacher ratio and faculty qualification for first year common courses

**List of faculty members teaching first year courses**

| Sr. No. | Name of the faculty | Qualification | Designation | Date of joining the institution | Department with which associated | Distribution of teaching load (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 1st year | UG | PG |
| 1. | Dr. J.D. Ekhe | Ph.D | Professor | 24/07/1996 | Chemistry | -- | 50 | 50 |
| 2. | Dr. S.S. Umare | Ph.D | Professor | 23/08/1996 | Chemistry | 21 | 31.7 | 47.3 |
| 3. | Dr. (Mrs.) Anupama Kumar | Ph.D | Associate Professor | 06/01/2000 | Chemistry | 14.2 | 42.8 | 43 |
| 4. | Dr. Sujit Kumar Ghosh | Ph.D | Associate Professor | 04/07/2012 | Chemistry | -- | -- | 100 |
| 5. | Dr. (Mrs.) Ramani V. Motghare | Ph.D. | Assistant Professor | 17/05/2006 | Chemistry | 100 | -- | -- |
| 6. | Dr. Chayan Das | Ph.D/ | Assistant Professor | 30/05/2006 | Chemistry | 25 | -- | 75 |
| 7. | Prof. Atul V. Wankhede | Ph.D/ | Assistant Professor | 26/05/2009 | Chemistry | 62.5 | -- | 37.5 |
| 8. | Dr. Sangesh P. Zodape | Ph.D | Assistant Professor | 02/04/2012 | Chemistry | 25 | -- | 75 |
| 9. | Dr. Umesh Rohidas Pratap | Ph.D/M.Sc. | Assistant Professor | 02/05/2012 | Chemistry | 62.5 | -- | 37.5 |
| 10. | Dr. Susanth K. Nayak | Ph.D | Assistant Professor | 20/01/2015 | Chemistry | 52 | 48 | -- |
| 11. | Dr. S. Laxmi Gayatri | Ph.D | Assistant Professor | 06/02/2015 | Chemistry | 53.8 | -- | 46.2 |
| 12. | Dr. Abhishek Banerjee | Ph.D | Assistant Professor | 18/06/2016 | Chemistry | 100 | -- | -- |
| 13. | Dr. Sandipan Haldar | Ph.D | Assistant Professor | 23/06/2016 | Chemistry | 85 | 15 | -- |
| 14. | Dr. V.K. Deshpande | Ph.D | Professor & Head | 08/03/1988 | Applied Physics | 30 | 35 | 35 |
| 15. | Dr. R.S. Gedam | Ph.D | Associate Professor | 28/08/1998 | Applied Physics | 20 | 45 | 35 |
| 16. | Dr. B.R. Snkapal | Ph.D | Associate Professor | 10/05/2012 | Applied Physics | -- | -- | 100 |
| 17. | Dr. G. Hemachandra | Ph.D | Associate Professor | 23/05/2012 | Applied Physics | 100 | -- | -- |
| 18. | Dr. (Mrs.) S.R. Patrikar | Ph.D/M.Sc. | Assistant Professor | 16/05/2006 | Applied Physics | 70 | -- | 30 |
| 19. | Dr. (Mrs) A. V. Deshpande | Ph.D. | Assistant Professor | 16/05/2006 | Applied Physics | 50 | 25 | 25 |
| 20. | Dr. (Mrs.) S.M. Giripunje | Ph.D | Assistant Professor | 07/10/2008 | Applied Physics | 60 | -- | 40 |
| 21. | Dr. K. Mohan | Ph.D | Assistant | 14/06/2012 | Applied | 30 | -- | 70 |

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|---|---|---|---|---|---|---|---|---|
| | Kant | | Professor | | Physics | | | |
| 22. | Dr. M.S. Ramkartik | Ph.D. | Assistant Professor | 26/12/2014 | Applied Physis | 70 | -- | 30 |
| 23. | Dr. Poorva Singh | Ph.D. | Assistant Professor | 11/05/2015 | Applied Physis | 60 | 10 | 30 |
| 24. | Dr. Aviroop Das | Ph.D. | Adjunct Assistant Professor | 01/08/2016 | Applied Physis | 100 | -- | -- |
| 25. | Dr. G.P. Singh | Ph.D. | Professor | 27/03/1995 | Mathematics | -- | -- | 100 |
| 26. | Dr. P. Pramod Chakravarthy | Ph.D. | Associate Professor | 31/05/2006 | Mathematics | -- | 50 | 50 |
| 27. | Dr. M. Devakar | Ph.D. | Assistant Professor | 24/11/2008 | Mathematics | -- | 50 | 50 |
| 28. | Dr. Pallavi Mahale | Ph.D. | Assistant Professor | 27/11/2008 | Mathematics | -- | 50 | 50 |
| 29. | Dr. G. Naga Raju | Ph.D. | Assistant Professor | 01/07/2010 | Mathematics | 50 | -- | 50 |
| 30. | Dr. R. P. Pant | Ph.D. | Assistant Professor | 25/07/2012 | Mathematics | 50 | -- | 50 |
| 31. | Dr. Pradip Roul | Ph.D. | Assistant Professor | 13/08/2012 | Mathematics | 50 | -- | 50 |
| 32. | Dr. Deepesh Patel | Ph.D. | Assistant Professor | 23/01/2015 | Mathematics | 50 | -- | 50 |
| 33. | Dr. V V Awasthi | Ph.D. | Assistant Professor | 19/07/2016 | Mathematics | 50 | 50 | -- |
| 34. | Dr. Jyoti Singh | Ph.D. | Assistant Professor | 22/07/2016 | Mathematics | 50 | -- | 50 |
| 35. | Dr. Ashutosh Singh | Ph.D. thesis submitted | Adjunct Assistant Professor | 01/08/2016 | Mathematics | 100 | -- | -- |
| 36. | Mr. Krishna Kumar | Ph.D. | Adjunct Assistant Professor | 25/07/2016 | Mathematics | 100 | -- | -- |
| 37. | Mr. Anup Kumar Sharma | Ph.D. thesis submitted | Adjunct Assistant Professor | 25/07/2016 | Mathematics | -- | 100 | -- |
| 38. | Mr. Dinesh Kumar | Ph.D. thesis submitted | Adjunct Assistant Professor | 01/08/2016 | Mathematics | 50 | 50 | -- |
| 39. | Mr. V. B. Borghate | Ph.D. | Professor | 01/08/1985 | Electrical Engg. | 25.93 | 55.56 | 18.52 |
| 40. | B. S. Umre | Ph.D. | Associate Professor | 02/07/1984 | Electrical Engg. | 14.82 | 74.7 | 11.11 |
| 41. | M. R. Ramteke | Ph.D. | Associate Professor | 05/03/1995 | Electrical Engg. | 33.33 | 55.56 | 11.11 |
| 42. | A. S. Junghare | Ph.D. | Associate Professor | 07/03/1995 | Electrical Engg. | 16.00 | 84.00 | -- |
| 43. | S. R. Tambay | Ph.D. | Assistant Professor | 03/08/1981 | Electrical Engg. | 7.41 | 2.96 | 29.62 |

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|---|---|---|---|---|---|---|---|---|
| 44. | Prof. Mrs. R. J. Satputaley | M.Tech. | Assistant Professor | 18/07/2008 | Electrical Engg. | 31.03 | 58.62 | 10.34 |
| 45. | Dr. A. Dhabaley | Ph.D. | Assistant Professor | 16/05/2005 | Electrical Engg. | 27.59 | 44.83 | 27.59 |
| 46. | N. R. Patne | Ph.D. | Assistant Professor | 18/05/2006 | Electrical Engg. | 31.03 | 68.96 | -- |
| 47. | Dr. S. V. Bopshetty | Ph.D | Associate Professor | 18/07/1980 | Mech. Engg. | -- | 100 | -- |
| 48. | Mr. A. A. Thakre | M.Tech. | Assistant Professor | 03/08/2006 | Mech. Engg. | 50 | 50 | 50 |
| 49. | Mr. M. S. Kotambkar | M.Tech. | Assistant Professor | 27/07/2006 | Mech.Engg. | 55 | 55 | 55 |
| 50. | Prof. D. A. Jolhe | M.Tech. | Assistant Professor | 15/09/2008 | Mech. Engg. | 68 | -- | 32 |
| 51. | Prof. N. K. Lature | M.Tech. | Assistant Professor | 15/09/2008 | Mech. Engg. | 78 | -- | 22 |
| 52. | Dr. T.V.K. Gupta | Ph.D. | Assistant Professor | 16/12/2014 | Mech. Engg. | 78 | -- | 22 |
| 53. | Prof. P. V. Kane | M.Tech. | Assistant Professor | 02/12/2008 | Mech. Engg. | -- | 100 | -- |
| 54. | Dr. Trushar Gohil | Ph.D. | Assistant Professor | 30/04/2015 | Mech. Engg. | -- | 52 | 47 |
| 55. | Prof. Ravikumar Dumpala | Ph.D. | Assistant Professor | 01/06/2015 | Mech. Engg. | -- | 81 | 19 |
| 56. | Dr. L. M. Gupta | Ph.D. | Professor | 18/10/1989 | Applied Mechanics | 20 | 20 | 60 |
| 57. | Dr. M. M. Mahajan | Ph.D. | Professor | 18/08/1992 | Applied Mechanics | -- | 53.8 | 46.2 |
| 58. | Dr. R. K. Ingle | Ph.D. | Professor | 14/09/1992 | Applied Mechanics | 15.4 | 38.5 | 46.2 |
| 59. | Dr. G. N. Ronghe | Ph.D. | Professor | 29/06/1987 | Applied Mechanics | -- | 16.7 | 83.3 |
| 60. | Dr. O. R. Jaiswal | Ph.D. | Professor | 30/10/1998 | Applied Mechanics | 22.2 | 55.6 | 22.2 |
| 61. | Dr. R. S. Sonparote | Ph.D. | Associate Professor | 11/08/1992 | Applied Mechanics | -- | 37.5 | 62.5 |
| 62. | Dr. S. V. Bakre | Ph.D. | Associate Professor | 16/05/2006 | Applied Mechanics | -- | 58.3 | 41.7 |
| 63. | Dr. Sangeeta Gadve | Ph.D. | Associate Professor | 08/06/2012 | Applied Mechanics | -- | 58.3 | 41.7 |
| 64. | Dr. D. Datta | Ph.D. | Assistant Professor | 15/06/2010 | Applied Mechanics | 23.1 | 38.5 | 38.5 |
| 65. | Dr. Ratnesh Kumar | Ph.D. | Assistant Professor | 17/04/2012 | Applied Mechanics | 38.5 | 46.2 | 15.4 |
| 66. | Mr. S. B. Borghate | M.Tech. | Assistant Professor | 30/08/1998 | Applied Mechanics | 56.3 | 31.3 | 12.5 |
| 67. | Mr. A. Y. | M.Tech. | Assistant | 14/06/2006 | Applied | -- | 57.1 | 42.9 |

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|---|---|---|---|---|---|---|---|---|
| | Vyavhare | | Professor | | Mechanics | | | |
| 68. | Mr. A. P. Khatri | M.Tech. | Assistant Professor | 28/11/2008 | Applied Mechanics | 69.2 | 15.4 | 15.4 |
| 69. | Dr. M. D. Goel | Ph.D. | Assistant Professor | 15/07/2016 | Applied Mechanics | 69.2 | 15.4 | 15.4 |
| 70. | Mr. M. Rahul | M.Tech. | Adjunct Professor | 25/07/2016 | Applied Mechanics | 100 | -- | -- |
| 71. | Ms Rutuja Wanjari | M.Tech. | Adjunct Professor | 25/07/2016 | Applied Mechanics | 100 | -- | -- |
| 72. | Mr. C S Chaudhary | M.Tech. | Adjunct Professor | | Applied Mechanics | -- | 100 | -- |
| 73. | Dr. M. Ghosal | Ph.D. | Associate Professor | 16/08/1988 | Humanities & S. Science | 50 | -- | 50 |
| 74. | Dr. G. N. Nimbarte | Ph.D. | Associate Professor | 24/11/2008 | Humanities & S. Science | 100 | -- | -- |
| 75. | Navneet Utlawar | M.A. | Adjunct Assistant Professor | 19/07/2013 | Humanities & S. Science | 100 | -- | -- |
| 76. | Mr. Jaipal | M.A. | Adjunct Assistant Professor | 25/07/2016 | Humanities & S. Science | 100 | | |
| 77. | Priyanka Bansod | M.A. | Teaching Assistant | 15/07/2013 | Humanities & S. Science | 100 | -- | -- |
| 78. | A. S. Mokhade | M.Tech. | Associate Professor | 23/08/1996 | Computer Science & Engineering | 84.62 | 15.38 | -- |
| 79. | Mrs. Deepti Shrimankar | Ph.D. | Assistant Professor | 26/11/2008 | Computer Science & Engineering | 28.57 | 71.43 | -- |
| 80. | Dr. P.A. Sharma | Ph.D. | Assistant Professor | 21/06/2015 | Computer Science & Engineering | 25 | 75 | -- |
| 81. | Dr. Praveen Kumar | Ph.D | Assistant Professor | 22/06/2016 | Computer Science & Engineering | 58.33 | 41.66 | -- |
| 82. | Mr. Bharat Kapse (Ad-hoc) | M.Tech. | Adjunct Assistant Professor | 01/08/2016 | Computer Science & Engineering | 73.33 | 26.66 | -- |
| 83. | Ms. Monali Ramteke | M.Tech. | Adjunct Assistant Professor | 27/07/2016 | Computer Science & Engineering | 100 | -- | -- |

## 7.1. Academic Support Units (35)

7.1.1. Assessment of First Year Student Teacher Ratio (FYSTR) (10)

Data for first year courses to calculate the FYSTR:

| Year | Number of students (approved intake strength) | Number of faculty members (considering fractional load) | FYSTR | Assessment = (10x15)/FYSTR (Max. is 10) |
|---|---|---|---|---|
| CAYm2(13-14) | 731 | 22 | 33.23 | 4.51 |
| CAYm1 (14-15) | 760 | 24 | 31.67 | 4.74 |
| CAY (15-16) | 748 | 36 | 20.78 | 7.22 |
| Average | | 27 | 28.56 | 5.49 |

7.1.2. Assessment of Faculty Qualification Teaching **First Year Common Courses** (15)

Assessment of qualification = $3 \times (5x + 3y + 2z0)/N$, where $x + y + z0 \leq N$ and $z0 \leq Z$

x = Number of faculty members with PhD
y = Number of faculty members with ME/MTech/NET-Qualified/MPhil
z = Number of faculty members with BE/BTech/MSc/MCA/MA
N = Number of faculty members needed for FYSTR of 25

| Year | x | y | z | N | Assessment of faculty qualification |
|---|---|---|---|---|---|
| CAYm2(13-14) | 17 | 04 | 01 | 22 | 13.50 |
| CAYm1 (14-15) | 19 | 04 | 01 | 24 | 13.62 |
| CAY (15-16) | 27 | 08 | 01 | 36 | 13.42 |
| Average Assessment of faculty qualification | | | | | 13.51 |

**7.1.3**. Basic science/engineering laboratories (adequacy of space, number of students per batch, quality and availability of measuring instruments, laboratory manuals, list of experiments) (8)

| Lab Description | Space, Number of students | Software used | Type of Experiments | Qualify of Instruments | Lab Manuals |
|---|---|---|---|---|---|
| First Year Basic Electrical Engineering Lab. (EEP101) | 100 square meters<br><br>Around 18 students per practical | This is a hardware laboratory | Hands-on experiment where students first wire-up and then conduct | Good quality instruments are used.<br><br>Adequate | Lab manuals are available for all the experiments. |

| | | | | | |
|---|---|---|---|---|---|
| | batch | | the experiment. Experiments are designed to verify circuit laws and demonstrate and reinforce concepts taught in theory classes | numbers of instruments are available. | |
| B.Tech First Year General Lab | Two labs For General and optics experiments separately | NIL Demonstration through LCD Projector | Basic General Physics Experiments | Adequate Quality Four SET for each experiment | Yes, for each experiments |
| B.Tech 1st Year General Lab | One general Lab covers all experiment | Nil | Basic General Applied Chemistry Experiments | Adequate & High Quality Ample sets for each experiment | Yes, for each experiment. |
| Engineering Drawing Lab. | Three classrooms (each 400 sq-feet area 18 students in each batch Four batches for each section. | Nil | Sheet Work | Wooden Models | NA |
| Computer Programming Lab | 2000 Sq.Ft<br><br>20 | Turbo C | Programming | Available and adequate | Available and adequate |

(Instruction: The institution needs to mention the details for the basic science/engineering laboratories for the first year courses. The descriptors as listed here are suggestive in nature.)

**7.1.4.** Language laboratory (2)

| Lab Description | Space, Number of students | Software used | Type of Experiments | Qualify of Instruments | Guidance |
|---|---|---|---|---|---|
| Language learning facility | 100 licences on Internet | Lingo fx x 25 | Language learning 25 foreign languages | Computer | Self learning |
| | | | | | |

(Instruction: The institution may provide the details of the language laboratory. The descriptors as listed here are not exhaustive).

### 7.2. Teaching - Learning Process(40)

**7.2.1.** Tutorial classes to address student questions: size of tutorial classes, hours per subject given in the timetable (5)

Provision of tutorial classes in timetable: YES/NO
Tutorial sheets provided: YES/NO
Tutorial classes taken by faculty/teaching assistants/senior students/ other: Faculty
Number of tutorial classes per subject per week: Number of students per tutorial class:
Number of subjects with tutorials: 1st year …2nd year…3rd year…..4th year
(Instruction: Here the institution may report the details of the tutorial classes that are being conducted on various subjects and also state the impact of such tutorial classes).

**7.2.2**. Mentoring system to help at individual levels (5)

(Instruction: Here the institution may report the details of the mentoring system that has been developed for the students for various purposes and also state the efficacy of such system).
Type of mentoring: Professional guidance / career advancement / course work specific / laboratory specific / total development

Number of faculty mentors: One
Number of students per mentor: 30
Frequency of meeting: Every 15 days
Faculty Advisors – Prof. D V Moghe

**7.2.3**. Feedback analysis and reward / corrective measures taken, if any (5)

(Instruction: The institution needs to design an effective feedback questionnaire. It needs to justify that the feedback mechanism it has developed really helps in evaluating teaching and finally contributing to the quality of

teaching).

Feedback collected for all courses: YES/~~NO~~

Specify the feedback collection process: A standard feedback is collected from all the students before the start of end semester examination. The system of feedback collection is manual. Collected feedback is scrutinized by Head of Department. All the parameters related to comprehensive ability of teacher is analyzed. All the feedback written by students is communicated to respective teacher by Head of department.

Percentage of students participating:. 80 to 90%

Specify the feedback analysis process: The feedback analysis is done manually. All the parameters related to teacher performance is graded out of common marks. Ability of teaching with respect to each item is analyzed. All the comments written by students is communicated to respective teacher by the Head of the Deparement

Basis of reward / corrective measures, if any:

Number of corrective actions taken in the last three years:

2012-2013: 01

2011-2012: 01

2010-2011: 01

**7.2.4**. Scope for self-learning (5)

(Instruction: The institution needs to specify the scope for self-learning / learning beyond syllabus and creation of facilities for self-learning / learning beyond syllabus.)

Many e-learning material, e-books, journal and magazines are collected and made available to the students at the Institute Library to help the students to build the habit of self-learning. Moreover, provision of Internet in the hostels is facilitated to help the students to learn beyond what is taught in the classroom. Periodic seminars are also created to encourage the student to know about newly published papers and journals.

**7.2.5**. Generation of self-learning facilities, and availability of materials for learning beyond syllabus (5)

(Instruction: The institution needs to specify the facilities for self-learning / learning beyond syllabus.)

**7.2.6**. Career Guidance, Training, Placement, and Entrepreneurship Cell (5)

(Instruction: The institution may specify the facility and management to facilitate career guidance including counselling for higher studies, industry interaction for training/internship/placement, Entrepreneurship cell and incubation facility and impact of such systems)

**7.2.7**. Co-curricular and Extra-curricular Activities (5)

(Instruction: The institution may specify the Co-curricular and extra-curricular activities, e.g., NCC/NSS, cultural activities, etc)

**7.2.8**. Games and Sports, facilities, and qualified sports instructors (5)

(Instruction: The institution may specify the facilities available and their usage in brief)

Sports and games are essentials components of human resource development, holding to promote good health, comradeship and spirit of healthy competition, which in turn, has positive and deep impact on the holistic development of the personality of the youth who is a potential source of energy, enthusiasm and inspiration for development, progress and prosperity of the nation. Coaching facilities are provided to the selected students (selected by conducting the selection trials of various games). Specialized coaches are appointed to train the students going to participate in various West Zone, All India and Inter-Nit Tournaments. Well qualified sports instructors are regularly instruct the students.

**Games and Sports Facilities:-**

**Sports facilities currently available on the Campus**

- One Cricket Ground with six Turf wickets.
- One Football Ground with flood light arrangement.
- Two Volleyball Courts with flood light
- One Badminton Court.
- A Table Tennis Hall
- Three Lawn Tennis Courts.
- One Flood light Basketball Court.
- Well equipped Gymnasium
- Cricket pavilion with the seating capacity of 500 students

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## 8. Governance, Institutional Support and Financial Resources (75)
## 8.1. Campus Infrastructure and Facility (10)

### 8.1.A Campus

The VNIT Campus is spread over an area of 214 acres near Ambazari lake. It presents a spectacle of harmony in architecture and natural beauty. The campus has been organized in three functional sectors;

- Hostels.
- Academic area: Departments, Administrative Buildings, Library and Information Center and various central facilities.
- Residential Sector for staff and faculty

The academic buildings are located fairly close to both, the hostels and the staff quarters. The campus has a full-fledged computerized branch of State Bank of India with ATM facility, Canara Bank, and a Post Office.

The Institute has its own well equipped Health Center with a residential Medical Officer. The specialized services of Psychiatric & Psychological Counsellor, Dietician, Physiotherapist, Pathology lab, Yoga centre. Also medical consultants in Ayurveda and Homeopathy are available. Patients suffering from serious illness / requiring intensive care are referred to the Govt. Medical College and other Hospital nearby and other Health Care Centers duly approved under the CGHS.

An adequately equipped canteen is close to the instruction zone and hostels. Two more cafeterias exist on the campus. The Institute has a well equipped Gymkhana apart from various playgrounds for Tennis, Badminton, Volleyball, Football, Hockey, and Cricket. NCC unit is also located on campus.

Institute is gearing us its infrastructure over the years and is improving its infrastructure. This year, Institute has finished construction of 1000 seat boys hostel. Construction of classroom complex is in place.

**Boys hostel**:


**8.1.B Administration**

As per the provisions of the NIT Act, the Board of Governors (BoG) is responsible for superintendence, direction, and control of the Institute. Thus, the BoG is vested with full powers of the affairs of administration / management and finances of the Institute. Members of the Board represent Government of India, Government of Maharashtra, Industries, and faculty of the Institute. The Director is the principal academic and executive officer of the Institute. Besides the BoG, the Senate, the Finance Committee (FC) and the Building and Works Committee (BWC) are statutory committees and therefore important authorities of the Institute.
Apart from the above statutory committees, the Board has the power to constitute various sub-committees for smooth and efficient administration. Thus, the Board has constituted the Stores Purchase Committee (SPC), Grievance Committee (GC), and Special Cell. The SPC administers the centralized procurement of equipment and material whereas the GC provides a platform to hear the views of staff and faculty on grievances. The Special Cell functions to protect the interest of backward-class candidates through procedural, institutional, and other safeguards.

**8.1.C Academic Programmes**

The Institute offers 9 Under-Graduate programs viz., B. Tech. in Chemical, Civil, Computer Science, Electrical and Electronics, Electronics and Communication, Mechanical, Metallurgical and Materials and Mining Engineering and Bachelor of Architecture.
The Institute also offers 18 Post-Graduate Full time programs (2 years duration) viz., M. Tech. in Industrial Engg., Heat Power Engg, CAD-CAM, Materials Engg, VLSI Design, Communication System Engineering, Computer Science Engg., Integrated Power System, Power Electronics and Drives, Structural Engineering, Structural Dynamics and Earthquake Engineering, Environmental Engineering, Water Resources Engineering, Construction Technology and Management, Transportation Engineering and Urban Planning, Excavation Engineering, Chemical Engineering. The Institute also offers M.Tech. by research program in all engineering departments, Ph.D.(Full/Part Time).
Institute has stared M.Sc. programs in Chemistry, Mathematics and Physics from current year.
The Doctoral Research is done in all Engineering and Sciences departments. Institute is a recognized centre under QIP scheme for Ph.D. program in Electrical

and Metallurgical & Materials Engineering department and for M. Tech. program in Electrical and Civil Engineering departments.

**8.1.1**. Maintenance of academic infrastructure and facilities (4)

(Instruction: Specify distinct features)

**Maintenance of Infrastructure & facilities** :

The college has an extensive Infrastructure spread over 214 acres comprising of Academic Buildings, Departments, Lecture Theatres, Auditorium, Food outlets, student Residences, faculty and staff quarters, Guest House, sport fields, stadia, roads, power supply systems, Roads, Water supply, selvage disposal Network etc. A full fledged Estate Maintenance section is operational since the inception of the college. For civil maintenance as well as the supervision of new construction, Electrical Maintenance including Back up generation by Diesel Generator Telecom and Data network (ISDN & Optical Fibre) is taken care by independent units. A security section supervises the maintenance of Law & order on the campus and vicinity.

Annual Maintenance contract for academic infrastructures including computing facility, UPS and air-conditioning (facility management at Institute level)

Annual maintenance contract or on-call basis maintenance service is affected for critical level laboratory equipment. Many of the critical equipment are procured with 3 years warranty.

Assistant Engineer has the responsibility to maintain the Institute campus under the supervision of Dean (Planning & Development). Assistant Estate Engineer coordinates and oversees the functions of the buildings, water supply and electrical wings.

**8.1.2**.Hostel (boys and girls), transportation facility, and canteen (2)

| Hostels | No, | No. of Rooms | No. of Students accommodated |
|---|---|---|---|
| Hostel for Boys | 7 | 2582 | 2211 |
| Hostel for Girls | 4 | 886 | 860 |

**8.1.3. Electricity, power backup, telecom facility, drinking water, and security (4)**

**8.1.3. A Electricity**:

As a self sufficient campus which is also a minor township, the entire energy requirements are under own control of the Institute. The Institute is an HT consumer getting supply from the State Electricity Board at 11 kV by UG cable/as a high priority express Feeder and is exempt from load shedding interruptions. The current maximum load demand is of the order of 1000 KVA while the total connected load is estimated at 1500 Kw at substantially unity power factor. The 200 acre Campus is served by three substation having 3 transformers of 400 KVA each and a smaller transformer of 250 KVA. The Internal distribution to various units of the campus such as Hostel, Academic Bldgs., Residential area is entirely by underground LT

cabling. As a backup to the Electricity Board supply due to unforeseen reasons beyond institute's control, a set of 2 Diesel Generators each of 250 KVA capacity is available for serving essential load such as computer/Network center Library/Administration Bldg. etc.
The entire Electrical Installation is maintained in house under the supervision of coordinator – Electrical maintenance who is usually a senior Professor in Electrical Engg. Deptt. The Campus roads are also having energy efficient lighting which under automatic timer control device. The entire installation is annually checked by the statutory authority of Electrical Inspector for safety, reliability and Earthing etc. The average Electrical consumption of the campus is around 112000 KWh units over one calendar year with hostels being significant part of the overall load. As a part of the modernisation solar water heaters are installed in all hostels and plan are underway to introduce solar PV as well LED lights to significantly reduce Main Power from Electric supply utility.

**8.1.3.B Water Supply Details**:

The college campus gets its water supply from Nagpur Municipal Corporation as well as from it's own wells. To ensure regular and uninterrupted supply to all user a network of 9 underground sumps (reservoirs) are created having total storage capacity of 12-85 lakh litres of Potable Drinking Water. The average daily consumption is 6.50 lakh litres, mains water supply is limited to daytime hours from 7.45 am to 11.00 a.m. to individual Buildings overhead tanks.

**8.1.4 C Campus Security Section**:

The VNIT campus has a full fledged security section having 12 permanent employees. The section is headed by Security Officer assisted by Asstt. Security Officer and 10 permanent cadre service guards. This is supplemented by designated guard units provided by a private security agency supervised by college security personal. All Major Installations such as Entry gates, Hostels (Boys & girls), Library and other sections are provided round the clock security supplemented by walkie-talkie phone system.

**8.2. Organisation, Governance, and Transparency (10)**

**8.2.1. Governing body, administrative setup, and functions of various bodies (2)**

(A) **Board of Governors**

| S. N. | NAME | Designation |
|---|---|---|
| 1. | **Mr. Vishram Jamdar,** **Industrialist,** Kinetic Gears E-19/1, MIDC Area, Hingna Road, Nagpur – 440 028 | Chairman |
| 2. | **Shri S P Goyal,** Joint Secretary Department of Higher Education, Ministry of HRD, Govt. of India, "C" Wing, Shastri Bhavan, NEW DELHI – 110 115 | Member |
| 3. | **Jr. Secretary & Financial Adviser (HRD),** Deptt. of Higher Education (IFD), 118-C, Shastri Bhawan, NEW DELHI – 110 115 | Member |
| 4. | **Shri Sanjeev Sharma,** | Member |

| | | |
|---|---|---|
| | Director NITs, MHRD, NEW DELHI – 110 115 | |
| 5. | **Shri Rajesh Singh,**<br>Director, Deptt. of Higher Education (IFD), 118-C, Shastri Bhawan, NEW DELHI – 110 115 | Member |
| 6. | **Prof. (Ms.) Joyashree Roy,**<br>Professor of Department of Economics, Jadavpur University, Kolkata, 11, Central Park, KOLKATA – 700 032 | Member |
| 7. | **Prof. S. C. Sahasrabudhe,**<br>Director, Dhirubhai Ambani Institute of Information & Communication Technology, Gandhinagar, Near Indroda Circle, GANDHINAGAR – 382 007 | Member |
| 8. | **Prof. Uday N. Gaitonde,**<br>Deptt. of Mechanical Engineering,<br>Indian Institute of Technology, Bombay<br>Powai, Mumbai – 400 076 | Member |
| 9. | **Dr. J. D. Ekhe,**<br>Associate Professor, Department of Chemistry, VNIT, Nagpur | Member |
| 10. | **Dr. Laxmikant M. Gupta**<br>Professor, Department of Applied Mech., VNIT, Nagpur | Member |
| 11. | **Dr. Narendra S. Chaudhari,**<br>Director, VNIT, Nagpur | Member |
| 12. | **Dr. S. R. Sathe**<br>Registrar, V.N.I.T., Nagpur | Member-Secretary |

(B) **Senate**

| S. N. | Name | Design. |
|---|---|---|
| 1 | **Dr. Narendra S. Chaudhari**,<br>Director, VNIT, Nagpur | Chairman |
| 2 | **Prof. Milind Atrey,**<br>Professor and In-charge SINE,<br>Department of Mechanical Engineering,<br>IIT Bombay, Powai,<br>MUMBAI – 400076 | Member |
| 3 | **Dr. (Ms.) Kamal Singh,**<br>Rtd. Vice-Chancellor of Amravati University<br>Nelco Society, NAGPUR | Member |
| 4 | **Prof. Meenakshi Gupta,**<br>Department of Humanities and Social Science, IIT Bombay, Powai,<br>MUMBAI – 400076 | Member |

| | | |
|---|---|---|
| 5 | **Prof. O. R. Jaiswal**<br>Dean (Academics), VNIT, Nagpur | Member |
| 6 | **Dr. S. R. Sathe**<br>Dean (Planning & Development), VNIT, Nagpur | Member |
| 7 | **Dr. P. M. Padole**<br>Dean (Faculty Welfare), VNIT, Nagpur | Member |
| 8 | **Dr. H. M. Suryawanshi**<br>Dean (Research & Consultancy), VNIT, Nagpur | Member |
| 9 | **Dr. G. P. Singh**<br>Dean (Students Welfare), VNIT, Nagpur | Member |
| 10 | **Dr. R. K. Ingle**<br>Head, Deptt. of Applied Mechanics, VNIT, Nagpur | Member |
| 11 | **Prof. L. M. Gupta**<br>Professor of Applied Mechanics, VNIT, Nagpur | Member |
| 12 | **Dr. M. M. Mahajan**<br>Professor of Applied Mechanics, VNIT, Nagpur | Member |
| 13 | **Dr. G. N. Ronghe**<br>Professor of Applied Mechanics, VNIT, Nagpur | Member |
| 15 | **Dr. V. K. Deshpande**<br>Head, Deptt. of Applied Physics, VNIT, Nagpur | Member |
| 16 | **Dr. (Mrs.) Rajashree Kotharkar**,<br>Head, Dept. of Architecture, VNIT, Nagpur | Member |
| 17 | **Dr. V. S. Adane**<br>Professor of Architecture, VNIT, Nagpur | Member |
| 18 | **Dr. (Mrs.) Alpana Dongre,**<br>Professor of Architecture, VNIT, Nagpur | Member |
| 19 | **Dr. K. L. Wasewar**<br>Head, Chemical Engg. Deptt., VNIT, Nagpur | Member |
| 20 | **Dr. S. S. Umare**<br>Head, Deptt. of Chemistry, VNIT, Nagpur | Member |
| 21 | **Dr. A. R. Tembhurkar**<br>Head, Civil Engg. Deptt., VNIT, Nagpur | Member |
| 22 | **Dr. V. A. Mhaisalkar**<br>Professor of Civil Engineering, VNIT, Nagpur | Member |
| 23 | **Dr. Rajesh Gupta**<br>Professor of Civil Engineering, VNIT, Nagpur | Member |
| 24 | **Dr. Y. B. Katpatal** | Member |

| | | |
|---|---|---|
| | Professor of Civil Engg., VNIT, Nagpur | |
| 25 | **Dr. P. S. Deshpande**<br>Professor of Computer Sc. & Engg., VNIT, Nagpur | Member |
| 26 | **Dr. M. V. Aware**<br>Professor of Electrical Engg., VNIT, Nagpur | Member |
| 27 | **Dr. K. D. Kulat**<br>Assciate Dean, Edu. Tech. and Library, VNIT, Nagpur | Member |
| 28 | **Dr. R. B. Deshmukh**<br>Professor, Centre of VLSI and Nano Technology,<br>VNIT, Nagpur | Member |
| 29 | **Dr. Avinash G. Keskar**<br>Professor of Electronics Engg., VNIT, Nagpur | Member |
| 30 | **Dr. Rajendra M. Patrikar**<br>Head of Electronics & Engg., VNIT, Nagpur | Member |
| 31 | **Dr. Abhay S. Gandhi**<br>Head of Electronics Engineering, VNIT, Nagpur | Member |
| 32 | **Dr. Yogesh M. Deshpande,**<br>Head, Deptt. of Humanities, VNIT, Nagpur | Member |
| 33 | **Dr. P. P. Chakravarthy**<br>Head, Deptt. of Mathematics, VNIT, Nagpur | Member |
| 34 | **Dr. Shashikant B. Thombre**<br>Professor. of Mechanical Engg., VNIT, Nagpur | Member |
| 35 | **Dr. Animesh Chatterjee**<br>Professor of Mechanical Engg., VNIT, Nagpur | Member |
| 36 | **Dr. N. R. Thote**<br>Professor of Mining Engineering, VNIT, Nagpur | Member |
| 37 | **Dr. A. M. Kuthe**<br>Head Mechanical Enggineering, VNIT, Nagpur | Member |
| 38 | **Dr. S. R. Bhide**<br>Head, Deptt. of Electrical Engg., VNIT, Nagpur | Member |
| 39 | **Dr. D. R. Peshwe**<br>Head, Deptt. of MMEl , VNIT, Nagpur | Member |
| 40 | **Dr. I. L. Muthreja**<br>Head, Deptt. of Mining Engg., VNIT, Nagpur | Member |
| 41 | **Dr. K. M. Bhurchandi** | Member |

| | | |
|---|---|---|
| | Professor, Deptt., ECE, VNIT Nagpur | |
| 42 | **Dr. S. G. Sapate**<br>Professor, Deptt. MME, VNIT Nagpur | Member |
| 43 | **Dr. A. P. Patil**<br>Professor, Deptt., MME, VNIT, Nagpur | Member |
| 44 | **Dr. Manish Kurhekar**<br>Assciate Dean, MIS Network and Website, VNIT, Nagpur | Member |
| 45 | **Dr. V.S. Kale**<br>Assciate Dean, Electrical Works, VNIT, Nagpur | Member |
| 46 | **Dr. S.V. Bakre**<br>Assciate Dean, Procurements and Stores, VNIT, Nagpur | Member |
| 47 | **Dr. P. S. Kulkarni**<br>Assciate Dean, Exams, VNIT, Nagpur | Member |
| 48 | **Dr. R. S. Sonparote**<br>Assciate Dean, Civil work, VNIT, Nagpur | Member |
| 49 | **Dr. A. B. Andhare**<br>Assciate Dean, T & P, VNIT, Nagpur | Member |
| 50 | **Dr. J. D. Ekhe**<br>Assciate Dean, Students activity and Sports, VNIT, Nagpur | Member |
| 51 | **Dr. D. H. Lataye**<br>Assciate Dean, Hostel Affairs, VNIT, Nagpur | Member |
| 52 | **Dr.Yogesh Deshpande**<br>Assciate Dean, Public Relations, VNIT, Nagpur | Member |
| 53 | **Dr. V.R. Kalamkar**<br>Assciate Dean, III Cell & Alumni Activities, VNIT, Nagpur | Member |
| 54 | **Dr. S. R. Sathe**<br>Registrar, VNIT, Nagpur | Member-Secretary |

## (C) **Finance Committee**

| S. N. | NAME | Designation |
|---|---|---|
| 1. | **Mr. Vishram Jamdar,**<br>**Industrialist,**<br>Kinetic Gears E-19/1,MIDC Area,Hingna Road,Nagpur – 440 028 | Chairman |
| 2. | **Shri. S. P. Goyal**<br>Joint Secretary , Department of Higher Education,<br>Ministry of HRD, Govt. of India, "C" Wing, Shastri Bhavan, NEW DELHI – 110 115 | Member |

| | | |
|---|---|---|
| 3. | Joint Secretary & Financial Advisor, (HRD),<br>Ministry of HRD,<br>Deptt. of Higher Education (IFD), 118-C, Shastri Bhawan, NEW DELHI – 110 115 | Member |
| 4. | **Shri Sanjeev Sharma,**<br>Director NITs,<br>MHRD, NEW DELHI – 110 115 | Member |
| 5. | **Shri Rajesh Singh,**<br>Director, Deptt. of Higher Education (IFD), 118-C, Shastri Bhawan, **NEW DELHI – 110 115** | Member |
| 6. | **Prof. S. C. Sahasrabudhe,**<br>Director, Dhirubhai Ambani Institute of Information<br>& Communication Technology, Gandhinagar,<br>Near Indroda Circle,<br>GANDHINAGAR – 382 007 | Member |
| 7. | **Prof. Uday N. Gaitonde,**<br>Deptt. of Mechanical Engineering,<br>Indian Institute of Technology, Bombay<br>Powai, Mumbai – 400 076 | Member |
| 8. | **Dr. Narendra S. Chaudhari,**<br>Director, VNIT, Nagpur | Member |
| 9. | **Dr. S. R. Sathe**<br>Registrar, V.N.I.T., Nagpur | Secretary |

(D) **Building & Works Committee**

| S. N. | NAME | Designation |
|---|---|---|
| **1.** | **Dr. Narendra S. Chaudhari,**<br>Director, VNIT, Nagpur | Chairman |
| **2.** | Addl. Secretary (HRD),<br>Ministry of HRD,<br>Deptt. of Higher Education (IFD), 118-C, Shastri Bhawan, NEW DELHI – 110 115 | Member |
| **3.** | **Shri Sanjeev Sharma,**<br>Director NITs,<br>MHRD, NEW DELHI – 110 115 | Member |
| **4.** | **Shri Rajesh Singh,**<br>Director, Deptt. of Higher Education (IFD), 118-C, Shastri Bhawan, **NEW DELHI – 110 115** | Member |
| **5.** | **Prof. S. C. Sahasrabudhe,**<br>Director, Dhirubhai Ambani Institute of Information<br>& Communication Technology, Gandhinagar,<br>Near Indroda Circle, GANDHINAGAR – 382 007 | Member |
| **6.** | **Dr. R. R. Yerpude**<br>**Dean (P&D),** V.N.I.T., Nagpur | Member |

| | | |
|---|---|---|
| **7.** | **A. A. Sagne / Rajesh K. Khatke**<br>**Chief Engineer, (Civil)**<br>Public Works Department (PWD)<br>Bandhkam Sankul, B.No.39/I, Civil Lines,<br>NAGPUR – 440001 | Member |
| **8.** | **R. R. Akulwar / V. N. Singne**<br>**Supdt. Engineer (Electrical),**<br>Public Works Department,<br>Bandhkam Sankul, B.No.39/I, Civil Lines,<br>NAGPUR – 440001 | Member |
| **9.** | **Dr. S. R. Sathe**<br>Registrar, V.N.I.T., Nagpur | Member-Secretary |

**Other information is as under** -

Statutory Committees -

| Name of the Committee | Frequency of the meetings | Attendance |
|---|---|---|
| Board of Governors | 4 in a year | Average 70% |
| Finance Committee | 3 in a year | Average 80% |
| Building & Works Committee | 4 in a year | Average 80% |
| Senate | 4 in a year | Average 90% |

Other than the above Committees, there in also the Staff Selection Committee (Statutory) for Selection of faculty and non-faculty employees which meets as and when necessary. This is a standard composition of the committee which includes official & Non official members.

The last Staff Selection Committee for recruitment of faculty posts was held in 2012 and for non-faculty posts in 2008.

In addition the board has constituted following Committees for compliance with rules & regulations.

**1) Special Cell**: VNIT Nagpur has constituted Special Cell for faculty & staff. The regular meetings are conducted. To ascertain the Goal reservation policy is observed scrupulously.

**2) Stores Purchase Committee**: Stores Section is dealing with all kinds of Indigenous as well as Imported goods required for research purpose. There is centralized purchase procedure in the Institute. The procedure to be adopted for the purchase of diverse kind of equipments and stores required by the various users of the institute should be in consonance with the procedure approved by the BOG, of the Institute.

There is Stores Purchase Committee (SPC) constituted by the Competent Authority. All the purchases above the purchase value Rs.10,00,000/- (Rs. Ten Lakh Only) has to take the approval from the Stores Purchase Committee (SPC) before awarding the purchase order. Apart from the purchase activities, Stores Section also deals with the disposal/auction of the unserviceable materials after taking the approval of the Director in form GFR-17.

**3) Grievance Cell**: VNIT Nagpur has constituted Grievance Cell for faculty & staff. The regular meetings are conducted & the various Grievances of staff are addressed.

The authority of the Institute is kept informed regarding Grievances & attempt is made to address the same. The Grievances is received from CPGRAMS are addressed online & the replies is provided.

**4) Women's Cell**: To address the Grievances related to sexual harassment of women and girl students of the Institute.

1) To celebrate the Women's Day in March each year.
2) To arrange workshops on health related issues.
3) To arrange workshop for general wellness of women.
4) To arrange talks on self defence'.
5) To arrange instructors to train girls/women for self protection.
6) To arrange camps on osteoporosis and distribution of free Calcium sachet provided by Health Centre.

No of meetings from 2012 to Dec. 2016 – Around 10 meetings conducted on various dates

**8.2.2**. Defined rules, procedures, recruitment, and promotional policies, etc. (2)
(Instruction: List the published rules, policies, and procedures; year of publications; and state the extent of awareness among the employees/students. Also comment on its availability on Internet, etc.)

8.2.3, 8.2.4 Most of the information viz.. Act, Statutes, constitution of various Committees, Academic Programmes, grievance mechanism, and minutes of all Statutory Committees are placed on Institute web-site and updated from time to time.

**8.2.3**. Decentralisation in working including delegation of financial power and grievance redressal system (3)
(Instruction: List the names of the faculty members who are administrators/decision makers for various responsibilities. Specify the mechanism and composition of grievance redressal system, including faculty association, staff-union, if any.)

**LIST OF DELEGATION OF FINANCIAL POWERS**

| Sr.No. | Particulars | Functionaries | Proposed Financial Power |
|---|---|---|---|
| 01. | All kinds of expenditure under plan and non plan budget | Director | Up to 8 Crores |
| 02. | All kinds of expenditure under plan and non plan budget | Deputy Director | Upto 50 Lakhs |
| 03. | All kinds of purchases & other expenditure from Sponsor Research, Projects, Schemes and Consultancy Funds | Dean (R&C) | Upto 10 Lakhs |

| | | | |
|---|---|---|---|
| 04. | For Purchase of Consumables from Projects, Schemes and Consultancy Fund | Principal Investigator | Upto 2 Lakhs (for Consumables only) |
| 05. | 1. Stores, spares, accessories under allotted operating grant (Non Plan)<br>2. Purchases under allotted Plan Grant, | Heads of Deptts. Prof-in-Charge (T&P), Librarian | Upto 2 Lakhs |
| 06. | All Expenditure related to student's activities, including sports. | Dean (St. Welfare) | Upto 2 Lakhs |
| 07. | Purchases, Payments of scholarship & other allied expenditure within approved & allotted grant of the year. All related expenditure of PG students & research scholars within approved budget. | Dean (Academics) | Upto 10 Lakhs |
| 08. | Expenditure related to their operational expenses (Office, small equipment, consumables etc. | All Deans | Upto Rs. 2 Lakhs |
| 09. | Expenditure for campus development, minor repairs, cleaning, minor repair of roads, parks, convocation and miscellaneous for which the administrative approval is accorded and fund is allotted for the purpose. | Dean (P&D) | Upto Rs. 2 Lakhs |
| 10. | Purchases of Journals, consumables, spares and accessories etc. form budgetary allocation of the year | Chairman, Library Committee | Upto Rs. 2 Lakhs |
| 11. | Expenditure for medicine/consumabl -es/equipments directly related to Health Service expense. | Medical Officer | MO: upto Rs. 1 Lakhs in each case, with Celling of Rs. 5 lakhs per year |
| 12. | [i] Payment of Telephone bill FAX, | | Full power of [i] and |

| | | | |
|---|---|---|---|
| | Bill Electricity/bill, Water bill etc.,<br>[ii] Purchases of equipment, uniform, consumables, stationeries, spares & accessories. for registry/requirement for departments not covered above within allotted grant of the year. | Registrar | Upto Rs. 2 Lakh |
| 13. | For contingency expenditure | Dy. Registrar, Ass. Registrar (Independent Charges) | Up to Rs. 10000 |

List of faculty members who are administrators/decision makers for various jobs –

**Deans**

* Dean (Planning and Development) -- Dr. Rajendra Yerpude
* Dean (Faculty Welfare) -- Dr. P. M. Padole
* Dean (Research and consultancy) -- Dr. A. K. Chatterjee
* Dean (Academics) -- Dr. V. K. Deshpande
* Dean (Students Welfare) -- Dr. V. B. Borghate

The Institute Grievance Redressal Committee is constituted with the following members:-

* Dr. M. M. Mahajan, Prof. of Structural Engg. – Chairman
* Dr. Aniket M. Deshmukh, Assoc Prof. of Architecture -- Member
* Shri Askok Thakur, Senior Assistant -- Member
* Shri C. V. Chalpati Rao -- Member
* Shri V. S. Kapse, Liaison Officer, SC/ST -- Member
* Dr. A. Andhare, Associate Prof. of Mech. Engg. -- Member-Secretary

**8.2.4**. Transparency and availability of correct/unambiguous information (3)
(Instruction: Availability and dissemination of information through the Internet. Information provisioning in accordance with the Right to Information Act, 2005).
All relevant information are made available through website.
Information is made available through emails and circulars.
The RTI Cell is constituted in accordance with the provisions of Right to Information Act, 2005 as follows-

Public Information Officer -- Dr. S r. Sathe, Registrar
First Appellate Authority -- Dr. R. K. Ingle, HoD AM
Second Appellate Authority -- Dr. N. S. Chaudhari,Director

**8.3. Budget Allocation, Utilisation, and Public Accounting (10)**

Summary of current financial year's budget and the actual expenditure incurred (exclusively for the institution) for three previous financial years.

In Rupees

Rs in lakhs

| Item | Budgeted in CFY (2015-16) | Expenses in in CFY (2015-16) | Budgeted in CFY (2014-15) | Actual Expenses in CFY (2014-15) | Budgeted in CFY (2013-14) | Actual Expenses in CFY(2013-14) |
|---|---|---|---|---|---|---|
| Infrastructural built-up | 12600.00 | 3411.18 | 10464.00 | 2808.48 | 5773.00 | 3303.08 |
| Library | 500.00 | 23.83 | 175.00 | 16.4 | 150.00 | 136.9 |
| Laboratory equipment | 3191.50 | 780.58 | 4031.00 | 583.07 | 2000.00 | 485.63 |
| Stipend | 1500.00 | 1591.16 | - | - | - | - |
| Laboratory consumables | 28.40 | 39.38 | 60.00 | 38.96 | 50.00 | 29.12 |
| Teaching and non teaching staff salary | 6536.05 | 6121.44 | 6185.00 | 5839.6 | 6005.00 | 5202.06 |
| R&D | 4631.51 | 2850.00 | 1256.00 | 1394.95 | 678.40 | 560.14 |
| Training & travel | 13.09 | 14.38 | 25.00 | 8.03 | 20.00 | 17.28 |
| Other, specify | 973.40 | 848.46 | 1340.50 | 853.23 | 1077.60 | 932.54 |
| **Total** | **29973.95** | **15680.41** | **23536.05** | **11542.72** | **15754.00** | **10666.75** |

**8.3.1. Adequacy of budget allocation (4)**

(Instruction: Here the institution needs to justify that the budget allocated over the years was adequate.)

The Institute receives grant-in-aid from the Government of India based on the budget formulated by it. There is enough fund made available by the Government of India for Plan and Non-Plan activities. Infrastructure facilities are created on priority basis based on the available fund from the Government of India.

**8.3.2. Utilisation of allocated funds (5)**

(Instruction: Here the institution needs to state how the budget was utilised during the last three years.)

The budget is utilized based on the project priority. Accommodation of students and faculty has been accorded top priority besides creating academic infrastructure (class

rooms, laboratories etc.) as the sudden increase in students' intake necessitated the creation of more hostels and faculty residences.

**8.3.3. Availability of the audited statements on the institute's website (1)**

(Instruction: Here the institution needs to state whether the audited statements are available on its website.)

The account of the Institute is audited by a team of auditors from the Comptroller & Auditor General of India and the Audit Report is prepared by the CAG Office. A copy of the Report is given to the Institute. Under the provision of the National Institutes of Technology Act 2007, the Audit Report of the Institute account is placed before the Parliament every year. Till its placement before both the Houses of Parliament and its considerations, the Report remains confidential.

**8.4. Programme Specific Budget Allocation, Utilisation (10)**

Summary of budget for the CFY and the actual expenditure incurred in the CFYm1 and CFYm2 (exclusively for this programme in the **department**):

| **Item** | **Budgeted in CFY 2015-16 as on 31 Dec. 15** | **Budgeted in CFY 2014-15** | **Actual Expenses in CFY 2014-15** | **Budgeted in CFY 2013-14** | **Actual Expenses in CFY 2013-14** | **Budgeted in CFYm 2012-13** | **Actual Expenses in 2012-13** |
|---|---|---|---|---|---|---|---|
| Laboratory equipment | | | | | | | |
| Software | | | | | | | |
| R&D | | | | | | | |
| Laboratory consumables | | | | | | | |
| Maintenance and spares | | | | | | | |
| Training & travel | | | | | | | |
| Miscellaneous expenses for academic activities | | | | | | | |
| Total | | | | | | | |

* The amounts shown under expenditure does not include many items of routine expenses met from Centralised Institutional Source 'such as AMC/Computer Consumables and student related travel expenditure which, however, are aggregated in The Institutional Income Expenditure statement in Part I - item I-10.

(Instruction: The preceding list of items is not exhaustive. One may add other relevant items if applicable.)

**8.4.1. Adequacy of budget allocation (5)**

(Instruction: Here the institution needs to justify that the budget allocated over the years was adequate.)

**8.4.2. Utilisation of allocated funds (5)**

(Instruction: Here the institution needs to state how the budget was utilised during the last three years.)

**8.5. Library (20)**

**8.5.1. Library space and ambience, timings and usage, availability of a qualified**

Librarian and other staff, library automation, online access, networking, etc. (5)

(Instruction: Provide information on the following items.).

Carpet area of library (in m2) Reading space (in m2) = 6400 $m^2$

Number of seats in reading space = 150 (Night Reading)+ 200 (Library) = 300

Number of users (issue book) per day = 512

Number of users (reading space) per day =468

Timings: During working day, weekend, and vacation = 360 days, 8:30 a.m. to 9:30 p.m.

Number of library staff = 23 (08 permanent)

Number of library staff with degree in Library Management = 21

Computerisation for search = 21

indexing, issue/return records Bar coding used = yes

Library services on Internet/Intranet INDEST or other similar membership

Archives

**8.5.2. Titles and volumes per title (4)**

| Year | **Number of new titles added** | **Number of new editions added** | **Number of new volumes added** |
|---|---|---|---|
| **CAYm2 2012-13** | 1060 | 1060 | 6049 |
| **CAYm1 2013-14** | 1398 | 1398 | 4953 |
| **CAYm 2014-15** | 369 | 0369 | 1056 |
| **CAYm 2015-16** | 2630 | 2630 | 260 |

**SUBJECT WISE TITLE (TILL 31ST MARCH 2012)**

| **Sr.No.** | **Subject** | **Title** | **Volume** |
|---|---|---|---|
| 01. | Applied Mech. | 355 | 605 |
| 02. | Architecture | 5154 | 8937 |
| 03. | Chemical | 2512 | 4352 |

| | | | |
|---|---|---|---|
| 04. | Chemistry | 3182 | 6398 |
| 05. | Civil | 8667 | 15016 |
| 06. | Computer Sci. | 7990 | 11286 |
| 07. | Electronics | 5093 | 8347 |
| 08. | Electrical | 6475 | 14130 |
| 09. | Humanities | 1476 | 2307 |
| 10. | Maths | 3176 | 5911 |
| 11. | Mechanical | 7055 | 13710 |
| 12. | Metallurgy | 6193 | 9526 |
| 13. | Mining | 4661 | 6461 |
| 14. | Physics | 1793 | 6665 |
| 15. | L.S. & H. | 155 | 155 |
| **TOTAL** | | **63937** | **113806** |

**SUBJECT WISE TITLES (TILL 31ST MARCH 2013)**

| Sr.No. | Subject | Title | Volume |
|---|---|---|---|
| 01. | Applied Mech. | 440 | 2176 |
| 02. | Architecture | 5265 | 9350 |
| 03. | Chemical | 2634 | 4986 |
| 04. | Chemistry | 3261 | 8079 |
| 05. | Civil | 8780 | 15730 |
| 06. | Computer Sci. | 8079 | 14130 |
| 07. | Electronics | 5267 | 9962 |
| 08. | Electrical | 6531 | 15165 |
| 09. | Humanities | 1488 | 2744 |
| 10. | Maths | 3236 | 6548 |
| 11. | Mechanical | 7118 | 14449 |
| 12. | Metallurgy | 6239 | 10114 |
| 13. | Mining | 4676 | 6856 |
| 14. | Physics | 1806 | 7145 |
| 15. | L.S. & H. | 177 | 177 |
| **TOTAL** | | **64997** | **127311** |

**SUBJECT WISE TITLES (TILL 31ST MARCH 2014)**

| Sr.No. | Subject | Title | Volume |
|---|---|---|---|
| 01. | Applied Mech. | 481 | 2297 |
| 02. | Architecture | 5406 | 9804 |
| 03. | Chemical | 2679 | 5158 |
| 04. | Chemistry | 3397 | 8797 |

| | | | |
|---|---|---|---|
| 05. | Civil | 8849 | 15951 |
| 06. | Computer Sci. | 8140 | 14471 |
| 07. | Electronics | 5363 | 10143 |
| 08. | Electrical | 6628 | 16014 |
| 09. | Humanities | 1748 | 3037 |
| 10. | Maths | 3263 | 6622 |
| 11. | Mechanical | 7196 | 14945 |
| 12. | Metallurgy | 6293 | 10489 |
| 13. | Mining | 4707 | 6911 |
| 14. | Physics | 1874 | 7307 |
| 15. | L.S. & H. | 371 | 390 |
| **TOTAL** | | **66,395** | **1,32,336** |

## SUBJECT WISE TITLES (TILL 31ST MARCH 2015)

| Sr.No. | Subject | Title | Volume |
|---|---|---|---|
| 01. | Applied Mech. | 496 | 2333 |
| 02. | Architecture | 5418 | 9862 |
| 03. | Chemical | 2705 | 5201 |
| 04. | Chemistry | 3409 | 8820 |
| 05. | Civil | 8876 | 15978 |
| 06. | Computer Sci. | 8172 | 14669 |
| 07. | Electronics | 5372 | 10152 |
| 08. | Electrical | 6644 | 16250 |
| 09. | Humanities | 1782 | 3140 |
| 10. | Maths | 3265 | 6624 |
| 11. | Mechanical | 7212 | 14962 |
| 12. | Metallurgy | 6303 | 10512 |
| 13. | Mining | 4708 | 6912 |
| 14. | Physics | 1878 | 7320 |
| 15. | L.S. & H. | 524 | 657 |
| **TOTAL** | | **66,764** | **1,33,392** |

## SUBJECT WISE TITLES (TILL 31ST MARCH 2016)

| Sr.No. | Subject | Title | Volume |
|---|---|---|---|
| 01. | Applied Mech. | 496 | 2333 |
| 02. | Architecture | 5418 | 9862 |
| 03. | Chemical | 2705 | 5201 |
| 04. | Chemistry | 3409 | 8820 |
| 05. | Civil | 8876 | 15978 |
| 06. | Computer Sci. | 8188 | 14693 |
| 07. | Electronics | 5373 | 10172 |
| 08. | Electrical | 6644 | 16250 |
| 09. | Humanities | 1782 | 3140 |
| 10. | Maths | 3265 | 6624 |
| 11. | Mechanical | 7212 | 14962 |
| 12. | Metallurgy | 6303 | 10512 |
| 13. | Mining | 4708 | 6912 |
| 14. | Physics | 1878 | 7320 |
| 15. | L.S. & H. | 524 | 657 |
| **TOTAL** | | **66781** | **133436** |

**8.5.3** Scholarly journal subscription (3)

| Details | | CFY 2016 | CFY1 2015 | CFYm2 2014 | CFY m3 2013 |
|---|---|---|---|---|---|
| Science | As soft copy | -- | 41 | 41 | 41 |
| | As hard copy | -- | 13 | 15 | 12 |
| Engg. And Tech. | As soft copy | 2559 | 1757 | 358 | 736 |
| | As hard copy | 33 | 38 | 48 | 57 |
| Architecture | As soft copy | Nil | 00 | 00 | 00 |
| | As hard copy | Nil | 16 | 15 | 16 |

(1) 05 Subject collection with 694 title of Elsevier.
(2) ACS 41 title of Chemical Engg. Web editions for the year 2013.

**8.5.4**. Digital Library (3)

Availability of digital library contents: Available
If available, then mention number of courses, number of e-books, etc. Availability of an exclusive server: **Yes**
Availability over Intranet/Internet: **Yes**
Availability of exclusive space/room: **Yes**
Number of users per day: (**1) Issue counter 512 (2) Reference section 245 (3) Periodical section 167 (4) Reading Room section 468 (5) Stock Room section 182 (6) Reprography section 376 (7) CD-ROM use 098**

**8.5.5.** Library expenditure on books, magazines/journals, and miscellaneous contents (5)

| **Year** | **Expenditure** | | | | **Comments, if any** |
|---|---|---|---|---|---|
| | Book | Magazines/journals (for hard copy subscription) | Magazines/journals (for soft copy subscription) | Misc. Contents | |
| CFYm3 2012 | 53.32 Lacs | 49,73,906.00 | 1,56,054.00 | | |
| CFYm2 2013 | 97.82 Lacs | 21,61,376.00 | 60,62,510.00 | | |
| CFYm1 2014 | 82.14 Lacs | 24,95,955.00 | 84,80,762.00 | | |
| CFY 2015 | 9.60 Lacs | 21,31,141.00 | 7,03,873.00 | | |
| CFY 2016 | 1.00 Lac | 12933.00 | 12754705.00 | | |

**Virtual Class Room:**

DETAILS ;-

Money Given By National Informatics Center (NIC);-

- Total Project Cost of Virtual Class-Room -- Rs. 32,26,524/-
- Civil Work for Virtual Class Room -- Rs.10,00,000/-
- Technical Assistant for Virtual Class Room -- Rs. 1,80,000/-
- Bandwith;-

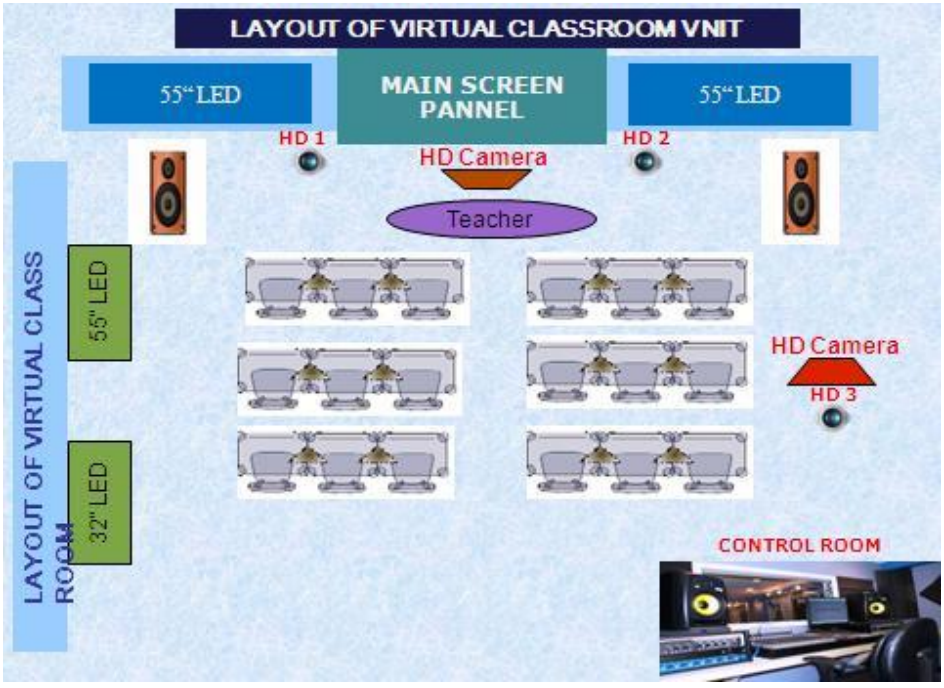
Speed for Video only 50 mbps
Speed for net only 50 mbps
Total Bandwidth 100 mbps

- Portal of NKH http;/www.nkn.in/
- IP Address for NKN;-
- 10.119.19.194

- 10.119.19.192/27 such Range is also allocated

**Contact Details;-** 1] VNIT Co-ordinator;- Prof. V. J. Abhyankar,
2] VNIT Technical Assistant;- Mr. Rahul Hepat,
Mr. A.A. Hardas

### 8.5.5.1 Layout of Virtual Classroom




## 8.6. Incubation facility (5)

(Instruction: Specify the details of incubation facility in terms of capacity, utilisation terms and conditions, usage by students)

Center for Innovation- VNIT Nagpur (CIVN), a section 25 (non-profit) company is set up to promote innovation and entrepreneurship by converting and translating technology ideas and innovation in various disciplines of science and engineering into products, processes and services for commercial exploitation and the benefit of society.

Thus, CIVN came into existence in 2012 to administer the technology incubator and accelerate the growth of entrepreneurship in VNIT campus and people of the region.

CIVN under assistance of Rajiv Gandhi Science and Technology Commission Government of Maharashtra (RGSTC) runs and manages a Technology Incubator (TI) at VNIT, Nagpur to facilitate incubation of new enterprises with innovative technologies by admitting them in TI and providing them physical, technical and networking supports and services.

VNIT has been carrying research in cutting edge technologies which have potential to generate large amount of wealth, provided the gap between research and commercialization of the research output is bridged. Center for Innovation is able to address this gap by providing platform for the entrepreneurs to setup high wealth generating industries in Maharashtra using such cutting edge research.

Industry Institute Interaction Cell (III) at VNIT has been active since inception in 1993. It has established linkages with local industry, industry associations, and Govt. Departments in the promotion of technology. The technology developed in the laboratories can be used for development of new products and services.

VNIT would like to support a thriving and knowledge based business community in the Vidarbha area. We expect CIVN to produce responsible business enterprises and entrepreneurial leadership that will not only make a valuable contribution to the local economy, but also increase awareness in the region about a highly productive carrier option available.

The concept has already been accepted for implementation by the Governing Body of the Institute. A beginning has already been made in Electronics Engineering Deptt. and other departments shall follow soon. The basic details as currently approved are as follows:
Good infrastructure with common office facilities, computers, internet access, Shared facilities such as printing, photocopying, faxing, and scanning, well laid out entry and exit policies for tenant companies.

- Involvement, commitment and full cooperation from host institute and other stake holders.
- Experts for core technical guidance and assistance.

- Labs and technical facilities for prototype development.
- Assessment of Techno-commercial Viability of Proposals Received and proper mentoring.
- IPR and Legal Advice through a panel of specialist legal advisers identified for the purpose to help the prospective entrepreneurs.
- The centre proposes to tie-up incubating companies with reputed bankers and venture capitalists for mobilizing finances through Banks/Venture Capitalists/Angel Investors.
- Skill Development Programs for Managing Business activity shall be carried out by VNIT, other training institutes and individual experts as deemed fit.

## 8.7 Internet (5)

- Name of the Internet provider: BSNL ,Vodafone,NKN
- Available bandwidth: Leased Line
- Access speed: 1 Gbps and 170Mbps(BSNL+Vodafone): Good Access Speed
- Availability of Internet in an exclusive lab: Yes
- Availability in most computing labs: Yes
- Availability in departments and other units: Yes
- Availability in faculty rooms: Yes
- Institute's own e-mail facility to faculty/students: Yes
- Security/privacy to e-mail/Internet users: Yes
- (Instruction: The institute may report the availability of Internet in the campus and its quality of service.)

### 8.7.1 Network Center Information;-

- The Network Centre (NC) primarily caters to the Internet Access requirements throughout the institute that includes Departments, Sections, Centers, Main Administrative Building, Hostels, Guest House, and CDEEP. Connectivity is also provided to remote locations like the Health Center, Security Cameras installed on the Gates, Quarter Wi-Fi network, etc. The institute has a Campus-wide fiber optic gigabit network with High End Central Core switch at the Network Centre.

- VNIT is a member of the National Knowledge Network (NKN) of the Government of India through which connectivity of 1 Gbps is provisioned. The internet access to the institute is also available from various service providers, through which the bandwidth available is around 170 Mbps.
- The Network Centre manages the annual maintenance of the desktops of the entire institute. It also operates and maintains the well-equipped Online Virtual Classroom created under the NKN project.
- The Network Centre has developed and is maintaining the institute and department websites. The Network Centre also manages institute mail server and provide e-mail services to all staff and students.
- The Network Centre has a Cisco Servers,10 Blades. Various Servers like Web Server, Mail Server, Proxy servers, DNS Servers, etc. are hosted.
- VNIT encourage use of free and open software like GNU/Linux distributions.
- Network Center provides advanced and special purpose softwares such as ANSYS, MATLAB, EXATA and AUTOCAD as well as NPTEL Videos for all the inside users in campus. Microsoft OS Software License for servers.

- Network center has hardware such as core switch, blade chasis, Blade server, Rack mount server, SAN Storage, Lenovo All in one Desktops, HP Laserjet M 1536 DNF Printer, Lenovo MAKE Desktop, HP Dual CPU Server, Netscreen Firewall, Check Point UTM, HP-ML-370 G4 Server Dual Processo

### 8.7.2 Physical Layout of Fiber Optic Cable of VNIT

**Figure I**

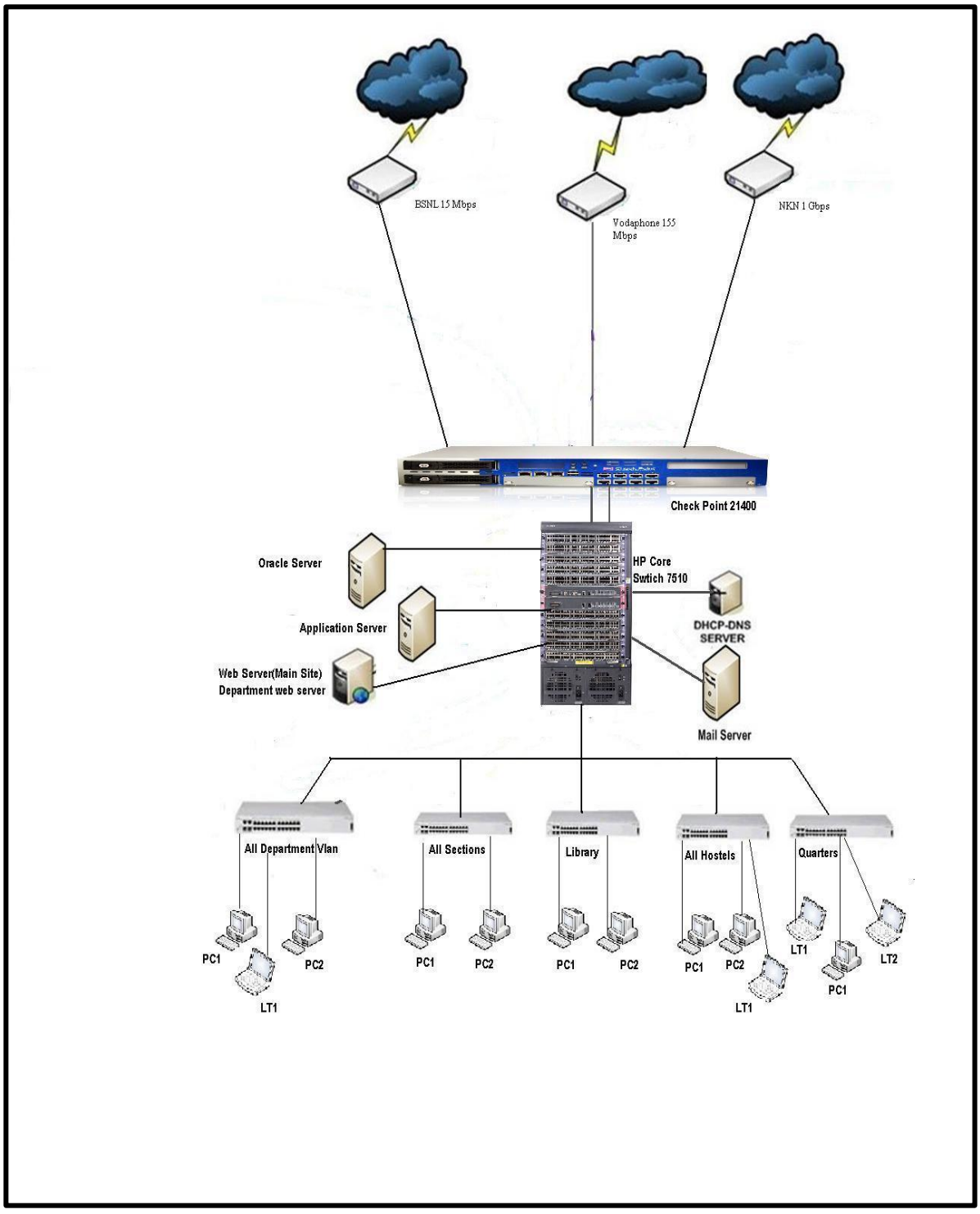
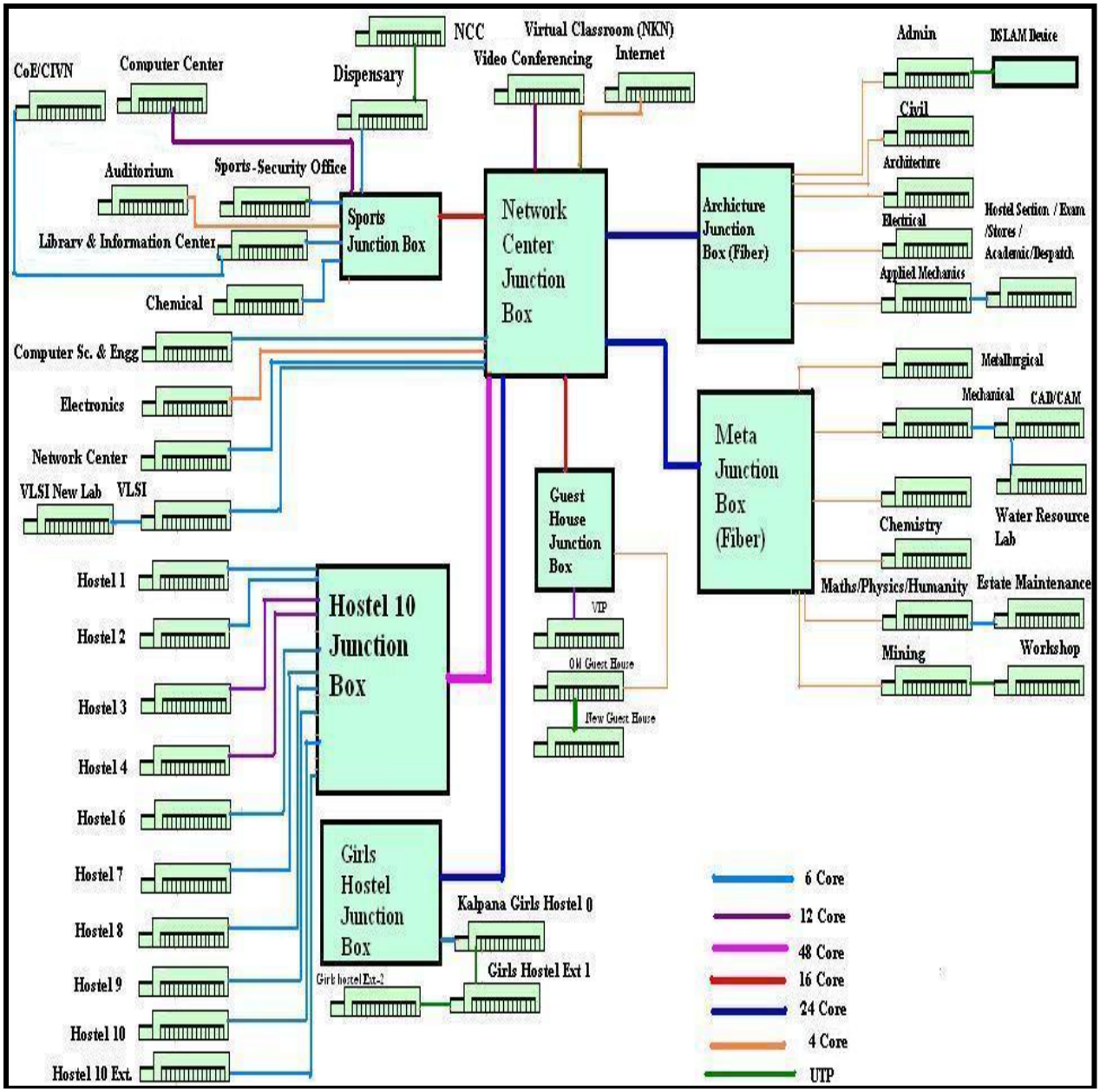

BSNL 15 Mbps
Vodaphone 155 Mbps
NKN 1 Gbps
Check Point 21400
Oracle Server
Application Server
Web Server(Main Site)
Department web server
HP Core Swtich 7510
DHCP-DNS SERVER
Mail Server
All Department Vlan
All Sections
Library
All Hostels
Quarters
PC1
PC2
LT1
LT2

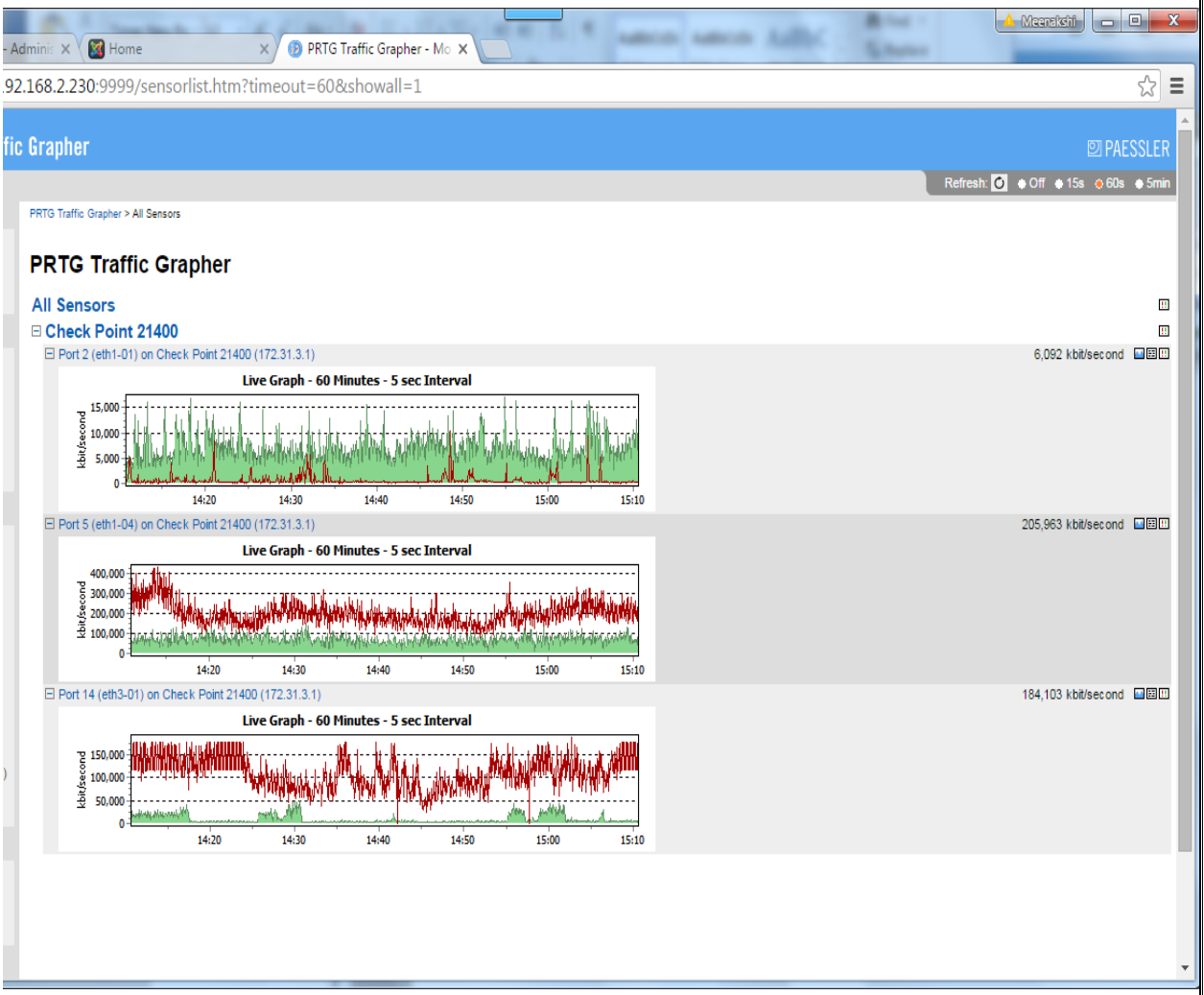
**Figure II B**




**Physical Layout of Fiber Optic cable of VNIT Campus**

### 8.7.3 PRTG Traffic Grapher

**Figure III**




## 8.8 Safety Norms and Checks (5)

**8.8.1.** Checks for wiring and electrical installations for leakage and earthing (1)

| Sr.No. | Particulars | No. of Exits |
|---|---|---|
| 1 | Auditorium | 7.00 |
| 2 | Large Classrooms/Laboratories | 2.00 |
| 3 | Library | 2.00 |

**8.8.2.** Fire - fighting measures: Effective safety arrangements with emergency multiple exits and ventilation/exhausts in auditoriums and large classrooms/laboratories, fire - fighting equipment and training, availability of water, and such other facilities (1)

**Adequate ventilations and multiple exits are provided in all academic buildings, laboratories**.

**Fire Fighting Measures:**

1] We have fire extinguishers (mega mess, hostel blocks, in CAD/CAM, Department,

some are still in propose)

2] As per chief advisor of fire audit committee S.T. Chaudhari's advice we have DCP,

CO2 pressure extinguishers are placed (fire hydride system is not there)

3] Emergency safety arrangements: No

4] Multiple exits and ventilation/exhausts in auditorium and large labs/classrooms: Yes

5] A number of fire extinguishers are located at various sensitive locations throughout the campus. A total of 16 stations containing different types of Fire fighting media such as Foam, Coz, W/C and DCP are functional and under continuous surveillance for dealing with any fire related emergency.

240 fire extinguishers of different types (CO2 , W/C, DCP , Foam) and capacity (2 kg , 4.5 kg , 5 kg ,6.5 kg and 10 kg, 9 Ltrs and 50 Ltrs ) all over the Institute were installed after thorough inspection and fire safety audit by Mr. HT Chaudhary, Fire Advisor & Chief fire officer (Maharashtra State power Generation Company Limited).

Some new buildings which have recently come up are to be equipped with Fire extinguishing facilities. This is in process after specialist advice by Fire Advisor.

Regular refilling is done after expiry date and of the empty cylinders used in incidents.

Institute has engaged services of security agency which have their own training centre and are provide trained guards. Regular refresher training is also provided in security section by the security agency for effective fire extinguishing preparedness.

Institute had completed the formalities of mobile fire extinguisher (bike mounted) to effectively deal with all types of fire at any place in the Campus. However the procurement could not be completed but will be procured for better fire safety.

Need cropping up from time to time is taken care of viz. fire extinguisher CO 2 Type; 4.5 kg capacity has been installed in EDA lab in November 2015.

**8.8.3. Safety of civil structure (1)**

Being a publicly funded Institution (Central Govt.), all Infrastructure/construction has to follow CPWD/VNIT. Norms and all buildings are supervised by qualified Engineers during construction. Before the buildings are accepted for use from the construction contractors all checks are done for stability of civil structure. Each

structure is specifically certified by the In-charge Engineer from Estate Maintenance section after physical verification. The latest certificate is reproduced below:

**VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR**
**PHYSICAL VERFICIATION CERTIFICATE**
**TO WHOM SO EVER IT MAY CONCERN**

This is to certify that the physical and structural verification of all buildings and connected ancillaries has been carried out during the year 2012-13 and found in order.

Date : 10/07/2013

sd/-
ENGINEER
ESTATE MAINTENANCE SECTION
V.N.I.T. NAGPUR

**8.8.4. Handling of hazardous chemicals and such other activities (2)**
(Instruction: The institution may provide evidence that it is taking enough measures for the safety of the civil structures, fire, electrical installations, wiring, and safety of handling and disposal of hazardous substances. Moreover, the institution needs to show the effectiveness of the measures that it has developed to accomplish these tasks.)

**8.9 Counselling and Emergency Medical Care and First aid (5)**
Availability of counselling facility (1) Arrangement for emergency medical care (2) Availability of first-aid unit (2) (Instruction: The institution needs to report the availability of the facilities discussed here.)

**8.9.1 Medical Care:**

**Availability of medical care and emergency, first-aid facility**:
Institute through its health centre provides preventive, promotive & curative health services to the students, employees & their families. Resident doctor on campus & 24 x 7. Availability of ambulance services to take care of emergency needs.
Holistic health services available at health centre include family physician, counsellors, lady doctor, Paediatrician & dental services. Alternative health services like Homeopath available. Referral for Ayurvedic services is available. Physiotherapy services promote fitness & address sports related problems.
Speciality Clinics for eyes & skin problems is available. Mental health services are provides though counsellors & Psychiatrist. First aid facility is provided at all hostels.

**8.9.2 Games and Sports-General**

Research indicates that regular physical education, included in curriculum, produces physical, psychological, and intellectual benefits. Physical education may help prevent degenerative disease, improve overall physical condition, maintain emotional balance, promote a sense of social effectiveness, contribute to academic

performance, and establish positive recreation habits. Therefore, physical education must be supported as an integral part of comprehensive education.

Sports and Games are essentials components of Human Resource Development, holding to promote good health, comradeship and spirit of healthy competition, which in turn, has positive and deep impact on the holistic development of the personality of the youth who is a potential source of energy, enthusiasm and inspiration for development, progress and prosperity of the nation.

Further, excellence in sports enhances the sense of achievements, national pride and patriotism. Sports being practical way of education facilitate beneficial recreation, improve productivity, foster social harmony inculcating sense of discipline and dedication in general life. Sports give a strong message of peace, friendship and understanding among the people of participants. Today, sports are prime need in a civilized society, as it helps to promote national integration, emotional integrity and professional intellect among the participants.

According to UNESCO General Conference (1978) Article 1; which advocates that practice of physical education and sport is a fundamental right for all:

Every human being has a fundamental right of access to physical education and sport, which are essential for the full development of his personality. The freedom to develop physical, intellectual and moral powers through physical education and sport must be guaranteed both within the educational system and in other aspects of social life.

Every one must have full opportunities, in accordance with his national tradition of sport, for practicing physical education and sport, developing his physical fitness and attaining a level of achievement in sport which corresponds to his gifts.

The Article 2; further endorse that Physical education and sport form an essential element of lifelong education in the overall education system:

2.1 Physical education and sport, as an practice of sports must be ensured throughout life by means of a global, lifelong and democratized education.

2.2 At the individual level, physical education and sport contribute to the essential dimension of education and culture, must develop the abilities, will-power and self-discipline of every human being as a fully integrated member of society. The continuity of physical activity and the maintenance and improvement of health, provide a wholesome leisure-time occupation and enable man to overcome the drawbacks of modern living. At the community level, they enrich social relations and develop fair play, which is essential not only to sport itself but also to life in society.

2.3 Every overall education system must assign the requisite place and importance to physical education and sport in order to establish a balance and strengthen links between physical activities and other components of education.

**National Institutions play a major role in physical education and sport.**

It is essential that public authorities at all levels and specialized non-governmental bodies encourage those physical education and sport activities whose educational value is most evident. Their action shall consist enforcing legislation and regulations, providing material assistance and adopting all other measures of encouragement, stimulation and control. The public authorities will also ensure that such fiscal measures are adopted as may encourage these activities.

It is incumbent on all institutions responsible for physical education and sport to promote a consistent, overall and decentralized plan of action in the framework of lifelong education so as to allow for continuity and co-ordination between compulsory physical activities and those practiced freely and spontaneously.

Thus in tune with above ideology, the faculties of Physical Education at this institute exploit all the possible dimensions of physical education & sports through the variety of activities in our Institute:

01) Physical Education is an audit course at the institute and they are taught sports skills, strategic preparation, and tactical preparation. Faculties of physical education work to increase the physical fitness of first year students (more than 750 in number) through various physical fitness programs. Apart from this teaching on play fields, they are also taught Physiological, Psychological, Sociological and Emotional aspects associated with sports and physical activities through talks and seminars.

02) Health club facilities are also provided to the students where they practice various health related Gymnasium activities in the allotted Morning and Evening hours under the guidance of a trained coach.

03) Sports medicine Research Lab: Physiological parameters related with physical fitness of staff and students are also examined through Sports Medicine Lab equipments. Suitable Physical Fitness programs are advised to the students as well as staff members of the institute after evaluating their physical fitness. Overweight and underweight students are also given appropriate weight gain and weight loss programs by the faculties of physical education.

04) Coaching facilities are also made available to the students selected by conducting the selection trials of various games. Specialized Coaches are appointed to train the students going to participate in various in Inter-NIT Tournaments.

05) Another attractive sporting activity is the Institute Gathering which is organized every year by the students under the supervision of the Physical Education section. This is an event, where various inter-departmental sports activities are conducted with overwhelming response where the participants are students institute teaching and non-teaching staff.

**Participation of students in different games**

The Institute encourages the students by exposing them to various Inter-NIT tournaments and also in local inter-collegiate tournaments. All the selected students are motivated by providing them with track suits and playing kits. Blazers are provided to all the student council members of the institute as a token of appreciation

**Participation in All India Inter NIT Tournaments**:

Through All India Inter NIT Tournament a student can exhibit his/ her talent in front of students of all the NITs in India. This year total 126 students, 85(M) & 41 (W) participated in various All India Inter NIT Tournaments organized by various NITs in India. The following table shows the detail of participation by the institute in various All India Inter NIT Tournament organized by various NITs in India during the year 2014-15.

| Sr. No. | Game | Tournament organized by | Duration | Total participants | | Position |
|---|---|---|---|---|---|---|
| | | | | Men | Women | |
| 1. | Athletics | NIT Rourkela | 23rd to 25th of January 2014 | 20 | 9 | 2 silver Medals & 3 Bronze Medals |
| 2. | Cricket | NIT Allahabad | 13th to 15th of February 2015 | 15 | 0 | S/F |
| 3. | Kho-Kho | NIT Agartala | 19th to 21st February 2015 | 12 | 0 | Winner |
| 4. | Table Tennis | NIT Bhopal | 21st to 23rd of March 2015 | 4 | 3 | Women - Runner up |
| 5. | Volleyball | NIT Kurukshetra | 28th to 31st of March 2015 | 12 | 12 | Participation |
| 6. | Basketball | NIT Surat | 3rd to 5th of April 2015 | 12 | 12 | Participation |
| 7. | Badminton | | | 5 | 0 | Men- Individual event - Sahil Akhtar :- Winner |
| 8. | Chess | | | 5 | 5 | Men- Third Position, Women- Runner Up |
| **Total Participants** | | | | 85 | 41 | 126 |

**Local Tournaments:**

The Institute also understands the importance of local tournaments and exposes the students in various local tournaments whenever it is possible as per the Academic Calendar. This year the Institute participated in Dr. Punjabrao Deshmukh Sports Festival in the disciplines of Cricket, Basketball and Football tournament.

**Krik Mania:**

Through this Invitational 50 limited over Cricket Tournament a platform is provided to the upcoming Cricketers of local colleges. Since last 22 years through this particular event students of the institute are learning various skills of organizing a sporting event under the guidance of Physical Education department. In present edition of Krik Mania Dr. Ambedkar College, Nagpur won the tournament by defeating the Dhanwate National College, Nagpur where as our institute team reached up to S/F.

**Intramural and Krida Diwas( National Sports Day):**

It is very important to provide maximum participation to the student community in sports, to keep the overall atmosphere of the institute healthy and sporting. Through this event students get all the opportunities to interact with each other and explore their hidden talent in sports. With this point of view and to encourage sports, the Physical Education Section celebrates the birth anniversary of the great Hockey legend Major Dhyanchand on 29th of August every year. This year following sports

were organized under Annual Intramural program: Football, Cricket, Volleyball, Throw ball, Kho-Kho Table-Tennis, Kabaddi and Chess. This year's Krida Diwas was inaugurated by honorable Director of the institute, Dr. N. Chaudhary , all the students were distributed sweets on this occasion.

The objective of organizing such events in the campus is to involve the engineering students in some physical activities and teach them sportsmanship, team spirit and help them in socialization through sports activities. The Biggest advantage of organizing such event, especially for the first year B. Tech. students is that every student of the first year know each other. It also helps to provide solid platform for their healthy social relationship throughout their academic course; students also learn skills of organization, administration, officiating and coaching.

**Medical examination:**

Medical Examination is compulsory for all the first year B. Tech. /B. Arch. students in first semester itself. This examination is done by our Medical Officer Dr. S. Batra. and his team with the coordination of Physical Education section. This particular examination provides the data of students with postural deformities, obesity, underweight, stress, hypertension and some other medical problems. Thus with readily available data such students are provided individualized suitable physical fitness program.

**Physical Efficiency Test:**

Physical Fitness is an ability to carry out the daily tasks of the job with vigor and alertness, without undue fatigue, with ample energy to engage in leisure time pursuits and to meet the above average physical stresses in emergency situations.

The Physical Efficiency of every first year B. Tech. / B. Arch. students is measured by applying suitable tests of Physical Fitness. Components such as abdominal strength, respiratory endurance, flexibility of hip joint & hamstring muscles and speed are measured. PET is an important tool through which a student can know about his/ her physical efficiency as they have to perform all the below mention tests in one day itself. All the students they appreciate this unique physical activity as it helps them to know their capability to do strenuous job tasks.

**Module of Physical Efficiency Test:**

| Sr. No. | Component | Tests | Time/Distance | Score |
|---|---|---|---|---|
| 1 | Respiratory Endurance | Cooper's Test | 12 minute | Total distance covered during 12 minute is recorded with the help of stop watch, and VO2 Max is calculated by applying suitable formula |
| 2 | Speed | 100 meter flat race for boys/ 60 meter flat race for girls | 100 meter/ 60 meter | Timing 100Mt/ 60 Mt. is recorded in seconds for each student |
| 3 | Abdominal Strength | Bent Knee Sit Ups | One Minute | Maximum legal sit ups performed in one minute is recorded for each student |
| 4 | Shoulder Strength | Push | ---------- | Maximum push ups |

| | | | | |
|---|---|---|---|---|
| | | Ups/Modified push ups for girls | | performed by is recorded for each student |
| 5 | Flexibility of Hp Joint and Hamstring Muscles | Sit And Reach | Centimetre | Maximum stretching is recorded in centimetre with the help of measuring scale for each student |

**NBA Visit:**

The members of NBA team visited physical education section on 5th of January 2015 and inspected various facilities being provided by to the students. The team members were informed about various physical education program offered to the students.

Wellness and Weight Management program:

Overweight and obesity in the youth is on increase. It is the result of physical inactivity, and cause for poor physical fitness. It also carries high risk of developing chronic diseases like diabetes, blood pressure, heart trouble, joint problems etc. in the peak of their career.

On the basis of students identified through Medical Examination having postural deformities, overweight and underweight; a week long integrated program during second week of January 2015 by the team of Physician, Physiotherapist, Dietician, Counseller along with faculties of Physical Education was conducted for such students at Cricket pavilion.

**Run for Unity:**

Hundreds of students along with large number of staff members of the institute solemnly pledged on the occasion of Rashtriya Ekta Diwas on October 31 to dedicate themselves to preserve the Unity, Integrity and Security of the nation. Later we all joined the "Run for Unity" programme organized by Physical Education Section at the institute campus. The program was inaugurated by the Registrar of the institute.

**Swachata Bharat Abhiyan:**

"Swachhta Shapath/Cleanliness Oath" was administered by faculties of physical education along with the student council members at 9.45 AM on 2nd October 2014.

Fitness talk in Hindi Workshop:

A fitness talk was organized by Dr. Robin Simon a faculty in Physical Education for the teaching and non teaching staff of the institute as one of the programme of Hindi Workshop. Different dimensions of physical fitness, various training principles, and effects of physical activities on different physiological systems were discussed in the workshop. Later various health related physiological parameters such as BMI, Rate of Respiration, Resting Pulse Rate, Visceral Fat, BMR, Flexibility etc. were tested. Appropriate physical fitness programme was also suggested according to individual's need.

**Sports facilities available on the Campus :**

One Cricket Ground with six Turf wickets.
One Football Ground with flood light arrangement.
Two Volleyball Courts with flood light arrangement
Three Lawn Tennis Courts.
One Flood light Basketball Court.
One Kho- Ko ground with flood light arrangement
One Kabaddi ground with flood light arrangement
Well equipped Gymnasium
Separate Gym for girls in the girl's hostel
Table Tennis Hall
Cricket pavilion with the seating capacity of 500 students
Indoor Badminton Stadium with four Wooden sprung Surfaced Badminton courts
A big hall to accommodate at least 12 Table Tennis Tables
A hall to practice Yoga Class room

**********

## 9. Continuous Improvement (75)

This criterion essentially evaluates the improvement of the different indices that have already been discussed in earlier sections.

From 9.1 to 9.5 the assessment calculation can be done as follows

If a, b, c are improvements in percentage during three successive years, assessment can be calculated as

Assessment = (b-a) + (c-b) + 5/3 (a+b+c)

### 9.1. Improvement in Success Index of Students (5)

**From 4. 1**

| Items | LYG(c) | LYGm1(b) | LYGm2(a) | Assessment |
|---|---|---|---|---|
| Success Index | **0.70** | **0.73** | **0.78** | **0.7** |

### 9.2. Improvement in Academic Performance Index of Students (5)

**From 4. 2**

| Items | LYG(c) | LYGm1(b) | LYGm2(a) | Assessment |
|---|---|---|---|---|
| API | **14.26** | **14.18** | **14.42** | **72** |

### 9.3. Improvement in Student - Teacher Ratio (5)

**From 5. 1**

| Items | CAY(c) 2015-2016 | CAY m1(b) 2014-2015 | CAY m2(a) 2013-2014 | Average of 3 years |
|---|---|---|---|---|
| STR | **17.18** | **14.7** | **12.27** | **16.94** |

### 9.4. Enhancement of Faculty Qualification Index (5)

**From 5. 3**

| Items | LYG(c) 2015-2016 | LYGm1(b) 2014-2015 | LYGm2( a) 2013-2014 | Average of 3 years |
|---|---|---|---|---|
| FQI | **8.7** | **9.5** | **8.4** | **8.9** |

### 9.5. Improvement in Faculty Research Publications, R&D Work and Consultancy Work (10)

**From 5.7and 5.9**

| Items | LYG(c) 2015-2016 | LYGm1(b) 2014-2015 | LYGm2( a) 2013-2014 | Average of 3 years |
|---|---|---|---|---|
| FRC(Research ) | **15** | **16** | **17** | **16** |
| FPPC(publications) | **15** | **14** | **15** | **14.7** |

### 9.6. Continuing Education (10)

In this criterion, the institution needs to specify the contributory efforts made by the faculty members by developing the course/laboratory modules, conducting short-term courses/workshops, etc., for continuing education during the last three years.

| Module description | Any other contributory institute / industry | Developed/ organized | Duration | Resource persons | Target audience | Usage and citation etc. |
|---|---|---|---|---|---|---|
| Expert Lecture Series on Advanced Engineering Materials | TEQIP -II and IIM Nagpur Chapter | VNIT, IIM Nagpur Chapter | 06 days 12 April 16 – 18 April 16 | Scientists and Eminent Professors from Research and Academia | UG, PG and Ph.D. | Up gradation on knowledge and information on Advanced Engineering Materials |
| 18th National Seminar on Aerospace Structures (NaSAs) 2014 | | VNIT, Jawahalal Nehru Aluminium Research Design & Development (JNARDDC), Aeronautical Research & Development Board | 2 days December 15-16,2014. | Scientists and Eminent Professors from Research and Academia. Experts from Structures Panel of Aeronautical Research & Development Board (AR & DB). | UG, PG, Ph.D, Scientist, Faculty members | Up gradation on knowledge and information on contemporary research in area of Aerospace Science and Engineering |

| | | | | | | |
|---|---|---|---|---|---|---|
| 18th International Conference on Non-ferrous Minerals & Metals- 2014 | | Jawahalal Nehru Aluminium Research Design & Development (JNARDDC), VNIT, International Bauxite, Alumina, and Aluminum Society (IBAAS), | 2 days<br><br>July 11-12,2014 | Scientists and experts from Aluminium R & D organization and Industry | UG, PG, Ph.D, Scientist, Faculty members | To enhance understanding on present challenges in Aluminium Industry |
| Education Program on Advanced Welding Technology Program For Managers And Engineers | | Indian Society for Non-Destructive Testing (ISNT) and VNIT | One day 12th February 2014 | YY Mahajan | Managers and Engineering working in area of welding in various organization | To develop understanding on application and challenges in Welding |
| Short term course on Heat treatment and Metallography | | Organized by MME VNIT | 2 days 23-24 Feb 2013 | Prof A D Chopde, Dr S G Sapate A B. Choudhary, Dr R K Khatirkar | Engineers Technicians, QC staff of industry and academicians | Upgradation of technical , practical skills in the area of heat treatment and metallogrpah y to industry |
| Short term course on Characterisation of Materials | - | Organized by MME VNIT | 22-24 March 2013 | Dr S G Saapte. Dr Khatirkar and eminent experts from IIT/IISc and research labs in India | Academicians from educational institutes, R& D engineers from industry | Up gradation of technical , practical skills in the area of Characterisati on of Materials |
| Failure Analysis of Engineering Materials | None | Department of Metallurgical & Materials Engineering | 18-20th April, 2013 | Dr. C M Manjunatha, NAL Bangalore, Dr. Kiran Akela, ARDE, Pune, Dr. Avinash Arankale, Automobile | Research Scholars , M.Tech and Faculties from other department | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Research Institute Pune, Prof. B.S. Murty IIT Madras, S.K. Nath, CPRI Nagpur | | |
| Synchrotron based X-ray characterization and Data analysis | None | Department of Metallurgical & Materials Engineering | 3rd May, 2013 | Dr. Imteyaz Ahmad, Research Scientist, Stanford University, USA | Research Scholars, M.Tech Students | None |
| Three days workshop on "Metallurgy For Non Metallurgists" (MFNM) | | Department of Metallurgical and Materials Engineering, VNIT Nagpur | 3 days - 4th- 6th February, 2010 | Prof. Vikram Jayaram, IISc Bangalore Dr. K.V. Ramana Rao, JNARDC Nagpur. Faculty of MME, VNIT Nagpur | Industries, Institute, etc | |

Assessment =

### 9.7. New Facility Created (15)

Specify new facilities created during the last three years for strengthening the curriculum and/or meeting the POs:

1. Modern Teaching Tools
2. Creep Lab
3. High temperature furnaces & austempring furnaces
4. 250kN Servohydraulic system
5. Injection moulding machines for polymer.
6. EDM

### 9.8. Overall Improvements since last accreditation, if any, otherwise, since the commencement of the programme (20)

The last accreditation is conducted in 2009. The detail of improvement are as follows.

| Specify the strength / weakness | Improvement brought in | Contributed by | List of PO(s), which are strengthened | Comments, if any |
|---|---|---|---|---|
| CAY | 1. Research outputs<br>2. Institute & Industrial Collaboration<br>3. Revenue generation<br>4. Organisation of Continuing education programs.<br>5. Development of support systems for academic development.(visits, expert lectures , use of modern teaching tools )<br>6. Participation of students at national & international level. | | PO1 ,PO2,PO3, PO4, PO5,PO6,PO9,PO10,PO 11, PO12 | |
| CAYm1 | 1. Research outputs<br>2. Revenue generation<br>3. Teaching techniques | | $PO_1$ ,PO2,PO3, PO4, PO5,PO6,PO9,PO10,PO 11, PO12 | |
| CAYm2 | 1. Faculty strength<br>2. Infrastructure<br>3. Revenue generation<br>4. Research outputs<br>5. Organisation of Continuing education programs. | | PO1 ,PO2,$PO^3$, $PO^4$, $PO^5$,$PO^6$,$PO^9$,$PO^{10}$,$PO^{11}$ ,$PO^{12}$ | |

# Declaration

The head of the institution needs to make a declaration as per the format given below:

This Self-Assessment Report (SAR) is prepared for the current academic year (2013-2014) and the current financial year (2013-2014) on behalf of the institution.

I certify that the information provided in this SAR is extracted from the records and to the best of my knowledge, is correct and complete.

I understand that any false statement/information of consequence may lead to rejection of the application for the accreditation for a period of two or more years. I also understand that the National Board of Accreditation (NBA) or its sub-committees will have the right to decide on the basis of the submitted SAR whether the institution should be considered for an accreditation visit.

If the information provided in the SAR is found to be wrong during the visit or subsequent to grant of accreditation, the NBA has right to withdraw the grant of accreditation and no accreditation will be allowed for a period of next two years or more and the fee will be forfeited.

I undertake that the institution shall co-operate the visiting accreditation team, shall provide all desired information during the visit and arrange for the meeting as required for accreditation as per the NBA's provision.

I undertake that, the institution is well aware about the provisions in the NBA's accreditation manual concerned for this application, rules, regulations and notifications in force as on date and the institute shall fully abide to them.

Signature, Name, and Designation of
the Head of the Institution with seal

Place:
Date:

# Annexure 1

## (V) COURSE OUTCOME

1. MML201 INTRODUCTION TO MATERIALS SCIENCE & ENGINEERING (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MML-201 | Basic Science: | 2 |
| Course Title: | Introduction to Material Science & Engineering | Engineering Topics: | 6 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. M.M.Thawre | Compliant: | Course Book 2012-2013 |

XI. Catalog Description:

Introduction of different types of materials & their processing, structure & property relationship. Atomic structure , bonding diffusion , various processing methods for metals, ceramics, composites various property studies like optical, electrical thermal etc, of all materials. of corrosion control.

XII. Course Coordinator: Dr. M.M.Thawre, Room No. F8, First Floor, Materials Engineering Center

XIII. Pre-requisites and Co-requisites: None

XIV. Textbook and /or Other Required Material

a. Materials Science and Engineering - A First Course - V. Raghavan. (PHI)
b. Introduction to Materials Science – A. Guy, McGraw Hill
c. The Science & Engineering of Materials - Askeland & Phule
d. The Science of Engineering Materials – Lamster

XV. Course Objectives:

Upon successful completion of this course, each student should be able to understand :

i. Concept of Material Science and Engineering, Classification of Materials
j. Levels of Structure and Basic of Structure Property Relationship.
k. Atomic structures, bonding & crystal imperfections
l. Equilibrium and Kinetics diffusion and phase transformation
m. Applications & processing of various material types.
n. Material degradation - oxidation and corrosion.
o. Conducting, Insulating Material, Semiconductors, Magnetic, Dielectric materials.
p. Advanced materials for specialty applications

XVI. Expanded description of the course

Introduction, concept of Material Science and Engineering, Classification of Materials, Levels of Structure and Basic of Structure Property Relationship.

Atomic Structure and Chemical Bonding Crystal Geometry and Crystal Structure, Structure of Solids, Crystalline Imperfections.

Diffusion , thermal, optical and magnetic properties of materials.Equilibrium and Kinetics diffusion and phase transformation. Material degradation - oxidation and corrosion. Processing and applications of metals, ceramics , composites & polymers.

Conducting, Insulating Material, Semiconductors, Magnetic, Dielectric materials. Advanced materials for specialty applications.

XVII. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week

XVIII. Contribution of Course to Professional Component

a. Lecture: Students get acquainted with various types of materials, their properties, applications processing methods etc.

XIX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

XX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|
| a | X | X | | | X | | | |
| b | X | X | | | X | | | |
| c | X | X | | X | X | | | |
| d | X | X | | X | X | | X | X |
| e | X | X | | | X | X | X | X |
| f | X | X | | X | X | X | X | X |
| g | X | X | | | X | X | | |
| h | X | X | | | X | X | X | X |

MML203 ENGINEERING PHYSICAL METALLURGY (3-0-2) 8 credits

Course Outline

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MMC-203 | Basic Science: | 2 |
| Course Title: | Engineering Physical Metallurgy | Engineering Topics: | 4 |
| Contact Hours | 3-0-2 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. D.R.Peshwe | Compliant: | Course Book 2012-2013 |

1. Catalog Description:

The course will provide brief description of crystal structure and crystal defects, solidification of metals and alloys, phase rule, concept of thermodynamics & kinetics of phase transformation, nucleation, grain growth. The course will also include detailed study of construction of phase diagrams, binary equilibrium diagrams, equilibrium phase diagrams of industrially important ferrous and nonferrous alloys, structure property relationship and microstructure evaluation by various metallography techniques.

XXI. Course Coordinator: Prof. D.R.Peshwe, Room No. G13, Ground Floor, New Building of Department

XXII. Pre-requisites and Co-requisites: None

XXIII. Textbook and /or Other Required Material

a. Introduction to Physical Metallurgy : S.H. Avnor.
b. Physical Metallurgy (Vol. I & II), Dr. P.R. Khangaonkar
c. Principles of Metallographic Practice, R.Kehl
d. Engineering Metallurgy (Vol. I & II), R.A.Higgins
e. The Science & Engineering of Materials, D.R.Askeland

XXIV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

a) Various kinds of crystal structure and crystal defects.
b) Theoretical basics of phase diagrams.
c) Evolution of microstructure during processing.
d) Co-relation of microstructure with properties and performance.
e) Basics of alloy designing.
f) Techniques of Metallography study.
g) Structure-property-application corelationship in ferrous and nonferrous alloys.

XXV. Expanded Course Description

a. Expanded description of the course

Crystalline and amorphous materials, Bonding, Elements of Crystallography, Crystal Structure of Metals, Crystallographic notation of atomic planes and directions, Imperfections in metal crystals, Allotropy in metals, Single crystal and polycrystalline aggregates.

Solidification of metals and alloys, Cooling curves, Concepts of nucleation and growth, Heat transfer associated in nucleation and growth, Homogeneous and Heterogeneous nucleation, Structure of metal ingots, Dendritic and other growth processes.

Construction of binary alloys, Formation of alloy phases, viz. Solid solutions – substitutional and interstitial, Intermetallic compounds, Phase mixtures etc. Binary equilibrium diagrams of various systems, systems with partial solid solubilities involving eutectic and peritectic and other reactions.

Binary equilibrium diagrams involving monotectic, eutectoid and peritectoid reactions, Lever and phase rule and its applications, Solid state transformations, Ternary diagrams, Order disorders transformations.

Detailed study of Fe-C, Cu-Zn, Cu-Sn, Al-Si, Al-Cu, Al-Li and other nonferrous alloys, Babbit metals and their equilibrium diagrams, discussion on structures, properties and uses of some industrially important alloys based on the above systems.

Selection and preparation of specimens for metallurgical examination, Macro and Microscopic examinations, Etching reagents, Metallurgical Microscope, Principles and use of polarized light microscope, Phase contrast microscope and high temperature microscope.

b. Typical laboratory experiments
    i. To study the metallographic practice for sample preparation.
    ii. Study of metallurgical microscopes.
    iii. To study the microstructures of steels,
    iv. To study the microstructures of cast irons,
    v. To study the microstructures of Cu alloys (brasses, bronzes)
    vi. To study the microstructures of Al alloys (Al-Cu, Al-Si)
    vii. To study the microstructures of babbitts alloys.
    viii. To study the scanning electron microscope.
    ix. To draw/ understand the various equilibrium diagrams through problems.
    x. To study the macroexamination of samples (sulphur and phosphor printing)

XXVI. Class /Laboratory Schedule

a. Lecture: Three sessions of 60 minutes per week
b. Laboratory: One session of 100 minutes per week for a batch of 25 students

XXVII. Contribution of Course to Professional Component

a. Lecture: Students learn to construct and analyze phase diagrams and understand the structure property corelationship of major engineering materials.
b. Laboratory: Students learn about evolution of microstructures in metals and alloys during their processing, sample preparation, microstructural analysis and interpretation of results.

XXVIII. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

XXIX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| A | X | X | X | | X | X | X | | X |
| B | X | X | X | X | X | X | X | | X |
| C | X | X | X | | | X | X | X | X |
| D | X | X | X | X | X | X | X | X | X |
| E | X | X | X | X | | X | | X | X |
| F | X | X | X | | | X | X | X | X |
| G | X | X | X | X | X | X | X | X | X |

## 3. MML205 TESTING OF MATERIALS (3-0-2) 8 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MML-205 | Basic Science: | 1 |
| Course Title: | Testing of Materials | Engineering Topics: | 6 |
| Contact Hours | 3-0-2 | Design Content: | Yes |
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. R.K.Paretkar | Compliant: | Course Book 2012-2013 |

XXX. Catalog Description:

It is a core course aimed at Second Year UG students. The course introduces students with mechanical behavior of materials and their characterization techniques. It explains various stress strain relationships and their effects.

XXXI. Course Coordinator: Prof. R.K.Paretkar, Ground floor , Old Building of Metallurgy Department

XXXII. Pre-requisites and Co-requisites: None

XXXIII. Textbook and /or Other Required Material


1. George E.D.; Mechanical Metallurgy; McGraw Hill Publication, UK, 1988.
2. Raj Baldev, Jayakumar T., Practical Non – Destructive Testing; Narosa Publisher, New Delhi, 1997.
3. Metal Hand Book; 9th Edition Vol – 8; Mechanical Testing; ASM International, 1985
4. Davis H.E., Testing of Engineering Materials, McGraw Hill Publication, 1982.


XXXIV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

q. significance of measurement of properties & Various characterization techniques
r. Tensile & torsion test.
s. Impact Test & Fatigue test
t. Fracture
u. hardness
v. Non-destructive tests
w. Creep test

XXXV. Expanded Course Description

a. Expanded description of the course

Introduction : Type of engineering materials and their applications, testing of materials for evaluation, characterization and selection of various applications. Types of testing systems, significance of measurement of properties and test conditions, interpretation of test results.

Tensile Testing : Scope of tensile testing and significance of parameters measured in the test Necking during tension test, instability in tension, diffuse necking, stress distribution at the neck, ductility measurement in tensile testing – effect of gauge length.

Effect of strain rate and temperature on flow properties. Machine stiffness in tensile testing systems, measuring instrument computerization.

Torsion Test : Mechanical properties in torsion. Torsional stresses for large plastic deformation, torsional failure, torsion Vs. tension test.

Hardness Test : Hardness testing system, elastic and plastic behaviour during hardness testing. General consideration such as indenter size, shape, friction type of loading etc. in hardness testing. Concept of micro hardness. Major hardness testing systems such as Rockewll, Brinell, Vickers. Special hardness tests such as superficial, micro and shore.

Elements of brittle fracture elliptical crack and Griffith theory of Brittle fracture. Ductile to brittle transition. Notch effective in fracture.

Impact testing for brittle fracture. Notched bar tests, instrumented charpy test. Drop weight crack arrest test, Introduction to fracture toughness testing.

Fatigue Tests : Stress cycles and SN curve statistical nature of fatigue. Effect of mean strain concentration, size and surface condition on fatigue. Fatigue testing machines and equipments. Creep stress rupture tests. Creep cure and its analysis. Stress rupture test. Presentation of engineering creep data. Equipment test set up in creep testing.

Non – destructive Testing : Methods and classification. Elements and instrument in visual magnetic, radiographic, ultrasonic, electromagnetic, penetrant tests, their applications in quality control and inspection.

b. Typical laboratory experiments

1. Hardness Testing on "Rockwell Hardness Tester".
2. Hardness Testing on "Vickers Hardness Tester".
3. Hardness Testing on "Microhardness Tester".
4. Hardness Testing on "Brinnel Hardness Tester".
5. Tensile Testing.
6. Fatigue testing
7. Effect of Temperature on Tensile Properties.
8. Impact of Testing on Charpy.
9. Effect of Temperature on Impact Strength and Model of Fracture.
10. Effect of Strain Rate on Tensile Properties.
11. Demonstration of Ultrasonic Flaw Detector.
12. Demonstration of Magnetic Particle Testing.
13. Demonstration of Creep test

XXXVI. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week
b. Laboratory: One 100 minutes session per week for a batch of 25 students.

XXXVII. Contribution of Course to Professional Component

a. Lecture: Students learn mechanical behavior of material and various testing methods for characterizing materials for their mechanical properties
b. Laboratory: Students learn Various mechanical characterization methods.

XXXVIII. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

XXXIX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | | X | | X | X | | |
| b | X | X | X | X | X | X | X | | |
| c | X | X | X | X | X | X | X | | |
| d | X | X | X | X | X | X | X | | X |
| e | X | X | X | X | X | X | | | |
| f | X | X | X | X | | X | X | | X |
| g | X | X | X | X | | X | X | | X |

MML207 MINERAL DRESSING (3-0-2) 8 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MML-207 | Basic Science: | 2 |
| Course Title: | Mineral Dressing | Engineering Topics: | 4 |
| Contact Hours | 3-0-2 | Design Content: | NO |
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Dr.V.K.Didolkar | Compliant: | Course Book 2012-2013 |

XL. Catalog Description:

Awareness regarding ores/minerals in the society easy ways for their identification.Sulphide /non sulphide minerals& their flow-charts used in commercial plants. Applications of these minerals for various types of products such as fertilizers, paints/pesticides,pottery, cement etc.Processing of these ores/minerals to obtain various value-added products. Machines required for the size-reduction to liberate the values. Screening & classification. Gravity-separation operations such as Jigging, Tabling, Heavy media separation. Electrostatic separation &Magnetic separation operations. Calculations of Ratio of concentration, Recovery values.

XLI. Course Coordinator: Dr.V.K.Didolkar, Ground Floor, Old Building of Department.

XLII. Pre-requisites and Co-requisites: None

XLIII. Textbook and /or Other Required Material

a. Gaudin A.M.-Principles of mineral dressing-McGraw hills,TMH Edition 1971.
b. Taggart A.F.-Elements of mineral dressing-J.Wiley &sons, 1951, London/Newyork.
c. Jain S.K.-Ore Processing-Oxford &IBH Publi. 1986.
d. Taggart A.F.-Handbook of mineral dressing, Wiley handbook series.

XLIV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

x. Identification of Ores/Minerals.
Hands-on-training on Jaw/Gyratory Crushers.
y. Grinding in Ball/Rod mills.
z. Separation of minerals by Gravity Concentration-Jigging, Tabling &Heavy media separation.
aa. Froth flotation operation for upgradation of Ores/Minerals.
bb. Electrostatic/Magnetic separation operations.

XLV. Expanded Course Description

a. Expanded description of the course

Mineralogy:Studies of important metallic/non metallic minerals &their characteristics.Status of mineral beneficiation industries in India with their process flowsheets.Sampling methodology and equipments.

Comminution:Primary,secondary &special crushers &their performances.Cylindrical &cylindroconical ball mills,Rod mills,tube/pot mills,Dry/wet grinding,Open/closed circuit grinding,Laws of crushing/grinding,Work-index calculations.Degree of Liberation.

Screening/sizing &Classification:Standard screening tests, Particle- size-distribution. Sorting/sizing/pneumatic classifiers,Thickener &hydrocyclones,Filtration equipments,Rotary vacuum filters.

Gravity separation techniques:Principles of Jigging,Tabling &Heavy media separation techniques for coals &other minerals. (sulphides/nonsulphides).

Froth flotation:Natural flotability of minerals,Functions of Frothers/collectors/depressants etc. in flotation.Activators/deactivators/ph- modifiers.Flotation machines,Multi-stage flotation &column flotation.

Electrostatic &Magnetic separation:Principles of dry/wet separation techniques.

b. Typical laboratory experiments on
   (i) Single toggle blake jaw crusher.
   (ii) Rolls crusher
   (iii) Grinding in ball/rod mills
   (iv) Disc crusher
   (v) Micro-pulveriser
   (vi) Hydraulic Jig.
   (vii) Wilfly table.
   (viii) Denver flotation cell (Demonstration ).

XLVI. Class /Laboratory Schedule
   a. Lecture: Three 60 minutes sessions per week
   b. Laboratory: One 100 minutes session per week for a batch of 20 students

XLVII. Contribution of Course to Professional Component
   a. Lecture: Students learn to process the ores/minerals.
   b. Laboratory: Students learn about various machines/equipments required for mineral /ore dressing &their upgradation techniques.

XLVIII. Evaluation of Students:
   a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
   b. Grades: Relative grading

XLIX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | X | | X | X | X | | |
| b | X | X | | | | X | X | | |
| c | X | X | X | | | X | X | X | |
| d | X | X | X | X | X | X | X | X | X |
| e | X | X | X | X | | X | | X | X |
| f | X | X | X | | | X | X | X | X |

**MAL205 NUMERICAL ANALYSIS AND PROBABILITY THEORY (3-0-0) 6 credits**

**Numerical Analysis**: Solutions of algebraic and transcendental equations by Iteration method, method of false position, Newton-Raphson method and their convergence.

Solutions of system of linear equations by Gauss elimination method, Gauss Seidal method, LU decomposition method. Newton-Raphson method for system of nonlinear equations.

Eigen values and eigen vectors : Power and Jacobi methods.

Numerical solution of ordinary differential equations: Taylor's series method, Euler's modified method, Runge-Kutta method, Adam's Bashforth and Adam's Moulton, Milne's predictor corrector method.

Boundary value problems: Shooting method, finite difference methods.

**Probability theory:**

Random variables, discrete and continuous random variable, probability density function; probability distribution function for discrete and continuous random variable joint distributions.

Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

Binomial, Geometric distribution, Poisson distribution, Relation between Binomial and Poisson's distribution, Normal distribution, Relation between Binomial and Normal distribution.

Introduction to Stochastic Processes: Random processes, continuous and discrete, determinism, stationarity, ergodicity etc.

correlation functions, autocorrelation and cross-correlation, properties and applications of correlation functions.

**Text / Reference Books :**


1. Numerical methods for engineers and scientists, Wiley, Iyengar and Jain, Jain
2. An introduction to probability and statistics, Wiley, Rohatgi and Sateh.
3. Elementary numerical analysis, an algorithm approach, McGraw-Hill, Cante and De Boor
4. Probability, statistics with reliability, queuing and computer science and applications, Prentice Hall, Trivedi.

***MML202 POLYMERIC MATERIALS (3-0-2) 8 credits***

Course Outline

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MML- 202 | Basic Science: | 2 |
| Course Title: | Polymeric Materials | Engineering Topics: | 4 |
| Contact Hours | 3-0-2 | Design Content: | No |
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Dr. R.C. Rathod | Compliant: | Course Book 2012-2013 |

L. Catalog Description:

An important awareness and technical significance of polymeric materials in the society, classification of polymers , polymer structure and properties, Practical polymerization routes, mechanical and rheological of polymers, Different characterization techniques, various types of degradation and recycling of polymers, different types of additives , processing of polymers. Structure, properties and application of commodity types of polymers.

LI. Course Coordinator: Dr. R. C. Rathod, Ground Floor, Old Building of Department

LII. Pre-requisites and Co-requisites: None

LIII. Textbook and /or Other Required Material

a. Clegg D.W., Collyer A. A., Structure and Properties of Polymeric Materials, Mats. Publn., London, 1993.
b. Fried J.R., Polymer Science and Technology, Prentice Hall of India, New Delhi 2000.
c. Willam D., Callistor J.R., Material Science and Engineering, John Wiley and Sons, 1997.
d. Jones, Engineering Materials (Vol I/II), ASM Hand Book.

LIV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

cc. Theoretical and Practical basis of polymeric materials.
dd. Different polymerization process and its thermodynamic and kinetic aspect.
ee. Different practical polymerization routes for homopolymer and copolymer.
ff. Characterization of polymer (thermal, mechanical )
gg. Degradation and additives
hh. Structure, properties and application of commodity types of polymers

LV. Expanded Course Description

a. Expanded description of the course

LVI. An important awareness and technical significance of polymeric materials in the society, an amorphous and semicrystalline polymers , polymer structure – linear, branched,

network, cross-linked, Properties- physical and mechanical, polymerization process and its thermodynamic and kinetic aspect for homopolymerization and copolymerization, Practical polymerization routes such as bulk, solution, suspension, emulsion, Mechanical and rheological behavior of polymers, Different characterization techniques such as dialatometric method, heat capacity method , modulus of elasticity, thermo mechanical, differential thermal analysis, viscosity measurement, size exclusion chromatographic method , Chain end degradation and random degradation, additives- plasticizer and softeners, filler and reinforcing agent, stabilizer, flame retardants, blowing agents, cross-linking agents , processing – extrusion, blow molding, injection molding, thermoforming, calendaring, spinning, casting. Structure, properties and application of commodity types of polymers – PVC, PE, PMMA, ABS, PS.

b.Typical laboratory experiments

i. To calculate MFI of different polymers using extrusion plastometer
ii. To study the effect of temperature on the MFI of different polymers
iii. To determine the density and specific gravity of a given polymers by displacement method
iv. To determine the mechanical properties of different polymers using tensile test.
v. To determine the molecular weight of polyacrylamide using Ostwald viscometer
vi. To synthesize urea as a thermosetting polymer
vii. To synthesize PMMA as a thermoplastic polymer

LVII. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week
b. Laboratory: One 100 minutes session per week for a batch of 20 students

LVIII. Contribution of Course to Professional Component

a. Lecture: Students learn the course and increase awarness about polymer in the society
b. Laboratory: Students learn about synthesis of polymers, Polymer processing required for industrial application, Polymer testing in terms of physical and mechanical properties.

LIX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, Journal writing /viva-voce examination and end semester exam.
b. Grades: Relative grading

LX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | X | | X | X | X | | |
| b | X | X | | | | X | X | | |
| c | X | X | X | | | X | X | X | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| d | X | X | X | X | X | X | X | X | X |
| e | X | X | X | X | | X | | X | X |
| f | X | X | X | | | X | X | X | X |

MML204 TRANSPORT PHENOMENA (3-0-2) 8 credits

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 2.5 |
| Course No.: | MML204 | Basic Science: | 2 |
| Course Title: | Transport Phenomena | Engineering Topics: | 1.5 |
| Contact Hours | 3-0-2 | Design Content: | Yes |
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. S. G Sapate | Compliant: | Course Book 2012-2013 |

LXI. Catalog Description:

Introduction to heat and mass transfer, Importance of heat and mass transfer to metallurgical processes, heat treatment etc. basic principles of steady state and non steady state conduction heat transfer, Fins , design of Fins, Radiations heat transfer, Fluid flow through plates, tubes, ducts and channels, hydrodynamic boundary layer, Differential boundary layer equations, Continuity and momentum equations, Free and forced convection heat transfer, Heat exchangers, Thermal analysis of heat exchangers, LMTD , NTU method , Design of heat exchangers, Mass transfer, processes, classification, concentration, velocity and flux, Fick's law of diffusion, Mass diffusion equations, steady state and transient diffusion, equimolar diffusion, Mass transfer coefficient, convective mass transfer and applications.

LXII. Course Coordinator: Prof. S. G Sapate, Staff room, Old Building of Department

LXIII. Pre-requisites and Co-requisites: None

LXIV. Textbook and /or Other Required Material

a) D.S.Kumar: Heat & Mass transfer

b) J.P.Hollman: White PRS: Heat Transfer, Mcgraw Hill Company

c) E.R.G. Eckert: Robert M. Drake, Analysis of Heat and Mass Transfer, McGraw- Hill,

d) GP Incropera, DP Dewitt: Fundamentals of heat and mass transfer,Wiley

e) S.P.Sukhtme: A text book on Heat transfer.

f) Handbook on Making , shaping and treating of steels.

g) Trinks : Industrial furnaces – Vol I and Vol. II

LXV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

ii. Importance of heat and mass transfer in industries fundamental concepts of heat and mass transfer and governing laws of different modes of heat transfer

jj. Various modes of heat transfer such as steady state and transient heat conduction heat transfer.

kk. Fundamental concepts of fluid flow.

ll. Able to solve numerical and problems based on application of conduction, convection and radiation heat transfer to Metallurgical Engineering and processes.

mm. Thermal and metallurgical deign of heat exchangers and Fins

nn. Mass transfer concepts and its application to various processes.

LXVI. Expanded Course Description

a. Expanded description of the course

Introduction, importance of heat and mass transfer, heat transfer aspects in heating – reheating of steels, parameters, step heating, significance in heating – reheating of steels.
Steady state heat conduction, Fourier's law , one dimensional steady state heat conduction through composite walls, spheres, cylinders, critical radius of insulation, General three Dimensional equations with and without internal heat generation, Finite difference method. Transient conduction, types, Analysis of transient heat conduction, lumped heat capacity analysis, Analytical methods, Transient heat conduction in semi-infinite bodies, error function analysis, Heisler charts and their application to transient heat conduction.
Radiation heat transfer, nature of thermal radiations, black and gray bodies, laws of radiation, Radiation shape factor, heat transfer between black bodies, gray body radiation heat transfer for different geometries, interchange factor, Radiation shields, combined effects of conduction, convection and radiation.
Fluid flow and their classification, Laminar and turbulent flow, Fluid flow through plates, tubes, ducts and channels, hydrodynamic boundary layer, Differential boundary layer equations, Continuity and momentum equations, Blausius and Van-Kerman integral energy equations. Application of Dimensional analysis to convective heat transfer, Dimensional numbers and their significance, Empirical equations for free and forced convection for laminar and turbulent flow for different configuration, Liquid metal convective heat transfer.
Conduction –convection systems, Fins , types, heat transfer analysis of Fins, Fin efficiency and effectiveness, Heat exchangers, classification, fouling factor , overall heat transfer coefficient, thermal analysis of heat exchangers, LMTD and NTU method, design problems in heat exchangers.
Mass transfer, processes, classification, concentration, velocity and flux, Fick's law of diffusion, Mass diffusion equations, steady state diffusion, equimolar diffusion, Mass transfer coefficient, convective mass transfer and application.

b. Typical laboratory experiments/ Set of exercises

i. Numericals on basic principles of heat transfer by conduction, convection and radiation.

ii.Numericals on steady state conduction heat transfer.

iii.Problems on transient heat conduction.

iv.Problems on fluid flow and calculation of heat transfer rate under free convection condition.

v.Problems on determination of heat transfer by forced convection for different fluid flow conditions.

vi.Numericals on radiation heat transfer in black bodies.

vii.Problems on calculation of radiant energy in gray bodies and radiation shields.

viii.Design calculations of heat exchangers by thermal analysis using LMTD method.

ix.Thermal analysis of heat exchangers by NTU method.

x..Problems on conduction - convection systems : Fins (calculation of heat transfer, fin efficiency curves etc. and mass transfer

LXVII. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week
b. Laboratory: One 100 minutes session per week for a batch of 20 students

LXVIII. Contribution of Course to Professional Component

a. Lecture: Students learn to analyze different heat and mass transfer situations in industrial applications.
b. Laboratory: Students should be able to analyze and solve problems related to different modes of heat transfer and mass transfer and design of heat exchangers and fins.

LXIX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

LXX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | | | X | X | X | | |
| b | X | X | X | | X | X | X | | |
| c | X | X | X | | | X | X | X | |
| d | X | X | X | X | X | X | X | X | X |
| e | X | X | X | X | | X | | X | X |
| f | X | X | X | | | X | X | X | X |

**MML206 METALLURGICAL THERMODYNAMICS & KINETICS (3-0-0) 6 credits**

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/ Numericals: | 3 |
| Course No.: | MML-206 | Basic Science: | 1 |
| Course Title: | METALLURGICAL THERMODYNAMICS & KINETICS | Engineering Topics: | 3 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | Unknown | Curriculum Designation: | DC |
| Revised By: | Dr. Jatin Bhatt | Compliant: | Course Book 2012-2013 |

LXXI. **Catalog Description**:

It is a Departmental Core (DC) subject. This subject is designed to give students knowledge on fundamentals of thermodynamic and kinetics to metal extraction and phase transformations. Course also covers practical aspects to understand metallurgical process and significance of thermodynamics and kinetics in process of metals and alloys.

LXXII. **Course Coordinator**: Dr. Jatin Bhatt, Room No. F8, First Floor, Materials Engineering Centre

LXXIII. **Pre-requisites and Co-requisites**: None

**LXXIV. Textbook and /or Other Required Material**

a. Gaskell D.R.; Metallurgical Thermodynamics; McGraw Hill, USA, 1995

b. Darken L.S., Gurry. R.W.; Physical Chemistry of Metals; McGraw Hill, 1953.

c. A. Ghosh; Text book of Materials & Metallurgical Thermodynamics; Prentice Hll of India, Delhi, 2003.

d. Upadhaya G.S., Dube R.K.; Problems in Metallurgical Thermodynamics and Kinetics; Pergamon Press, N. York, 1977.

LXXV. **Course Objectives**:

Upon successful completion of this course, each student should be able to understand:

oo. Fundamental criteria involving evolution of thermodyanamic parameters

pp. Importance of thermodynamics and kinetics parameters to process metallurgy.

qq. Interrelation between thermodynamic parameters to process efficiency.

rr. Calculation involving thermodynamic data.

ss. Interpretation and application of thermodynamic data.

tt. Understanding solid state phase transformations from thermodynamic and kinetics aspects.

**LXXVI. Expanded Course Description**

**a. Expanded description of the course**

i. Scope and concept – Energy and its forms systems, path and state properties, Thermodynamics processes, Thermodynamic equilibrium, Reversible and Irreversible processes.

ii. First law of thermodynamics, Internal energy, Specific heat, Enthalpy and their derivative.

iii. Second law of thermodynamics – Entropy and its derivative. Concept of free energy, Criterion of equilibrium, thermodynamic potential. Zeroth and third law of thermodynamics

iv. Fugacity, activity, equilibrium constant, chemical equilibrium, partial molar properties and chemical potential. Thermodynamics of vapour phase in equilibrium with solids and liquids.

v. Thermodynamics of solution – Raoult's Law, Henry's Law, ideal, non – ideal and regular solutions, Gibbs – Duhem equation and its solution and applications – Multi-component solution, interaction parameter

vi. Ellingham diagrams for oxides, sulphides, halides etc. and their applications to metallurgical processes

vii. Thermodynamics of Electro-chemical Cell and Application.

viii. Kinds of metallurgical processes – order of reaction, Arrhenius equation, Absolute reaction rate

**LXXVII. Class Schedule**

Lecture: Three 50 minutes sessions per week

**LXXVIII. Contribution of Course to Professional Component**

Lecture: Students learn application of thermodynamics and kinetics to process involved in high temperature metallic reaction and solid state phase transformations

LXXIX. **Evaluation of Students**:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.

b. Grades: Relative grading

**LXXX. Relationship of Course Objective to Program Outcomes**

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | | X | | | X | | X | | |
| b | X | X | | X | X | | X | X | X |
| c | X | X | | X | X | | X | | X |
| d | X | X | | X | X | | X | | X |
| e | X | X | | X | X | X | X | X | X |
| f | X | X | | X | X | | X | | X |

**MML208 CERAMICS & REFRACTORY MATERIALS (3-0-0) 6 credits**

Course Outline

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 1 |
| Course No.: | MML-208 | Basic Science: | 2 |
| Course Title: | Ceramic Materials | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. A.R. Ballal | Compliant: | Course Book 2012-2013 |

Ceramic Materials - Crystalline structure, silicate structures and silica, glasses and other non crystalline ceramics, mechanical behaviour of ceramics, effect of temperature on mechanical behaviour.

Properties and applications of engineering ceramic materials, various phase diagrams in ceramic materials, imperfection in ceramic materials - Kroger Vink notation, Advance ceramic materials.

Processing of ceramic materials - glass forming process (pressing, blowing, drawing and fiber forming), particulate forming process (powder pressing, hydro-plastic forming, slip casting and tape forming) Sol-gel process.

Classification of refractory materials into Acidic, basic, neutral, rarer refractories. Requirements of a refractory. General processing of refractory bricks from natural raw materials. Properties of refractories such as True / Apparent density, True / Apparent porosity, cold crushing strength, pyrometric cone equivalent, refractoriness under load, reheat shrinkage, resistance to slag attack, spalling and thermal resistance, permeability to air / gas etc.

Drying, firing cycles of following refractory materials - Silica bricks, Magnesite bricks, Dolomite, Forsterite, Chromite bricks, Carbon / graphite refractory, Insulating bricks, classification of fireclays and fireclay bricks.

High alumina bricks; metal case bricks, low temperature and high temperature insulation bricks; refractory hard metal carbides / borides / nitrides / sillicides etc.

Refractory applications in Iron / Steel making furnaces, Cupola, Coke ovens, Calcinatin kilns, Rotary kilns for cement, Arc / Induction furnaces.

**Text / Reference Books:**


1. Kingery W.D.; Introduction to Ceramic Materials; John Wiley & Sons, 2004
2. Norton F.H.; Refractories & Ceramics; McGraw Hill Co., 1968
3. Jones; Engineering Materials (Vol I / II); Pergamon Press, 1993
4. Askeland D.R.; Science & Engineering of Materials (3rd Edition); Chapman Hall, 1996.
5. Callister W.D.; Material Science & Engineering (6th Edition); John Wiley & Sons Inc., 2003
6. Chester; Refractories : Production & Properties; Iron & Steel Institute, 1973.


**MML212 CERAMICS MATERIALS (3-0-0) 6 credits**

Introduction, Definition of ceramic materials, Spectrum of applications, Classification of Ceramics.

Basis of crystal structures in ceramics, Crystal Structures (Rock salt, NiAs, CsCl, Wurtzite, Rutile, Fluorites, Antifluorites, Perovskites, Silicates etc.).

Imperfection in ceramic materials – Kroger-Vink notation, Defect reactions, Stoichiometry and non-stoichiometry.

Processing of ceramic materials –Powder synthesis techniques, Consolidation techniques (slip casting, tape casting etc.), Sintering theory and mechanisms, Advanced techniques of sintering

Principles of Characterization of powders and sintered bodies (particle size and distribution, porosity, density, shrinkage, surface area etc.)

Basics of ceramic properties (Physical, Electrical, Mechanical, Magnetic, and thermal) Structure-Property co-relationship.

Classification of refractory materials into Acidic, basic, neutral, rarer refractories. Requirements of a refractory and applications.

Introduction to Advanced Ceramics and Applications (electro-ceramics, bio-ceramics, ultra-high temperature ceramics, thin films etc.), Opportunities and Challenges.

**Text / Reference Books:**


1. Modern ceramic engineering, Taylor and Francis, D.W. Richerson
2. Ceramic materials, B. Carter and G. Norton

3. Sintering theory and practice, R.M. German
4. Powder metallurgy and particulate materials processing, R.M. German.

MML210 CHEMICAL CHARACTERIZATION OF MATERIALS (3-0-2) 8 credits

Classification of various methods of analysis – Gravimetric, Volumetric, Gas Analysis, Calorimetric, Nephelometric electro – chemical methods; preparation of substances for analysis, error in quantitative analysis, Calculations of Gravimetric and Volumetric analysis results.

Principles of Gravimetric analysis, requirement for precipitates, choice and amount of precipitant, salt effect, effect of temperature, hydrogen ion concentration and complex formation on completeness of preparation; formation of amorphous and crystalline precipitates co-precipitation, washing of precipitates.

Principles of volumetric analysis, classification of methods, requirements of reactions, preparation of standard solutions.

Neutralization method : principle, theory of indicators, titration curves for titration of strong acid with strong alkali, weak acid with strong alkali, weak bases with strong acids, buffer action, indicator errors in titration.

Oxidation – Reduction methods, oxidation potentials, direction of reactions, equilibrium constants, titration cures and indicators, rate of reaction and side reaction.

Principles of redox titration – Permangnometry, dichrometry, iodometry, bromatometry, etc., standard solutions, and indicators.

Precipitation and complex forming methods, principles, titration curves, methods of determining the equivalence point etc. EDTA titrations.

LAB.

1. Determination of Carbon and Sulphur in Ferrous Materials by "Stroheleins Apparatus"
2. Determination of Manganese in steel by sodium Bismuthate method.
3. Determination of Chromium in steel by ammonium Persulphate method.
4. Determination of Phosphorus in steel by ammonium Nitromolybdate method.
5. Determination of Silicon in steel by gravimetric method.
6. Determination of Nickel in steel by Dimethylglyoxime method.
7. Determination of Sulphur in steel by Iodometric method.
8. Determination of Copper in steel by Iodometric and Electrogravimetric method.
9. Determination of Iron in iron ore by Volumetric method.
10. Preparation of standard solutions and standardization of standard solutions.

**Text / Reference Books :**


1. V. Alexeyev ; Qualitative Analysis; MIR Publishers, 1959
2. Jain S.P. & Agrawal BC; Text book of Metallurgical Analysis; Khanna Pub. Co., 1976.
3. W.V. Soot.; Standard methods of Chemical Analysis
4. A.I. Vogel.; Text book of Quantitative Inorganic Analysis; English Language Book Services, 1978
5. Young R.S.; Chemical Analysis in Extractive Metallurgy; Charles, Griffin & Co. Ltd, 1971

**MML-391: Metal Working Processes (3-1-0) 8 Credits**

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 1 |
| Course No.: | MML-391 | Basic Science: | 2 |
| Course Title: | Metal Working Processes | Engineering Topics: | 4 |
| Contact Hours | 3-1-0 | Design Content: | Yes |
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. A.R. Ballal | Compliant: | Course Book 2012-2013 |

LXXXI. Catalog Description:

It is a core course aimed at Third Year UG students. The course introduces the concepts of deformation (elastic and plastic) in metallic materials. It discusses the various phenomena occurring during mechanical working, heat treatment of metals/alloys. It also introduces the technologies related to shaping techniques like forging, rolling, extrusion etc.

LXXXII. Course Coordinator: Prof. A. R. Ballal, Room No. F11, Materials Engineering Center

LXXXIII. Pre-requisites and Co-requisites: None

LXXXIV. Textbook and /or Other Required Material

A) Mechanical Metallurgy, G. E. Dieter
B) Mechanical Behavior of Materials, T.H.Courtney
C) ASM Handbook Vol. 14.; Forming & Forging, ASTM

LXXXV. Course outcomes:

Upon successful completion of this course, each student should be able to:

uu. appreciate and understand the phenomenon of elastic deformation
vv. understand the basics of anisotropy in elasticity
ww. analyze stress and strain at any point
xx. understand the significance of empirical tools like yield criteria and their application
yy. understand the phenomena occurring during plastic deformation of metals/alloys
zz. co-relate the structure-property-co relationship during working and annealing
aaa. develop the knowledge of various metal working processes, effect of various process parameters, and their analysis

LXXXVI. Expanded Course Description

Engineering Stress – strain curve. True stress strain and flow curve, Important relations of flow curve. Concept of stress and strain in two and three dimensions. Principal stresses, Mohr's circle, Yield Criteria. Elastic behavior of metals/alloys, Atomistic model of elasticity, Elastic constants, Anisotropy in linear elastic behavior, Anisotropy ratios.

Basics of plastic deformation by slip, CRSS, dislocation movement and pinning, Concepts of strengthening mechanisms, Cold worked structure, Annealing and Recrystallization.

Fundamentals of Metal Working, Classification of processes, Metal working system. Mechanics of metal working, Deformation energy and slab analysis

approach. Temperature Effects, Hot working, Strain rate effects. Effect of metallurgical structure. Friction and lubrication in working. Workability, Residual stress, Experimental techniques in working, Introduction to Computer aided working.

Rolling Processes, Definition, Classification products and processing sequences in hot and cold rolling mills. Rolling mills, Analytical aspects of rolling. Rolling load torque and power calculations, variables of rolling. Defects- causes and remedies.

Forging process, Main forging operation, Open and closed die forging. Forging equipments, special forging equipments for isothermal ring rolling, near net shape. Analytical aspects, Forging defects. Powder forging.

Extrusion processes, Direct and Indirect Extrusion, Extrusion tooling, Analysis of simple extrusion, variables of extrusion. Products and materials suitable for extrusion. Tube drawing operations and their analysis. Wire rod drawing operations, Analysis of wire rod drawing. Drawing load and energy calculations.

Sheet Metal forming operation, Formability concepts. Drawing, stretching deep drawing, analysis of basic process, LDR, diffuse necking and formability limit diagram. Anisotropy

LXXXVII. Class /Laboratory Schedule

Lecture: Three 60 minutes sessions per week

Tutorial : One 100 minutes session per week per batch of 20 students

LXXXVIII. Contribution of Course to Professional Component

The course helps the students to attain proficiency in metal working operations needed in several processing industries in the country and abroad.

LXXXIX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two quizzes, and end semester exam. The evaluation in tutorial is based on performance in viva-voce. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

XC. Relationship of Course Objective to Program Outcomes

| Course Objective | **Engineering knowledge** | **Problem analysis** | **Design/Development of solution** | **Conduct investigation of** | **Modern tool usage** | **Engineer and society** | **Environmental and sustainability** | **Ethics** | **Individual and team work** | **Communication** | **Project management and** | **Life long learning** |
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**MML372 PRINCIPLES OF NON FERROUS EXTRACTION METALLURGY**
**(3-0-0) 8 credits**

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/ Numericals: | 2 |
| Course No.: | MML-372 | Basic Science: | 1 |
| Course Title: | PRINCIPLES OF NON FERROUS EXTRACTION METALLURGY | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | Unknown | Curriculum Designation: | DC |
| Revised By: | Dr. Jatin Bhatt | Compliant: | Course Book 2012-2013 |

XCI. **Catalog Description**:

It is a Departmental Core (DC) subject. This subject is designed to give students knowledge on fundamentals of extraction in non-ferrous materials by pyrometallurgy, hydrometallurgy and electrometallurgy route. Course also covers significance on process analysis economic consideration for efficient use of method for extraction. Fundamental of processing is dealt using thermodynamics and kinetics to better appreciate the process.

XCII. **Course Coordinator**: Dr. Jatin Bhatt, Room No. F8, First Floor, Materials Engineering Centre

XCIII. **Pre-requisites and Co-requisites**: Metallurgical Thermodynamics and Kinetics

**XCIV. Textbook and /or Other Required Material**

a. Ray H.S., Sridhar R., Abraham K.P.; Extraction of Non-ferrous Metals; West Publication., 1990
b. Rosenquist T; Principles of Extractive Metallurgy; McGraw Hill, 1985.
c. Serynkova; General Metallurgy
d. Volsky A.; Theory of Metallurgical Processes; Mir Publication, 1971.

XCV. **Course Objectives**:

Upon successful completion of this course, each student should be able to understand:

bbb. Fundamentals of non ferrous extraction.
ccc. Application of thermodynamics to non ferrous extraction process.
ddd. Significance of pyrometallurgy, hydrometallurgy and electrometallurgy.
eee. Preliminary treatment to ore and mineral.
fff. Process flow and analysis
ggg. Charge calculation for extraction process

**XCVI. Expanded Course Description**

**a. Expanded description of the course**

ix. General methods of extraction in Pyrometallurgy - Drying, Calcination, Roasting, Smelting, Carbothermic and Metllothermic

reduction, Refining techniques like Liquation, Distillation, Vacuum Distillation etc.

x. Principles of hydro and electrometallurgy with suitable examples
xi. Leaching techniques, Leaching solvents, Theory of leaching, bacterial leaching, electrochemical nature of leaching, gold and silver extraction.
xii. Pressure leaching, Sherritt - Gorden process for Copper, Nickel, Cobalt ores; Solvent extraction, Ion exchange.
xiii. Electrometallurgy - Electrolysis of aqueous solutions and fuses salts, Cell design, Recovery of metal values by Cementation
xiv. Electro-winning, Electro-refining etc. Principles and important applications
xv. Extraction of metals from oxides - Magnesium and Titanium extraction, Bayer's process, Hall Heroult process.
xvi. Extraction of meals from sulphides, Extraction of Copper, Lead, Zinc, Nickel

**XCVII. Class Schedule**

Lecture: Three 50 minutes sessions per week

**XCVIII. Contribution of Course to Professional Component**

Lecture: Students learn Scientific basis and fundamental theory behind extraction of non ferrous metals.

XCIX. **Evaluation of Students**:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

**C. Relationship of Course Objective to Program Outcomes**

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | X | | X | | X | X | X |
| b | X | X | | | X | | | | X |
| c | X | X | X | | | | X | | |
| d | X | X | X | | | | X | X | X |
| e | X | X | X | X | X | | | X | X |
| f | X | X | X | | X | | X | X | X |

## MMP372 PRINCIPLES OF NON FERROUS EXTRACTION METALLURGY LAB. (0-0-2) 2 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 2 |
| Course No.: | MMP-372 | Basic Science: | 1 |
| Course | Principles of Non- | Engineering Topics: | 4 |

| | | | |
|---|---|---|---|
| Title: | Ferrous Extraction Metallurgy | | |
| Contact Hours | 0-0-2 | Design Content: | Yes |
| Credit | 2 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. D. V. Moghe | Compliant: | Course Book 201 2013 |

CI. Catalog Description:
The laboratory module is based on the course content of MML 372: Principles of Non-Ferrous Extraction Metallurgy. This is designed to expose students to various pyro, electro and hydro metallurgical operations and processes.

CII. Course Coordinator: Prof. D. V. Moghe,

CIII. Pre-requisites:

CIV. Textbook and /or Other Required Material

D) Extraction Non-Ferrous Metals by H S Ray, R Sridhar and K P Abraham
E) Principles of Extractive Metallurgy by T Rosenquist

CV. Course outcomes:

Upon successful completion of this course, each student should be able to:

hhh. To develop clear understanding of various unit processes viz calcination, oxidation and sulphatization roasting, lime scavenged direct reduction, carbo-thermic reduction, leaching, cementation and electro-wining.

iii. To perform mass balance calculations.

CVI. Expanded Course Description

To perform experiments on calcination, oxidation and sulphatization roasting, lime scavenged direct reduction, carbo-thermic reduction, leaching, cementation and electro-wining and study the effect of various process parameters on the reactions, products and quantify the results.

CVII. Class Schedule:

Laboratory: One 100 minute sessions per week for a batch of 20 students

CVIII. Contribution of Course to Professional Component

To perform scientific experiments and evaluate the role of thermodynamic and kinetic parameters.

CIX. Evaluation of Students:

c. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two quizzes, and end semester exam.
d. Grades: Relative grading

CX. Relationship of Course Objective to Program Outcomes

| Course Objective | Engineering knowledge | Problem analysis | Design/Development of solution | Conduct investigation of complex problems | Modern tool usage | Engineer and society | Environmental and sustainability | Ethics | Individual and team work | Communication | Project management and finance | Life long learning |
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| | | | | X | | | | | | | X | |

## MML373 FERROUS EXTRACTION METALLURGY (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 1 |
| Course No.: | MML-373 | Basic Science: | 2 |
| Course Title: | Ferrous Extraction Metallurgy | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. D. V. Moghe | Compliant: | Course Book 2012-2013 |

CXI. Catalog Description:
It is a core course aimed at Third Year UG students. The course introduces the concepts of Iron making – thermo-kinetic aspects, Reaction and Processes, Design, Construction and Operations of various processes. The modern operating principles and practices are reviewed.

CXII. Course Coordinator: Prof. D. V. Moghe,

CXIII. Pre-requisites: Metallurgical Thermodynamics and Kinetics

CXIV. Textbook and /or Other Required Material

F) Introduction to Modern Iron making by R. H. Tupkary
G) Principles of Blast Furnace Iron Making by A. K. Biswas
H) Iron Making and Steel Making by A Ghosh and A Chatterjee.

CXV. Course outcomes:

Upon successful completion of this course, each student should be able to:

jjj. Understand physic-chemical aspects, thermodynamics and kinetics of reactions and processes.
kkk. Appreciate techno-economic indices, productivity and consumption norms.
lll. Appreciate and evaluate Mass balance of processes.
mmm. Appreciate the design and operations of various processes
nnn. Gather critical knowledge of alternative Iron making technologies

CXVI. Expanded Course Description

Routes to Iron making, raw materials oxide feed preparation & charecterisation, Sintering & Pelletisation, Coke quality improvements, Blast Furnace design & evolution, bouduards equilibria, counter current reactor, reduction path mechanism McEwans model, burden distribution & control ( 14 Lectures )

Break down of oxide feed & swelling of pellets, indirect & direct reduction reactions, stack, bosh & hearth reactions, acid & basic burdening, in-furnace sulphur control, external treatments, low silicon hot metal, operating zones in furnace – dissection of quenched furnaces. ( 12 Lectures)

Melting mechanisms in bosh, indices for process control, modern trends in design & operation, alkali problem, mass balance calculations. Alternative technologies for iron making. (14 Lectures)

CXVII. Class Schedule

Lecture: Three 60 minute sessions per week

CXVIII. Contribution of Course to Professional Component

Ability to transfer class room instructions & knowledge into shopfloor working, problem solving & development & design capabilities.

CXIX. Evaluation of Students:

e. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two quizzes, and end semester exam.
f. Grades: Relative grading

CXX. Relationship of Course Objective to Program Outcomes

| Course Objective | **Engineering knowledge** | **Problem analysis** | **Design/Development of solution** | **Conduct investigation of complex problems** | **Modern tool usage** | **Engineer and society** | **Environmental and sustainability** | **Ethics** | **Individual and team work** | **Communication** | **Project management and finance** | **Life long learning** |
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| | | | | X | | | | | | | X | |
| | | | | X | | | | | | | X | |

## MML378 WEAR OF ENGINEERING MATERIALS (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 0.5 |
| Course No.: | MML378 | Basic Science: | 1 |
| Course Title: | Wear of Engineering Materials | Engineering Topics: | 4.5 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. S. G Sapate | Compliant: | Course Book 2012-2013 |

I. Catalog Description:

Introduction to tribology and wear, industrial importance of wear, classification of wear processes and problems of wear damage to engineering components. Different modes of wear, wear by hard particles, abrasion and erosion, sliding wear, fretting wear: mechanisms, factors influencing wear rate, Wear behaviour of engineering materials. Wear characterization. Frictional behavior of metals, ceramics and polymers. Types of Lubrication and lubricants.

Course Coordinator: Prof. S. G Sapate, Staff room, Old Building of Department

II. Pre-requisites and Co-requisites: Testing of materials

III. Textbook and /or Other Required Material

a) Huchings I.M.; Tribology, Friction and wear of Engineering Materials; Butterworth & Heinemann, 1992.

b) Arnell R.D., Davies P.B.; Tribology - Principles and Design Applications; Spriger Verlag, 1991.

c) A.S.M. Handbook : Friction, Lubrication Wear and Tribology (Vol. 18); ASM.

IV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

a. Industrial importance of wear and classification of wear processes.
b. Mechanisms, factors influencing wear rate, Wear behaviour of engineering material under different modes of wear such as wear by hard particles, abrasion and erosion. sliding wear, fretting wear etc.
c. Mechanisms, factors influencing wear rate, Wear behaviour of engineering material under sliding wear and fretting wear etc.
d. Apply the fundamental understanding of mechanism of wear to material selection for wear resistance.
e. Understand frictional behaviourof metals, polymers and ceramics and lubricants and lubrication types used for wear protection.
f. Understand techniques used for characterization of worn out surfaces.

V. Expanded Course Description

a. Expanded description of the course

Introduction, Tribology and wear, industrial importance of wear, wear classification, Sliding wear, mechanism, variables, sliding wear of metallic and non metallic materials, wear maps, test method.

Wear by abrasion, types, models of abrasion, Factors affecting abrasive wear, abrasive behaviour of engineering materials, abrasive wear testing, abrasion resistant materials Wear by erosion, models of erosion, factors affecting erosion, erosion behaviour of engineering materials, erosion resistant materials, test methods.

Friction and laws of fraction, frictional behaviour of meals and non metallic materials.

Wear characterization techniques, Miscellaneous forms of wear, Lubrication, types, Liquid and solid lubricants

b. Typical laboratory experiments/ Set of exercises

i)Study of different test apparatus such as pin on disc tribometer, dry sand rotating wheel abrasion tester, slurry abrasion test apparatus, slurry erosion test rig

ii) To study and conduct DSRW test using silica sand abrasives on Mild steel and low alloy steels

iii) To study the effect of load on slurry abrasion of low alloy steels.

iv) To study the effect of slurry concentration on slurry abrasion of low alloy steels.

v) To study the effect of normal load, sliding velocity and sliding distance on sliding wear of some non ferrous metals and alloys

vi) To study the effect of load, velocity and time on two body abrasion of heat treated carbon steels,

vii) To study the effect of slurry concentration, RPM and time on slurry erosion of mild steel

viii) To study the morphology of worn out surfaces under SEM under different wear situations.

c. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week

b.Laboratory : One 100 minutes session per week for a batch of 20 students

VI. Contribution of Course to Professional Component

a. Lecture: Students learn to analyze service conditions and property requirements under different wear situations and suggest suitable wear resistant material.

b. Laboratory: Students should analyze the test methods, test results of different wear tests conducted in the laboratory and apply to material selection for different wear situations.

VII. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.

b. Grades: Relative grading

VIII. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | | | | | X | X | | |
| b | X | X | X | | | X | X | | |
| c | X | X | X | | X | X | X | | |
| d | X | X | X | X | X | X | X | X | X |
| e | X | X | X | X | | X | | X | X |
| f | X | X | X | | | X | X | X | X |

**MMP378 WEAR OF ENGINEERING MATERIALS LAB. (0-0-2) 2 credits**

1. Study of various wear testing equipments.
2. Sliding wear test of ferrous and non-ferrous metals using pin on disc apparatus.
3. Dry sand rubber wheel abrasion testing of metallic materials.
4. To study the effect of operational variables on slurry erosion of steels.
5. Study of wear by solid particle erosion of metals and non metals.

MML377/MML388 CHEMICAL CHARACTERIZATION OF MATERIALS (3-0-0) 6 credits

Classification of various methods of analysis – Gravimetric, Volumetric, Gas Analysis, Calorimetric, Nephelometric electro – chemical methods; preparation of substances for analysis, error in quantitative analysis, Calculations of Gravimetric and Volumetric analysis results.

Principles of Gravimetric analysis, requirement for precipitates, choice and amount of precipitant, salt effect, effect of temperature, hydrogen ion concentration and complex formation on completeness of preparation; formation of amorphous and crystalline precipitates co-precipitation, washing of precipitates.

Principles of volumetric analysis, classification of methods, requirements of reactions, preparation of standard solutions.

Neutralization method : principle, theory of indicators, titration curves for titration of strong acid with strong alkali, weak acid with strong alkali, weak bases with strong acids, buffer action, indicator errors in titration.

Oxidation – Reduction methods, oxidation potentials, direction of reactions, equilibrium constants, titration cures and indicators, rate of reaction and side reaction.

Principles of redox titration – Permangnometry, dichrometry, iodometry, bromatometry, etc., standard solutions, and indicators.

Precipitation and complex forming methods, principles, titration curves, methods of determining the equivalence point etc. EDTA titrations.

**Text / Reference Books :**


1. V. Alexeyev ; Qualitative Analysis; MIR Publishers, 1959
2. Jain S.P. & Agrawal BC; Text book of Metallurgical Analysis; Khanna Pub. Co., 1976.
3. W.V. Soot.; Standard methods of Chemical Analysis
4. A.I. Vogel.; Text book of Quantitative Inorganic Analysis; English Language Book Services, 1978

5. Young R.S.; Chemical Analysis in Extractive Metallurgy; Charles, Griffin & Co. Ltd, 1971

MMP377CHEMICAL CHARACTERIZATION OF MATERIALS LAB. (0-0-2) 2 credits

1. Determination of Carbon and Sulphur in Ferrous Materials by "Stroheleins Apparatus"
2. Determination of Manganese in steel by sodium Bismuthate method.
3. Determination of Chromium in steel by ammonium Persulphate method.
4. Determination of Phosphorus in steel by ammonium Nitromolybdate method.
5. Determination of Silicon in steel by gravimetric method.
6. Determination of Nickel in steel by Dimethylglyoxime method.
7. Determination of Sulphur in steel by Iodometric method.
8. Determination of Copper in steel by Iodometric and Electrogravimetric method.
9. Determination of Iron in iron ore by Volumetric method.

Preparation of standard solutions and standardization of standard solutions.

**MML214 THEORY AND TECHNOLOGY OF HEAT TREATMENT (3-0-2) 8 credits**

Recapitulation of Fe-C equilibrium diagram, Eutectoid transformation in steels, and its significance, Time-Temperature Transformation diagrams, characteristics of pearlite and bainite transformations, Continuous cooling transformations, Characteristics of martensite transformation, critical cooling rate, Concept of Hardenability .Methods of determining hardenability, effect of various parameters on hardenability, Correlation of hardenability data.

Technology of heat treatment, Annealing, Normalizing, Hardening, Quenching media and their evaluation, Sub-zero treatment. Tempering, changes in structure and properties of steels during tempering, Temper embrittlement, Austempering, Martempering, Patenting.

Principles, Techniques, and applications of surface hardening treatments, Carburising, Nitriding, Cyaniding, Flame and Induction Hardening, Heat Treatment of surface hardened components.

Heat Treatment Atmospheres, Protective atmospheres, Defects due to heat treatment, causes and prevention, Case studies, Quenching stresses and defects.

Non-ferrous alloys-study of structure and properties, heat- treatment and uses of industrially important alloys : Aluminum base wrought and cast alloys, Aluminum and Beryllium bronzes.

Set of experiments based on the above syllabus.

**Text / Reference Books :**

1. ASM Hand Book.
2. Prabhudev K.H.; Hand Book of Heat Treatment of Steels; Tata McGraw Hill, 2000.
3. Avner SH; Physical Metallurgy, tata McGraw Hill.

**MML397 THEORY AND TECHNOLOGY OF HEAT TREATMENT (3-0-0) 6 credits**

Recapitulation of Fe-C equilibrium diagram, Eutectoid transformation in steels, and its significance, Time-Temperature Transformation diagrams, characteristics of pearlite and bainite transformations, Continuous cooling transformations, Characteristics of martensite transformation, critical cooling rate, Concept of Hardenability .Methods of

determining hardenability, effect of various parameters on hardenability, Correlation of hardenability data.

Technology of heat treatment, Annealing, Normalizing, Hardening, Quenching media and their evaluation, Sub-zero treatment. Tempering, changes in structure and properties of steels during tempering, Temper embrittlement, Austempering, Martempering, Patenting.

Principles, Techniques, and applications of surface hardening treatments, Carburising, Nitriding, Cyaniding, Flame and Induction Hardening, Heat Treatment of surface hardened components.

Heat Treatment Atmospheres, Protective atmospheres, Defects due to heat treatment, causes and prevention, Case studies, Quenching stresses and defects.

Non-ferrous alloys-study of structure and properties, heat- treatment and uses of industrially important alloys : Aluminum base wrought and cast alloys, Aluminum and Beryllium bronzes.

**Text / Reference Books :**


1. ASM Hand Book.
2. Prabhudev K.H.; Hand Book of Heat Treatment of Steels; Tata McGraw Hill, 2000.
3. Avner SH; Physical Metallurgy, tata McGraw Hill.


**MMP397 THEORY AND TECHNOLOGY OF HEAT TREATMENT (0-0-2) 2 credits**

Set of experiments based on the above syllabus.

**PHL305 ELECTRICAL & MAGNETIC MATERIALS (3-0-0) 6 credits**

**Magnetic Materials :** Concept of Magnetism, Classification of magnetic materials, diamagnetic, paramagnetic, ferromagnetic, anti-ferromagnetic and ferromagnetic materials. Spontaneous magnetization, ferromagnetic domains soft magnetic, magnetic materials, hard magnetic materials ferrites.

**Dielectric Materials :** Fundamental concepts, Types of polarization, electronic, ionic, orientational polarization polar and non-polar dielectrics, ferroelectricity and piezoelectricity spontaneous polarization, Curie-Weiss law, Electroceramics, Processing and applications of electroceramics, Transducers.

**Industrial Lasers :** Basic concepts, properties of lasers, Nd:YAG laser, $CO_2$ laser, Industrial applications of lasers, drilling, cutting, welding, heat treatment

**Electrical Conductivity Materials :** Conduction in Metals Free electron theory, Ohm's Law, Joule's Law, Factors affecting electrical resistivity of metals. Properties of Coppers, Brass, Aluminium, Materials for conducting applications, Hard and Soft Solders, electrical fuses heating elements, Ionic conductors, Superconductors, Silsbee's rule, Meissner effect, type – I and type – II superconductors, Applications of superconductors.

**Semiconductor I :** Semiconducting materials, element semiconductors, II – IV compounds, III – V compounds, ternary and quaternary compounds, oxide semiconductors, refractory semiconductors, magnetic semiconductors, organic semiconductors.

**Semiconductors – II :** The p-n junction diode, half wave and full wave rectifier, voltage stabilization, light emitting diode, the junction transistors, silicon controlled rectifiers (thyristors), integrated circuits, different types of ICs, metal oxides, silicon ICs.

**Text / Reference Books:**


1. Dekkar A. J.; Electrical Engineering Material ($19^{th}$ Edition); Prentice Hall India, 1997

2. Kenneth Krane; Modern Physics; (2nd Edition); John Wiley Eastern, 1998
3. Kasap S. O.; Principal of Electronic Materials and Devices (2nd Edition); TATA McGraw-Hill

**PHP306 ELECTRICAL AND ELECTRONIC MATERIALS LAB. (0-0-2) 2 credits**

1) To study the temperature variation of resistivity for a semiconductor and find its band gap by Four – Probe method.
2) To find the mobility and carrier concentration in the sample (metal or semiconductor) using Hall effect setup.
3) To determine the conductivity of given sample by Kelvin's Bridge Method.
4) To determine the coefficient of Thermal Conductivity of a bad conductor by Lee's disc method.
5) To study the Transmission of AC voltage through optical fibre and Co-axial cable and compare the result using Fibre Optics Kit.
6) To determine the Coercivity, Saturation Magnetisation, Retentivity and Hysteresis Loss of a given sample using Hysteresis Curve Tracer.
7) To measure the Dielectric Constant of a liquid dielectric and to study the temperature dependence of dielectric constant.
8) To determine the Magnetic Susceptibility of Paramagnetic solution by Quinke's Tube Method.
9) Application of LASER as a Particle Size Analyzer.
10) To determine the dielectric constant of given solid dielectric (Bakelite, Glass, Plywood and PZT sample) and analyze the result.
11) To study the variation of dielectric constant of PZT sample with temperature and determine its Curie temperature.
12) To study the variation of energy loss of ferromagnetic material with temperature and to determine its Curie temperature.

**MML355/MML380 PARTICULATE TECHNOLOGY (3-0-0) 6 credits**

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1 |
| Course No.: | MML-355 | Basic Science: | 2 |
| Course Title: | Particulate Technology | Engineering Topics: | 3 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. Y.Y. Mahajan | Compliant: | Course Book 2012-2013 |

Introduction, Methods of powder preparation (mechanical, chemical), Methods and equipments of powder compaction (Die compaction, Isostatic), Slip casting, Tape casting, Extrusion, Sintering – Method, Equipments, Atmospheres, Applications (Porous products, electrical contacts, Friction parts etc.)

**Books:**

Particulate Tech - A Textbook of Powder Metallurgy by Sands & Shakespears, Powder Metallurgy by AK Sinha

## MML381/MML443 METALLURGY OF NUCLEAR MATERIALS (3-0-0) 6 credits

- **Introduction:** Physico-chemical properties of Nuclear metals used as fuels (Uranium, Plutonium, Thorium etc.) and of Berrylium & zirconium as neutron moderator & fuel cladding metal respectively.
- Physico-chemical & thermodynamics principles of extraction processes viz. chemical ore break breakdown, solvent extraction, Ion-exchange, Halogenation.
- Consolidation, vacuum Refining & Ultra purification.
- Thermodynamicsof metallothermic reduction.
- Extraction of Uranium,production of Uranium in India.
- Production of plutonium, conversion of plutonium compounds to metallic state.
- Extraction of Thorium.
- Extraction of Zirconium & Beryllium.Nuclear Fuel production.

**BOOKS**

Sunderam C.V., Gupta C.K , Nuclear metals & materials in chemical technology , CSIR, New Delhi(1980).

Prakash B, Kantan S. R., Rao N. K., Metallurgy of Thorium production monograph 221 IAEA

Bellmay R & Hill N. A., Extraction & Metallurgy of Uranium Thorium & Beryllium Perganon, Press Oxford (1963).

H. S. Ray, K. P. Abraham & R. Sridhar , Extraction of Non ferrous Metals , Affiliated East- West Press PP 419-487.

## MML374 Characterization of Materials (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1 |
| Course No.: | MML-374 | Basic Science: | 2 |
| Course Title: | Characterization of Materials | Engineering Topics: | 3 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |

| | | | |
|---|---|---|---|
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Dr. Rajesh K. Khatirkar | Compliant: | Course Book 2012-2013 |

CXXI. Catalog Description:

Crystallography, optical microscopy, scanning electron microscopy, chemical analysis using scanning electron microscope, physics of X-rays, diffraction by crystalline materials, applications of X-ray diffraction, spectrometric and thermal analysis of materials.

CXXII. Course Coordinator: Dr. Rajesh K. Khatirkar, Department of Metallurgical and Materials Engineering, Materials Engineering Centre Building, Room No. MEC-F6, First Floor.

CXXIII. Pre-requisites and Co-requisites: None

CXXIV. Textbook and /or Other Required Material

a. Y. Leng, Materials Characterization, John Wiley & Sons, Hoboken, NJ, 2008.

b. D. Brandon and W.D. Kaplan, Microstructural Characterization of Materials, 2nd Edition, John Wiley & Sons, Hoboken, NJ, 2008.

c. D.B. Cullity and S.R. Stock, Elements of X-ray Diffraction, 3rd Edition, Prentice Hall, Upper Saddle River, NJ, 2001.

d. P.J. Goodhew, J. Humphreys, and R. Beanland, Electron Microscopy and Analysis, 3rd Edition, Taylor and Francis, London, UK, 2001.

e. Hatekayama and Quinn, Thermal Analysis Techniques, Wiley.

CXXV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

ooo. Basics of crystallography.

ppp. Microstructural characterization basics and techniques.

qqq. IR spectroscopic basics and techniques.

rrr. Thermal characterization methods.

sss. Applications of each technique and its limitations.

ttt. Selection of a characterization method for a particular application.

CXXVI. Expanded Course Description

a. Expanded description of the course

Introduction to materials characterization, its importance, structure sensitive/insensitive properties, structure-property correlation, crystallography basics, resolution, depth of field/focus, aberrations (spherical, chromatic and astigmatism), remedial measures for aberrations, levels of characterization (macro, meso and micro).

Optical microscopy (OM) – reflected/transmitted light microscope, theoretical and practical resolution of optical microscope, numerical aperture, principle of image formation, microscope construction and working, effective/empty magnification, different light sources, flat field correction, types of illumination – bright field, dark field, polarized light and phase contrast, applications of each type of illumination.

Sample preparation for optical microscopy, features of an image, introduction to scanning electron microscope (SEM), advantages/disadvantages as compared to OM, mechanics of SEM, types of electron gun and comparison between them (resolution, brightness, efficiency, cost and stability), ray diagram of SEM, working and construction, magnification.

Electron-specimen interaction, imaging modes (secondary and backscattered), effect of spot size, apertures, accelerating voltage on SEM image, Everhart-

Thornley detector, Robinson detector, solid state segmented detector, atomic number and topological contrast, critical probe current.

Chemical analysis using SEM, EDS/WDS working principle, construction, spot analysis, line scan and area scan, resolution of EDS/WDS detector, advantages/disadvantages, calibration of EDS/WDS, qualitative and quantitative analysis.

X-ray diffraction – Generation of X-rays, characteristic X-ray spectrum, Bragg's Law, Diffraction methods – Laue method, rotating crystal method, powder method, Principle, equipment and applications, structure factor, derivation of diffraction conditions for SC, BCC and FCC Bravais lattice, X-ray diffractometer, filters and counters/detectors, applications of X-ray diffraction in materials characterization – determination of crystal structure, lattice parameter, introduction of GIXRD.

Thermal analysis techniques – Importance, principles and applications of differential thermal analysis, differential scanning calorimetry and thermogravimetric analysis, accurancy, sensitivity, calibration and differences.

Gas chromatography, UV-Vis and Infra-red spectroscopy, Auger electron spectroscopy and X-ray fluorescence spectroscopy – principle, working and application.

CXXVII. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week

CXXVIII. Contribution of Course to Professional Component

a. Lecture: Students learn to select suitable characterization technique for a particular material/situation.

CXXIX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.

b. Grades: Relative grading

CXXX. Relationship of Course Objective to Program Outcomes

| Course Objective | Engineering knowledge | Problem analysis | Design / development of | Conduct investigation of | Modern tool | The engineer and society | Environment and | Ethics | Individual and team work | Communication | Project | Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | X | X | | | | X | X | | | X | | |
| b | X | X | | | | X | X | | | X | | X |
| c | X | X | | | | X | X | X | | X | | X |
| d | X | X | X | | | X | X | X | X | X | | X |
| e | X | X | X | X | | X | | X | X | X | | X |
| f | X | X | X | X | | X | X | X | X | X | | X |

## MMP374 Characterization of Materials (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |
| Course No.: | MMP-374 | Basic Science: | 1 |
| Course Title: | Characterization of Materials Lab | Engineering Topics: | 1 |
| Contact Hours | 0-0-2 | Design Content: | Yes |
| Credit | 2 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Dr. Rajesh K. Khatirkar | Compliant: | Course Book 2012-2013 |

I. Catalog Description:

Crystallography, optical microscopy, scanning electron microscopy, chemical analysis using scanning electron microscope, physics of X-rays, diffraction by crystalline materials, applications of X-ray diffraction, spectrometric and thermal analysis of materials.

II. Course Coordinator: Dr. Rajesh K. Khatirkar, Department of Metallurgical and Materials Engineering, Materials Engineering Centre Building, Room No. MEC-F6, First Floor.

III. Pre-requisites and Co-requisites: None

IV. Textbook and /or Other Required Material

a. Y. Leng, Materials Characterization, John Wiley & Sons, Hoboken, NJ, 2008.

b. D. Brandon and W.D. Kaplan, Microstructural Characterization of Materials, 2nd Edition, John Wiley & Sons, Hoboken, NJ, 2008.

c. D.B. Cullity and S.R. Stock, Elements of X-ray Diffraction, 3rd Edition, Prentice Hall, Upper Saddle River, NJ, 2001.

d. P.J. Goodhew, J. Humphreys, and R. Beanland, Electron Microscopy and Analysis, 3rd Edition, Taylor and Francis, London, UK, 2001.

e. Hatekayama and Quinn, Thermal Analysis Techniques, Wiley.

V. Course Objectives:

Upon successful completion of this lab, each student should be able to understand:

uuu. Microstructural characterization techniques.
vvv. IR spectroscopic techniques.
www. Thermal characterization methods.
xxx. Applications of each technique and its limitations.
yyy. Selection of a characterization method for a particular application.

VI. Expanded Course Description

a. Expanded description of the course

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b. Typical laboratory experiments

1. Optical microscopy
2. Scanning Electron Microscopy (imaging)
3. Chemical analysis using scanning electron microscopy (EDS)
4. Phase identification using X-ray Diffraction
5. Determination of Crystallize/Grain Size and Lattice Strain using XRD

6. Determination of onset of glass transition, crystallization and melting temperature using DTA.
7. Identification and purity determination using DSC
8. Quantification of crystalline percentage of a polymer using DSC
9. Identification of polymer using FTIR.

VII. Class /Laboratory Schedule
   c. Lecture: -
   d. Laboratory: One 100 minutes session per week for a batch of 20 students

VIII. Contribution of Course to Professional Component
   e. Lecture: -
   f. Laboratory: Students learn about the working of various characterization techniques. This helps them in selection of proper characterization techniques for a particular application/material/process.

IX. Evaluation of Students:
   g. Evaluation: A process of continuous evaluation is followed. It comprises of two viva exams, one quiz and home assignments. Precise distribution is announced in 1st practical.
   h. Grades: Relative grading

X. Relationship of Course Objective to Program Outcomes

| Course Objective | Engineering knowledge | Problem analysis | Design / development of solutions | Conduct investigation of complex | Modern tool usage | The engineer and society | Environment and | Ethics | Individual and team work | Communication | Project management and finance | Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | X | X | | | X | X | X | | | X | | X |
| b | X | X | | | X | X | X | X | | X | | X |
| c | X | X | X | | X | X | X | X | X | X | | X |
| d | X | X | X | X | X | X | | X | X | X | | X |
| e | X | X | X | X | X | X | X | X | X | X | | X |

## MML375 STEEL MAKING TECHNOLOGY (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 1 |
| Course No.: | MML-375 | Basic Science: | 2 |
| Course Title: | Steel Making Technology | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. D. V. Moghe | Compliant: | Course Book 2012-2013 |

CXXXI. Catalog Description:

It is a core course aimed at Third Year UG students. The course introduces the concepts of Steel making – thermo-kinetic aspects, Reaction and Processes, Design, Construction and Operations of various processes. The modern operating principles and practices are reviewed.

CXXXII. Course Coordinator: Prof. D. V. Moghe,

CXXXIII. Pre-requisites: Ferrous Extraction Metallurgy

CXXXIV. Textbook and /or Other Required Material

I) Introduction to Modern Steel Making by R. H. Tupkary
J) Fundamentals of Steel Making by E T Turkdogan
K) Iron Making and Steel Making by A Ghosh and A Chatterjee.

CXXXV. Course outcomes:

Upon successful completion of this course, each student should be able to:

zzz. Understand physic-chemical aspects, thermodynamics and kinetics of reactions and processes.

aaaa. Appreciate techno-economic indices, productivity and consumption norms.

bbbb. Appreciate and evaluate Mass balance, thermodynamic parameters, kinetics etc of reactions and processes.

cccc. Appreciate the design and operations of various processes

dddd. Gather critical knowledge of alternative Iron making technologies

CXXXVI. Expanded Course Description

Routes to steel Making- primary processes, Fe inputs – relative merits. Thermo – kinetics of C, Si, Mn, P reactions. Acid & basic slags, deoxidation & desulphurization, alloying. Bessemer, open hearth & twin hearth processes.

( 14 Lectures)

Oxygen Steel Making – top blown L D – reactor design, lance design, soft & hard blowing, slag control, slopping & productivity, Emulsions & refining mechanisms. Hybrid process & Q BOP, refractory for oxygen steel making.

( 12 Lectures)

Electric arc furnace steel making – conventional practice & modern trends, basic concepts of ladle refining & secondary steel making, ingot & strand casting.

( 14 Lectures)

CXXXVII. Class Schedule:

Lecture: Three 60 minute sessions per week

CXXXVIII. Contribution of Course to Professional Component

Appreciate and then improve upon techno-economic indices, operating practices and provide analysis and solutions of operating deficiencies.

CXXXIX. Evaluation of Students:

g. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two quizzes, and end semester exam.
h. Grades: Relative grading

CXL. Relationship of Course Objective to Program Outcomes

| Course Objective | Engineering knowledge | Problem analysis | Design/Development of solution | Conduct investigation of complex problems | Modern tool usage | Engineer and society | Environmental and sustainability | Ethics | Individual and team work | Communication | Project management and finance | Life long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | X | | | | | | | X | |
| | | | | X | | | | | | | X | |

**MML382 SOLIDIFICATION PROCESSING AND ADVANCED FOUNDRY TECHNOLOGY (3-0-0) 6 credits**

Solidification of metals and alloys, segregation and shrinkage phenomena in castings, solidification values for steels, calculation of solidification time for casting, heat transfer calculations in metal casting.

Principles of gating, fluid flow equations and application in gating design, aspiration in down sprue and at sharp corners, step gates stack molding, gating design for cast irons, spheriodal graphite iron and steel castings.

Risering techniques, riser design, calculation of feeding distance of riser for bars and plates.

Directional solidification in steel castings, principles of chill design, insulating and exothermic sleeves, hot tears.

Ferrous foundry practice, general principles underlying molding, core making, riser and gating design in grey cast iron, malleable cast iron, S.G. iron and steel, plant layout considerations.

Nonferrous foundry practice, recent trends in casting practice, analysis of casting defects, case studies.

**Text / Reference Books :**


1. Flinn R.A.; Fundamentals of Metal Casting; Addison Wesley Pub. Co., 1963.
2. Mukherjee P.C.; Principles of Metal Casting
3. Bray J.L.; Nonferrous Foundry Metallurgy; John Wiley & Sons, 1959.
4. Wladaver; Directional Solidification in steel castings.
5. Briggs R.W.; Metallurgy of Steel Casting; McGraw Hill, 1946.


**MMP382 SOLIDIFICATION PROCESSING AND ADVANCED FOUNDRY TECHNOLOGY LAB. (0-0-2)**

**2 credits**

Set of experiments based on the above syllabus.

**MML475 JOINING OF MATERIALS (3-0-0) 6 credits**

Course MML 475

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | - |

| | | | |
|---|---|---|---|
| Course No.: | MML-475 | Basic Science: | 1 |
| Course Title: | Joining of Materials | Engineering Topics: | 5 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. M.M.Thawre | Compliant: | Course Book 2012-2013 |

Survey of the welding processes, present status, classification, joint design, importance of backing and welding symbols.

Study of welding processes such as Gas, Electrodes, Resistance, Spot, Seam, Electron beam , laser beam etc. Scope, instruments, limitations, applications and standards , welding specifications, study of VA characteristics and different parameters affecting quality and electrode classifications.

Study of special welding processes such as TIG, MIG submerged arc, themit welding underwater ultrasonic welding and friction welding etc. scope, instruments, limitations applications, standards,welding specifications.

Welding problems and remedies in steels, cast iron and non-ferrous metals and alloys, requirements of quality control, inspection and testing in welding.

Importance of welding metallurgy, weldability, tests assessment techniques, heat flow in welding HAZ and distortion, numericals based on heat transfer and welding metallurgy.

Analysis of welding defects , dissimilar metal welding problems and remedies, welder accessibility test.

**Books:**

Welding & Welding Technology Littile R McGraw Hill, 2002. ASM Handbook No. 6 on Welding

Brazing & Soldering.

G.E.; Welding Metallurgy Vol. 1, Linnert AWS 1965.

Welding Technology Khanna O.P. Dhanpat Rai Publications, 1999.

Principles of Welding Technology Gourd.

**MMP475 JOINING OF MATERIALS LAB (0-0-2) 2 credits**

Set of practical based on the above syllabus.

**MML383 LIGHT METAL ALLOYS (3-0-0) 6 credits**

Classification of light metal alloys, their properties, importance of strength / wt ratio in engineering applications. Detailed engineering applications , Indian / International specifications.

Melting methodology of light metal alloys used of melting / refining flows.

Casting characteristics of light metal alloys (Ag, Mg, Te alloys).

Light metal alloys foundry practices, master alloy used in melting.

Physical metallurgy of light metals alloys, rolling, sheet metal working, extrusion etc.

Special Alloys: Duralumin, Al-Li, Mg-Li alloys - production and processing techniques & applications.

Titanium alloys: Alloying elements and their effects, types of alloys, their processing, heat treatment, properties and selection.

Strategic applications of light metal alloys., air craft industries. Functional considerations

Defects analysis in cast and rolled products

Failure analysis of light metal alloys components.

**Text / Reference Books :**


1. Raudebaugh R.J.; Non-ferrous Physical Metallurgy; Pitmavi Publishing Corpn., 1952.
2. Polmear I.J.; Light Alloys (3rd Edition); Arnold, 1995.
3. Bickert C.M.; Light Metals; Minerals Metals & Materials Society, 1990.
4. Brooks C.R.; Heat Treatment Processing & Structure Properties of Non Ferrous Alloys; ASM, 1984.


**MMP383 LIGHT METAL ALLOYS LAB (0-0-2) 2 credits**

| | |
|---|---|
| Information | unit |
| Department: Metallurgical and Material engg. | Math: - Science:- |
| Course no:MML 383/MMP 383 | Engg.: 6 |
| Title- Light metal alloys | |
| Contact hrs:3-0-0/0-0-2 | design: - |
| Credit-6 | other: - |
| Revision date: march 2012 | designation- DE |
| Revised by: Dr.S.N.Paul | compliant:course book/2012-13 |

I.Catalogue description- Light metal alloys/ DE/ MML/MMP 383

II.Course coordinator- Dr.S.N.Paul

III.pre/co- requisities-ug

IV.Text books

1.Light alloys-I.J.Polmear

2.heat treatment of non ferrous alloys-C.R.Brooks\

3.physical metallurgy of Ti alloys]—E.W.Collings

V.course objective –student able to understand structure,processing,properties,application of light alloys

VI.course description-processing,structure,properties application of Al,Ti,Mg alloys

Lab- based ón above

VII.Evaluation- continuos

Grading-relative

IX prog outcome

| | Obj | tools | sc,eng | expt | problem | comm. | Learning | response improvement |
|---|---|---|---|---|---|---|---|---|
| A | x | x | x | x | x | x | x | x |
| B | | | | x | x | | | |
| C | | | | | x | | | x |
| D | | | | | | | | x |
| | | | | x | | | | |
| E | | | | x | | | | |

F x

**MML376 INDUSTRIAL METALLURGY (3-0-0) 6 credits**

Course Outline

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1 |
| Course No.: | MML-376 | Basic Science: | 2 |
| Course Title: | **INDUSTRIAL METALLURGY** | Engineering Topics: | 3 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. Y.Y. Mahajan | Compliant: | Course Book 2012-2013 |

**Unit – I:**

Introduction to various terms used in foundry, Study of various unit operations required in foundry, Principles of sand molding, molding materials & processes, Sand Testing Methods, Reclamation of Sand. Introduction to various terms used in gating & risering systems and their functions. Casting defects & their remedies, melting units in foundries, recent trends in molding and casting processes.

**Unit II:**

Survey of the welding processes, present status, classification, joint design, importance of backing and welding symbols. Introduction to Welding Processes. Inspection & testing in welding, Introduction to welding metallurgy, weldability, study of special welding processes.

**Unit III:**

Introduction to Powder Metallurgy Techniques, advantages / disadvantages of PM techniques. Powder production methods. Sintering furnaces and their types; Sintering atmospheres, Testing & evaluation of powder.

**Text / Reference Books :**


1. Principles of metal casting, McGraw-Hill, Hiene and Rosenthal.
2. Welding and welding technology, McGraw-Hill, Littile
3. A textbook of powder metallurgy, Sands and Shakespears.
4. ASM Handbook on welding.


**MML384 ALLOY STEELS & HIGH TEMPERATURE ALLOYS (3-0-0) 6 credits**

Classification of Alloy Steels depending on alloying content, effect of alloying elements on the constitution, structure and properties of steels, ferrite former and carbide former, alloy cast irons.

Studies of low alloy structural steels, High strength low alloy steels, Dual phase steels, General Engineering Steels, Medium alloy and high alloy tool steels such as HCHC, HSS etc. Corrosion resistant stainless steels, processing and heat treatment of Hadfield's Mn Steel, spring steel, electrical sheet steels, steels for magnetic application, Maraging steel , Ausformed steel and TRIP Steels.

Heat treatment equipments, techniques employed for low, medium and high alloy steels with special emphasis on high speed tool steel, stainless steel, spring steels, alloy cast iron, ,

Various specification viz. AISI, BSS, DIN & IS for alloy steels and alloy cast iron. Heat resistant alloys - general properties, metallurgical structure, processing, applications and limitations, Super base alloys- Ni-base alloys, Co-base alloys, Fe-base alloys, Ni-Fe base alloys.

Titanium alloys for high temperature aeronautical applications, their processing, properties, selection.

**Text / Reference Books :**


1. Roberts G.A.; Tools Steels; American Society of Metals, 1980.
2. Clark, Varney W.R.; Metallurgy for Engineers; East West Press, 1962.
3. Peter Payson; The Metallurgy of Tools Steels; John Wiley & Sons, 1962.
4. ASM Handbook –Vol.1 ($10^{th}$ Edition); ASM International, 1995.


**MML386 SEMICONDUCTOR TECHNOLOGY (3-0-0) 6 credits**

Physics and Properties of Semiconductors materials: crystal structure, energy bands, Fermi level, carrier concentration at thermal equilibrium, carrier transport phenomena, Hall Effect, recombination mechanism, optical and thermal phenomenon.

Device Processing Technology: oxidation, diffusion, ion-implantation, deposition, lithography, etching and interconnect. p-n Junction: depletion region, diffusion, generation-recombination, current-voltage characteristics, junction breakdown, charge storage and transient behavior.

Metal-Semiconductor Contacts: equilibrium, idealized metal semiconductor junctions, ohmic contacts, Solar energy-definitions, its intensity distribution, variation and spectrum, thermodynamics of solar energy spectrum, mechanism of heat losses, efficiency, photo thermal conversion materials and their preparation and characterization.

Design of material for solar applications: collectors, selective surface, composite semiconductors, solar reflectors and concentrators, thermo-electric conversion, chalcogenide and alloy semiconductors, criteria for material selection, spectral response, efficiency. .

Types of Photovoltaic (PV) cells; p-n homo and hetero junction, First, Second and Third Generation PV devices.

PV materials: silicon - single crystalline, polycrystalline, ribbon, amorphous,nanocrystalline; CdS, Cu(In,Ga)Se2, Cd-Te/Se, GaAs, In-P/As, ZnMgO, PbS.

PV Material qualification for terrestrial and space application, radiation damage, arrays and solar cell systems, energy storage-thermal, chemical, electrochemical storage and hydrogen generation. Challenges and Solutions for Manufacturing of PV solar cell, Understanding the defect related issues

**BOOKS**


S.M. Sze, Physics of Semiconductor Devices, John Wiley & Sons, 2nd Edition (2001)

Antonio Luque and Steven Hegedus, Handbook of Photovoltaic Science and Engineering, John Wiley & Sons, 1 st Edition (2008)

S.S. Islam, Semiconductor Physics and Devices, Oxford University Press, 2nd Edition (2006)

**MML385 HYDRO AND ELECTRO METALLURGY (3-0-0) 6 credits**

**Introduction:** Justification of Hydrometallurgical selection of solvent processing, Eh-Ptt diagrams Principles underlying hydrometallurgical processes, various commercial hydrometallurgical processes. Criteria for selection of solvents, Types of Solvents.

- Thermodynamics & kinetics of hydrometallurgical processes.
- Unit operations in hydrometallurgical processing, Thickness & filters, counter current decantation.
- Applications of hydrometallurgy to Copper, Zinc, Precious metals etc.
- Solvent Extraction & Ion Exchange.
- Purification methods of leach solutions.
- Recovery of metal values from solution.
- Precipitation methods Thermodynamics & Kinetics of concentration.
- Electrolytic Recovery-

  Electrowining of methods from Aq. Solutions Electro Refining.
- Fured Salt Electrolysuis – Extraction of Aluminium & Magnesium from their ores.

  Mass balance calculations.

**BOOKS**

H. S. Ray, K. P. Abraham and R. Sridhar, Extraction of Non-Ferrous Metals , Affliated East- West Press.

T. Rosenquist , Principles of Extractive Metallurgy

S. Venkatachalam, Hydrometallurgy Narosa Publication Co

E. Jackson, Hydrometallurgical Processing & Reclaimation, John Wicky & Sons.

**MML471 STRUCTURAL METALLURGY (3-0-0) 6 credits**

| | |
|---|---|
| Dept—MME | Math- yes |
| Course no- MML 471 | Basic Sc.---1 |
| Title- Structural Metallurgy | Engg-----5 |
| Theory & Practical | |
| Contact hrs-3-0-0 | Design--- 0 |
| Credit-6 | other- 0 |
| Revision date-March 2012 | curriculum designation--DC |
| Revised by- Dr.S.N.Paul | Compliant---- course book2012-13 |

I. Catalogue description—MML471/ MMP471/ DC

II. Course coordinator- Dr.S.N.Paul

III. Pre requisities and co-requisities-

IV. Text books-

1. Physical Metallurgy principles-R.Reed-Hill
2. Elements of X-ray Diffraction-B.D.Cullity
3. Mechanical metallurgy- G.Dieter
4. Structure and properties of materials- John Wulff

V.Course objective- to understand phenomenon/ mechanism/ behaviour/application on
.crystallography,X-ray diffraction, diffusion,plastic deformation,phase transformation etc.

VI Course description-

1. crystallography- stereographic projection
2. X-ray diffraction-Bragg law, indexing,solvus line,residual stress
3. Diffusion- Fick laws,mechanism,solution , Kirkendall effect,Darken analysis etc.
4. Plastic deformation—CRSS,dislocation,work hardening,etc.
5. Phase transformation- nucleation, transformation in steels etc.

b. Problem based on;
Crystallography,stereographic projection,X-ray diffraction, diffusion, plastic deformation, phase transformation,rate of reaction

VII. class/ lab schedule-

a. Lecture- three 60 min/week
b. Lab--- one 110 min/week/batch of 20 students

VIII. evaluation –

a. Continuous evaluation- 2 sessional,1 end sem, int.assesment( quiz, seminar etc.)
b. Grades- relative

IX. program outcome

| Obj | modern tools | math/ engg./sc | expt | team | problems | comm.. | learning | respns. | Quality |
|---|---|---|---|---|---|---|---|---|---|
| Ax | x | | x | x | | | x | x | x |
| B | x | x | | | | | x | | |
| C | x | x | x | | | | x | | |
| D | x | | x | x | x | | x | | |
| E | x | x | x | | x | | x | | |
| F | | | x | | | | x | | |

**MMP471 STRUCTURAL METALLURGY LAB (0-0-2) 2 credits**

1. Problems on Crystallography – Stereographic projection – Determination of standard projection.
2. Problems on X-ray diffractions – Filters, Indexing, Stress analysis, Solvus line etc.Indexing – Determination of Bravais lattice, Lattice parameter from Debye-scherrer pattern.
3. problems on Diffusion – Ficks 1st and 2nd law, Analysis of Matano and Grube Jedal method, Kirkendall effect – Diffusion in Semi-infinite medium i.e. Carburizing, Nitriding etc.
4. Problems on Plastic deformation – Determination of CRSS, Energy of dislocation, Thomson's Tetrahedra etc.
5. Problems on Phase transformation and Rate of reaction.

## MML 472: ENVIRONMENTAL DEGRADATION OF METALLIC MATERIALS

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/ Numericals: | 1 |
| Course No.: | MML-472 | Basic Science: | 2 |
| Course Title: | Environmental Degradation of Metallic Materials | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. A.P. Patil | Compliant: | Course Book 2012-2013 |

XI. **Catalog Description**:

It is a Departmental Core (DC) course. It is designed to give students knowledge about economic and technical significance of environmental degradation of metallic materials, chemical and electrochemical nature of degradation, theoretical basis, various manifestations of degradation at room temperature and high temperature (forms of corrosion and their mechanisms), methods of corrosion testing, corrosion behaviour of industrially important metallic materials and methods of corrosion control.

XII. **Course Coordinator**: Prof. A. P. Patil, Room No. F7, First Floor, Old Building of Department

XIII. **Pre-requisites and Co-requisites**: None

**XIV. Textbook and /or Other Required Material**

a. Mars G. Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw-Hill, 2005
b. LL Shrier, RA Jarman and GT Burstien, Corrosion Volume-I: Metal/Environment Reactions, 3rd Edition, Butterworth Heinemann, 2005
c. LL Shrier, RA Jarman and GT Burstien, Corrosion Volume-II: Corrosion Control, 3rd Edition, Butterworth Heinemann, 2005
d. ASM International, ASM Handbook, Vol. 13A: Corrosion: Fundamentals, Testing and Protection, 2003.

XV. **Course Objectives**:

Upon successful completion of this course, each student should be able to understand:

a. Theoretical basis of environmental degradation of metallic materials.
b. Various anodic and cathodic reactions and their thermodynamic feasibility.
c. Forms of corrosion and their mechanisms.
d. Measures of corrosion prevention and control.
e. Methods used for corrosion testing
f. Corrosion behaviour of various industrial metals and alloys.

**XVI. Expanded Course Description**

**e. Expanded description of the course**

xvii. Introduction to corrosion, Examples of corrosion, Economic and Technical significance of Corrosion. Chemical and Electrochemical reactions.

Electro motive force, Electrode potential, Galvanic Series, Electrochemical Equilibrium, Potential - pH diagram (Examples $H_2O$, Zn-$H_2O$ and Fe - $H_2O$ system)

xviii. Electrode kinetics, Evans diagram, Polarization and types of polarization. Mixed potential theory. Passivity. Effect of oxidizer, solution velocity and galvanic coupling.

xix. Classification of various forms of corrosion and their mechanisms. Details of General pitting, crevice, intergranular, selective leaching, stress corrosion cracking, Hydrogen embrittlement, high temperature oxidation, Hot corrosion, etc. Wagner Electrochemical oxidation theory, Hauffe's valency affects.

xx. Methods of testing in corrosion, high temperature oxidation and hot corrosion. Methods like Gravimetric, Potential-time, Potentiodynamic polarization, Linear polarization, Electrochemical Impedance Spectroscopy, Electrochemical noise, etc. with case studies.

xxi. Corrosion behaviour of industrial metals and alloys like steels, stainless steels, copper and copper alloys, nickel and nickel alloy, aluminium and aluminium alloys, titanium and titanium alloys etc. Application of these metals and alloys. Effect of environment on their corrosion behaviour.

xxii. Methods of corrosion control (practical and fundamental approach) like selection of material, inhibition, coatings, alloying, heat treatment, change in design, change in corrosive environment, etc. Types of inhibitors, types of coatings. Cathodic and anodic protection. Instruments and accessories for cathodic and anodic protection.

**XVII. Class Schedule**

Lecture: Three 60 minutes sessions per week

**XVIII. Contribution of Course to Professional Component**

Lecture: Students learn to analyze corrosion situation and ways to prevent it.

XIX. **Evaluation of Students**:

f. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.

g. Grades: Relative grading

**XX. Relationship of Course Objective to Program Outcomes**

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | X | | X | | X | | |
| b | X | X | | | | | X | | |
| c | X | X | X | | | | X | | |
| d | X | X | X | X | X | | X | | X |
| e | X | X | X | X | | | | | |
| f | X | X | X | | | | X | | X |

**MMP472 ENVIRONMENTAL DEGRADATION OF METALLIC MATERIALS LAB. (0-0-2) 2 credits**

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/ Numericals: | 1 |
| Course No.: | MMP-472 | Basic Science: | - |
| Course Title: | Environmental Degradation of Metallic Materials Lab | Engineering Topics: | 4 |
| Contact Hours | 0-0-2 | Design Content: | - |
| Credit | 2 | Other: | 1 |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. A.P. Patil | Compliant: | Course Book 2012-2013 |

**XXI. Catalog Description:**

The laboratory module is based on course content of MML472: Environmental Degradation of Metallic Materials. It is designed to provide firsthand experience on laboratory practices, various forms of corrosion, effect of various environmental factors, relative corrosion behaviour of various industrial metals and alloys, and methods of carrion control.

XXII. **Course Coordinator**: Prof. A. P. Patil, Room No. F7, First Floor, Old Building of Department

XXIII. **Pre-requisites and Co-requisites**: None

**XXIV. Textbook and /or Other Required Material:**

h. Mars G. Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw-Hill, 2005

i. Year Book of ASTM Standards, Volume 3.02, ASTM, 2003

XXV. **Course Objectives**:

Upon successful completion of this course, each student should be able to know:

a. Conduction of various tests for corrosion rate determination.
b. Preparation of samples for various tests.
c. Methods used for corrosion testing.
d. Measures for corrosion control.
e. Identify forms of corrosion.
f. Corrosion behaviour of industrial metals and alloys.

**XXVI. Expanded Course Description**

j. Expanded description of the course

A set of practicals based on course module MML472: Environmental Degradation of Metallic Materials.

k. Typical laboratory experiments

i. Corrosion rate determination by weight loss method

(i) Effect of pH

(ii) Effect of oxidizer addition

(iii) Effect of inhibitor
(iv) Effect of galvanic coupling

ii. Study of reference electrode and potential measurement.
iii. Potentiodynamic polarization for determination of corrosion rate and passivity
iv. DLEPR test for determination of degree of sensitization
v. Demonstration of pitting corrosion
vi. Demonstration of crevice corrosion
vii. Demonstration of weld corrosion
viii. Demonstration of protection by sacrificial anode.

**XXVII. Class /Laboratory Schedule:**

Laboratory: One 100 minutes session per week for a batch of 20 students

**XXVIII. Contribution of Course to Professional Component:**

Laboratory: Students learn about methods of corrosion testing, precautions, sample preparation, test setup and instruments, effect of environmental factors, observe various forms of corrosion, corrosion rate calculations and interpretation of results.

**XXIX. Evaluation of Students:**

l. Evaluation: A process of continuous evaluation is followed. It comprises of regular journal submission, a quiz and home assignments. Precise distribution is announced in 1st lab.
m. Grades: Relative grading

**XXX. Relationship of Course Objective to Program Outcomes**

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| A | X | X | X | X | X | | X | | |
| B | | | X | X | | | X | | X |
| C | X | X | X | X | | | X | | |
| D | X | | X | X | X | | X | | |
| E | | X | X | X | | | X | | |
| F | | | X | X | | | X | | |

**MML474 X-ray diffraction and electron microscopy. (3-1-0) 8 credits**

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1 |
| Course No.: | MML-474 | Basic Science: | 3 |
| Course Title: | X-ray diffraction and electron microscopy | Engineering Topics: | 4 |
| Contact Hours | 3-1-0 | Design Content: | Yes |

| | | | |
|---|---|---|---|
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Dr. Rajesh K. Khatirkar | Compliant: | Course Book 2012-2013 |

CXLI. Catalog Description:

Crystallography, point groups, introduction to space group, physics of X-rays, reciprocal space, diffraction by crystalline materials, detailed applications of X-ray diffraction, electron diffraction, imaging using transmission electron microscope, principles and instrumentation involed.

CXLII. Course Coordinator: Dr. Rajesh K. Khatirkar, Department of Metallurgical and Materials Engineering, Materials Engineering Centre Building, Room No. MEC-F6, First Floor.

CXLIII. Pre-requisites and Co-requisites: None

CXLIV. Textbook and /or Other Required Material

a. D. Brandon and W.D. Kaplan, Microstructural Characterization of Materials, 2nd Edition, John Wiley & Sons, Hoboken, NJ, 2008.

c. D.B. Cullity and S.R. Stock, Elements of X-ray Diffraction, 3rd Edition, Prentice Hall, Upper Saddle River, NJ, 2001.

d. P.J. Goodhew, J. Humphreys, and R. Beanland, Electron Microscopy and Analysis, 3rd Edition, Taylor and Francis, London, UK, 2001.

e. C. Hammonds: Basics of crystallography and diffraction, Cambridge University Press, UK.

CXLV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

g. Basics of crystallography.
h. Point groups, space groups.
i. Reciprocal space.
j. Diffraction from materials.
k. Transmission electron microscopy (imaging and diffraction).
l. Detailed applications of XRD and TEM.

CXLVI. Expanded Course Description

a. Expanded description of the course

Introduction to crystallography, Symmetry – point group and space group, reading of the space group tables, X-ray diffraction – Generation of X-rays, characteristic X-ray spectrum, Bragg's Law, Diffraction methods – Laue method, rotating crystal method, powder method, Principle, equipment and applications, structure factor, derivation of diffraction conditions for SC, BCC and FCC Bravais lattice, X-ray diffractometer, filters and counters/detectors, texture, importance of texture, measurement of texture, pole figures (stereographic projections), orientation distribution function, sample symmetry, and its importance, applications of X-ray diffraction in materials characterization – determination of crystal structure, lattice parameter, examples of textures in cubic materials, Introduction of GIXRD, instrumental configuration for texture measurement and GIXRD.

Electrons as source, properties of electron beam, elastic and inelastic scattering of electrons, importance in electron microscopy, resolution, principles of transmission electron microscopy, construction, ray-diagram, working, sample preparation, contrast mechanisms, ring and spot diffraction patterns, detectors and imaging modes, kikuchi lines, measurement of lattice parameter, orientation relationship determination, Introduction to HRTEM.

b. Tutorials

Problems on the above.

CXLVII. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week
b. Tutorial: One 100 minutes session for a batch of 25 students.

CXLVIII. Contribution of Course to Professional Component

a. Lecture: Students learn theory and application of diffraction and TEM
b. Tutorial: Mathematical crystallography/diffraction.

CXLIX. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

CL. Relationship of Course Objective to Program Outcomes

| Course Objective | Engineering knowledge | Problem analysis | Design / development of | Conduct investigation of | Modern tool | The engineer and society | Environment and | Ethics | Individual and team work | Communication | Project | Life-long learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | X | X | | | | X | X | | | X | | |
| b | X | X | | | | X | X | | | X | | X |
| c | X | X | | | | X | X | X | | X | | X |
| d | X | X | X | | | X | X | X | X | X | | X |
| e | X | X | X | X | | X | | X | X | X | | X |
| f | X | X | X | X | | X | X | X | X | X | | X |

**MML366/MML476 PROCESS OPTIMIZATION (3-1-0) 8 credits**

1. Principles of Quality Engineering
    - Traditional concept of quality
    - Quadratic Loss Function
        - Variations of Quadratic Loss Function
    - Noise Factors – Causes of Variation
    - Average Quality Loss
    - Classification of Parameters: P Diagram
    - Optimization of Product or Process Design
    - Role of various quality control activities
2. Orthogonal Arrays
    - Different test strategies
    - Degrees of freedom, selection of a standard orthogonal array
    - ANNOVA
    - Case study 1 - matrix experiment using orthogonal arrays
3. Designing a optimized product / process
    - Case study 2 –
        - Selection of noise factors and testing conditions
        - Quality characteristics and objective function
        - Control factors and their levels
        - Matrix experiment and Data Analysis

4. Signal to Noise Ratios
    - S/N ratios for static problems
    - S/N ratios for dynamic problems

Statistical Process Control, Control Charts

**BOOKS.**

Quality engineering using robust design, Madhav S. Phadke
Taguchi techniques for quality engineering, Philip J. Ross

## MML479 SELECTION OF MATERIALS (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1.5 |
| Course No.: | MML479 | Basic Science: | 1 |
| Course Title: | Selection of Materials | Engineering Topics: | 3.5 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. S. G Sapate | Compliant: | Course Book 2012-2013 |

I. Catalogue Description:

Introduction to selection of materials, Properties of engineering materials, Properties trade off, Factors influencing materials election, material selection vs. materials processing, techno-economic aspects of materials selection, Selection of materials for static strength, stiffness, fracture toughness, Design for yielding and fracture toughness fatigue , creep and wear resistance.

Course Coordinator: Prof. S. G Sapate, Staff room, Old Building of Department

II. Pre-requisites and Co-requisites: Testing of materials

III. Textbook and /or Other Required Material

a. Charles J.A.; Crane FAA, Furness JAG; Selection & Use of Engineering Materials; Butterworth & Heinemann,
b. Dieter G.E.; Mechanical Metallurgy; McGraw Hill, 1988.
c. Ashby M.F., Jones D.R.; Engineering Materials; Pergamon Press, 1992.
d. Askeland DR : Engineering Materials
e. ASM Handbook : Vol.20: Material Selection : ASM

IV. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

a. Fundamental concepts of material selection, analysis of service conditions, property trade off, factors influencing material selection. Techno economic aspects of material selection.

b. Apply the fundamental concepts and factors involved in development of static strength and stiffness to material selection.
c. Apply the fundamental understanding of fracture toughness and fatigue to relevant material selection situations.
d. Apply the fundamental understanding of creep to relevant material selection situations
e. Analyze and solve numerical related to design for fracture toughness, fatigue and creep life estimation.
f. Understand different modes of wear, variables affecting wear modes and apply the concepts to material selection for different wear situations.

V. Expanded Course Description

a. Expanded description of the course

Introduction, engineering properties of materials and applications, property parameters for selection, materials selection and processing, factors affecting material selection, material selection vis-a-vis design.

Selection of material for static strength, assessment of strength levels of engineering materials, selection criterion for static strength. Materials selection for stiffness, importance of stiffness, stiffness of engineering materials, geometric stiffness, stiffness of sections, panel structure, material selection criterion for stiffness.

Selection of materials for toughness, assessment of toughness, transition temperature approach,

fracture mechanics, linear elastic fracture mechanics, EPFM assessment of fracture toughness

design and material selection for fracture toughness. case studies

Material selection for fatigue strength, mechanisms, evaluation of fatigue life, effect of mean stress fracture mechanics and fatigues factors, factor affecting fatigue of metallic materials, fatigue of polymeric materials, fatigue design philosophies.

Material selection for creep, evaluation of creep resistance, Creep curve. Effect of stress and temperature, development of creep resistant alloys, materials vis-a-vis service temperature, selection criterion.

Selection of materials for wear resistance, mode and mechanism of wear, material for resistance to

adhesion, abrasion and erosion, guidelines for selection. Case studies

b. Typical laboratory experiments

NA

VI. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week
b. Laboratory : NA

VII. Contribution of Course to Professional Component

a. Lecture: Students learn to analyze service conditions and property requirements for a particular engineering application and suggest suitable material/s depending on different service conditions. Students should be able to solve numericals based on deign aspects of fracture toughness and fatigue and creep life estimation
b. Laboratory: NA

VIII. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.
b. Grades: Relative grading

IX. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | X | X | | | | X | X | | |
| b | X | X | | | X | X | X | | X |
| c | X | X | | | | X | X | | |
| d | X | X | | X | X | X | X | X | X |
| e | X | X | | X | X | X | | X | X |
| f | X | X | | | | X | X | X | X |

**MML379 NON-DESTRUCTIVE TESTING (3-0-0) 6 credits**

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 2 |
| Course No.: | MML-379 | Basic Science: | 2 |
| Course Title: | **NON DESTRUCTIVE TESTING** | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. Y.Y. Mahajan | Compliant: | Course Book 2012-2013 |

Introduction and scope of non-destructive testing and evaluation (NDT/NDE) methods.
Visual examination , principles and equipments ,optical aids.
Liquid penetrant testing:, principle, procedure, penetrate materials and methods, applications.
Principles of magnetic particle testing, procedures and equipment's for MPT ,magnetic field testing; limitations of MP methods ,electromagnetic testing for residual stress measurement. Eddy current testing, principle and instrumentation, techniques like high sensitivity, multi frequency, high area, pulsed ECT, inspection of ferro-magnetic material, application and limitation ECT.
Radiographic inspection, principle, radiation sources, radiation attenuation's; film effect.
Radiographic imaging : geometric factors film, screens, sensitivity parameters ,exposure etc.
Imaging techniques: single wall, double wall, penetration ,single image etc., applications and case studies; limitations.
Ultrasonic Testing :

Basic principles, type of sound waves and their characteristics, ultra transducers characteristics, inspection methods, normal incident pulse echo through transmission. Angle beam, probe selection criterion ,sensitivity, penetration and resolution. Modes of display, A,B,C types of scan, immersion testing applications, case studies, limitations. Special / advanced techniques of NDE /AET, thermography, replica microscopy (in situ). Leak testing, remote field ECT, microwave inspection, topography, holography (only principle and applications).

Criteria for selection of NDT methods and instruments related to metallurgical processes / defect in cast ,forged and rolled, heat treated and fabricated items (one case study for each category), reliability in NDT. Statistical method & quality control in NDT codes and standard specifications.

**Text / Reference Books :**


1. Baldev Raj & T. Jayakumar ; Practicals Non-destructive Testing; Nanda Publishers, 1997.
2. Gordon& Breach ; Non-Destructive Testing; 1971
3. Ultrasonic Testing,; Krautkrammer Norsa Publ., 1993
4. Feigenbanm A.V.; Total Quality Control
5. Metal Handbook ASM 8th Edition, Vol. II
6. Non-destructive testing and quality control.
7. Davis Toxell; Non destructive evaluation of properties of materials.


**MML477 SECONDARY & SPECIAL STEEL MAKING (3-0-0) 6 credits**

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 2 |
| Course No.: | MML-477 | Basic Science: | 1 |
| Course Title: | Secondary and Special Steel Making | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. D. V. Moghe | Compliant: | Course Book 2012-2013 |

CLI. Catalog Description:
It is a elective course aimed at Final Year UG students. The course introduces the concepts of Clean Steels. The various unit operations and unit processes involved in clean steel making are discussed and evaluated in critical details.

CLII. Course Coordinator: Prof. D. V. Moghe,

CLIII. Pre-requisites: Steel Making Technology

CLIV. Textbook and /or Other Required Material

L) Secondary Steel Making by A Ghosh
M) Fundamentals of Steel Making by E T Turkdogan
N) Iron Making and Steel Making by A Ghosh and A Chatterjee.

CLV. Course outcomes:
Upon successful completion of this course, each student should be able to:

m. To develop clear understanding of the concept of clean steels – their characteristics and importance.
n. Understand the fundamentals and practices of secondary steel making processes
o. To perform thermodynamic and kinetic calculations
p. To appreciate the science and technology of stainless steel making

CLVI. Expanded Course Description

The concept of clean steels, non metallic inclusions – charecteristics, effect on properties & performance of steels, inclusion modification. Dissolved gases, tramps, segregation & grain size control. (7 Lectures)

Deoxidation & desulphurization of steel melts – clean steels – theoretical & practical aspects.(5 Lectures )

Role / control of stirring, slag composition, refractory, atmosphere & temperature in secondary Steel making ( 7 Lectures )

Vacuum degassing of melts – H,N,O.C control, stream, tank, DH,RH,VAD processes ( 4 Lectures )

Remelting – refining ESR & VAR processes. ( 3 lectures )

Stainless steel making ( 4 Lectures)

CLVII. Class Schedule:

Lecture: Three 60 minute sessions per week

CLVIII. Contribution of Course to Professional Component

To be able to work in and develop the field of clean steel making and usage.

CLIX. Evaluation of Students:

i. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two quizzes, and end semester exam.
j. Grades: Relative grading

CLX. Relationship of Course Objective to Program Outcomes

| Course Objective | **Engineering knowledge** | **Problem analysis** | **Design/Development of solution** | **Conduct investigation of complex problems** | **Modern tool usage** | **Engineer and society** | **Environmental and sustainability** | **Ethics** | **Individual and team work** | **Communication** | **Project management and finance** | **Life long learning** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | | | X | | | | | | | X | |

**MML480 FRACTURE MECHANICS (3-0-0) 6 credits**

Course MML 480

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1 |

| | | | |
|---|---|---|---|
| Course No.: | MML-480 | Basic Science: | 1 |
| Course Title: | Fracture Mechanics | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. R.K.Paretkar | Compliant: | Course Book 2012-2013 |

Concept and scope of fracture mechanics, Fracture Mechanics approach as evolved from the classical theory of fracture approach. Irwin's contribution to establish the fracture toughness as a fundamental property in LEFM and PYFM, Concept of fast fracture and toughness GC based on energy criterion. Gc related to Ke for different materials. Distribution of stress and strain at the notch tip. Stress singularity at notch tip stress intensity factor. Plane strain fracture Toughness, conditions for a valid KIC value. Plane strain fracture Toughness Testing. Elements of ASTM E-399 for fracture toughness tests.

Plasticity corrections for ductile materials Post Yield Fracture Mechanics. COD and CTOD concept and measurements. J-Integral approach and its application. R-Curve and its utility for materials selection on the basis of fracture toughness.

Metallurgical structure and fracture toughness, Micromechanism of fracture.

Use of fracture toughness for other application like fatigue crack growth da/dN studies, stress corrosion cracking (KICC), impact tests and empirical relations. Fracture toughness as a tool for design against fracture in structures.

**Books:**

Mechanical Metallurgy by GE Dieter

Engg. Materials by MF Ashby

**MMD401 PROJECT PHASE – I (4 credits)**

**MML473 COMPOSITE MATERIALS (3-1-0) 8 credits**

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 2 |
| Course No.: | MML-473 | Basic Science: | 1 |
| Course Title: | **Composite Materials** | Engineering Topics: | 5 |
| Contact Hours | 3-1-0 | Design Content: | Yes |
| Credit | 8 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |

| | | | |
|---|---|---|---|
| Revised By: | Prof. Y.Y. Mahajan | Compliant: | Course Book 2012-2013 |

Introduction -.concept and definition of composite materials limitations of conventional materials, classifications of composite materials, scope and applications of composite materials.

Composite matrix and reinforcement, matrix materials like metallic, polymer ,ceramic glass, their structures and properties, reinforcing materials like fibers (glass, carbon etc.) fabric, particles and whiskers and manufacturing methods, properties and characteristics.

Manufacturing techniques of composites - Polymer matrix (normal layout, limitation, vacuum bagging, filament winding, resin transfer, moulding, pultrusion etc), Metal matrix (chemical and physical vapour deposition, sintering melt.) and others.

Characterization of composites - structural, thermal, mechanical, physical, chemical and environmental.

Properties of composites - physical, mechanical, thermal, chemical, electrical and optical properties.

Applications and degradation of composites - automotive, aerospace; and others. Thermal and photo degradation.

**Text / Reference Books :**


1. Friedrich K; Friction & Wear of Polymer Composites Vol. 1(Composite Materials Series); Elsevier, 1986.
2. Matthews F.L ; Composite Materials Engg. & Science; Chapman & Hall, 1996.
3. Composites-ASM Vol.I ($10^{th}$ Edition), ASM Internationals, 1995.
4. Holliday L.; Composite Materials; Elseveis Publishing Co.; 1966.


## MML481 DEFORMATION BEHAVIOR (3-0-0) 6 credits

Course MML 481

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math: | 1 |
| Course No.: | MML-481 | Basic Science: | 1 |
| Course Title: | Deformation Behaviour | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. R.K.Paretkar | Compliant: | Course Book 2012-2013 |

Elastic and Plastic behaviour of Materials, Engineering Stress – strain curve. flow curve, Important relations of flow curve. Concept of stress and strain in two dimensions. Principal stresses, Mohr's circle, Yield Criteria.

Mechanistic models for elastic, plastic and time-dependant deformation, phenomenological description of plastic deformation in metals – slip, twinning, stacking faults etc. , strengthening mechanisms, deformation modes and mechanisms for polymeric and ceramic materials.

Fatigue of engineering materials, S-N Curve, Characteristics of fatigue fracture, Evaluation of fatigue behavior, mechanical and metallurgical aspects of fatigue life.

High temperature deformation of materials, creep, analysis of creep curve, structural changes during creep ,deformation mechanism maps,

Fracture of materials, types, effect of notch, structure and temperature, concept of toughness and fracture toughness, preliminary concept of LEFM and PYFM, strain energy release rate, stress intensity factors, Fracture toughness, design. Toughening mechanisms in various materials.

**Books:**

Mechanical Metallurgy by GE Dieter,
Mechanical Behavior of Materials by Dowling

**MML487 CONTINUOUS CASTING OF STEELS (3-0-0) 6 credits**

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | 2 |
| Course No.: | MML-487 | Basic Science: | 1 |
| Course Title: | Continous Casting of Steels | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DC |
| Revised By: | Prof. D. V. Moghe | Compliant: | Course Book 2012-2013 |

CLXI. Catalog Description:
It is a elective course aimed at Final Year UG students. The course introduces the role of key technologies, control and importance of process parameters, productivity and quality – in strand casting of steels.

CLXII. Course Coordinator: Prof. D. V. Moghe,

CLXIII. Pre-requisites: Steel Making Technology

CLXIV. Textbook and /or Other Required Material

O) Continous Casting of Steels by W R Irving
P) Iron Making and Steel Making by A Ghosh and A Chatterjee

CLXV. Course outcomes:

Upon successful completion of this course, each student should be able to:

q. To develop clear understanding of strand casting process.
r. To appreciate the role of heat transfer and control, turbulence, mold operations, EMS and mold fluxes.

s. To develop clear understanding of the theory and practice of segregation control and tundish metallurgy.
t. To critically assimilate the relation between operating practice – scientific parameters and quality of cast products.

CLXVI. Expanded Course Description

Introduction to strand casting & key technologies, heat transfer, control of primary & secondary cooling, casting fluxes, strand casting for long & flat products – billet / bloom / slab & thin slab casting. ( 14 Lectures )

Break out & its prevention, solidification & segregation control, fluid flow - turbulence in mold, nozzle Clogging. ( 14 Lectures)

Cracking & other surface defects - causes & remedies, EMS, Tundish Metallurgy. ( 12 Lectures )

CLXVII. Class Schedule:

Lecture: Three 60 minute sessions per week

CLXVIII. Contribution of Course to Professional Component

To provide scientifically trained young professionals for the ever growing strand casting industry.

CLXIX. Evaluation of Students:

k. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two quizzes, and end semester exam.
l. Grades: Relative grading

CLXX. Relationship of Course Objective to Program Outcomes

| Course Objective | **Engineering knowledge** | **Problem analysis** | **Design/Development of solution** | **Conduct investigation of complex problems** | **Modern tool usage** | **Engineer and society** | **Environmental and sustainability** | **Ethics** | **Individual and team work** | **Communication** | **Project management and finance** | **Life long learning** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | | | X | | | | | | | X | |

**MML486 FAILURE ANALYSIS (3-0-0) 6 credits**

Techniques of failure analysis

Stage of analysis, procedural sequence, collection of background data, classification of various failure needs, preparation of questionnaire, review of mechanical testing methods used in failure analysis, review of NDT method and their application in failure analysis

Classification of fatigue and fracture modes, fractography and preparation of samples for fractography.

Distortion failure - mechanism & types, stress systems related single load fracture of ductile and brittle material, stress verses strength relations in metallic materials, residual stress in engineering components, ductile and brittle fractures, fatigue fractures.

Fundamentals of fracture mechanics; fracture and Fatigue. Factors affecting fracture mechanics, Linear elastic fracture mechanics, Factors affecting fracture toughness ,

Fracture toughness testing ,Fracture mechanics approach to failure ,Numerical in fracture mechanics and fatigue.

Casting / Welding related failures:

Effect of non-metallic inclusions, segregation and dissolved gas on mechanical properties,

Metallurgical failure in cast products and weldments ,Corrosion related failures.

Corrosion Failures : Life cycle of a metal ,Basic nature of corrosion; types of corrosion (Galvanic, Crevice corrosion, pitting, stress corrosion etc.), Inter crystalline and transcrystalline corrosion in engineering components. Corrosion fatigue. Practical examples and case studies.

Elevated temperature failures. Creep Mechanism ,Elevated temperature fatigue ,Thermal fatigue ,Metallurgical Instabilities.

Environmentally induced failures. Wear Related failure: Wear types, Contact stress fatigue prevention methods. Subsurface origin and surface origin fatigue; Sub-case origin, cavitation fatigue.

Case Studies on : (Metallurgical aspects) Failure of Shaft, bearings etc ,Failure of Mechanical fasteners ,Failure in Pressure vessels ,

Failure in Welded structure ,Failure of gears ,Advanced experimental techniques in failure analysis.

**Text / Reference Books :**


1. Bob Ross; Investigating Mechanical Failures; Chapman & Hall (1st Edition), 1995.
2. Wulpi D.J; Understanding How Components Fail; (2nd Edition), 1999.
3. Collins J.S.; Failure of Materials in Mechanical Design; A Wiley Interscience Publications, (2nd Edition), 1993.
4. ASM; Failure Analysis; The British Engine Technical Reports, 1981.
5. Dieter, G.E.; Mechanical Metallurgy; McGraw Hill *Metric Edition), 1988.


## MML488 NANO MATERIALS (3-0-0) 6 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/ Numericals: | 1 |
| Course No.: | MML-488 | Basic Science: | 3 |
| Course Title: | NANO MATERIALS | Engineering Topics: | 3 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Dr. Jatin Bhatt | Compliant: | Course Book 2012-2013 |

Introduction, Electronic and optical properties, Chemical properties, Mechanical properties, Thermal properties, Magnetic properties.

Characterization techniques for nanomaterials.

Methods of synthesis, Consolidation of nanocrystalline materials.

Carbon based materials, Silicon based nanomaterials.

Existing and emerging applications of nanomaterials.
Safety Issues of nanomaterials

**Books:**

Physics and Chemistry of Nanostructured Materials; Shihe Yang and Ping Shen, Taylor & Francis, 2000

Handbook of Nano structured Materials and Nano Technology, H. S. Nalwa, Vols 1-5, Academic Press(2000).

**MML516 BIOMATERIALS (3-0-0) 6 credits**

Introduction- Clasification-General Characteristics-Structure & Properties of Materials-Relevance – Crystal/Molecular Structure-Imperfections-Phase Diagrams.

Implant Materials-Metallic, Ceramic,Polymer, Composite

Characterization of Biomaterials-Mechanical, Chemical, Thermal, etc.Structural evolution of biocompatibility with reference to corrosion. Structural property correlation

Application of Biomaterials-Orthopaedic, Dentistry, Cardiac Devices, etc.

Tissue Engineering- Soft Biomaterials

Case Studies, Proliferation of Biomaterials for development of Medical Technology & mankind

**Books:**

1. Biomaterials- Sujata Bhat
2. Handbook of Materials Behaviour Models, Vol.3- Multiphase Behaviour
3. Biomaterials- Artificial organs & Tissue Engineering (Handbook)
4. Science & Engineering of Materials- D.R. Askeland
5. Light Alloys- Polmear
6. Physical Metallurgy Principles- R. Reed-Hill
7. Physical Metallurgy of Stainless Steel- F.B Pickering

**MML489 SURFACE ENGINEERING (3-0-0) 6 credits**

**Course Outline**

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/ Numericals: | - |
| Course No.: | MML-489 | Basic Science: | 2 |
| Course Title: | Surface Engineering | Engineering Topics: | 4 |
| Contact Hours | 3-0-0 | Design Content: | - |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Prof. A.P. Patil | Compliant: | Course Book 2012-2013 |

CLXXI. **Catalog Description**:

It is a Departmental Elective (DE) course. It is designed to give students knowledge about methods of surface engineering, their principles, various coatings, their structures and applications.

CLXXII. **Course Coordinator**: Prof. A. P. Patil, Room No. F7, First Floor, Old Building of Department

CLXXIII. **Pre-requisites and Co-requisites**: None

**CLXXIV. Textbook and /or Other Required Material**

a. PH Morton, Surface Engineering and Heat Treatment- past present and future, The Institute of Metals, London, 1991
b. CD Verghese, Electroplating and other surface treatments- a practical guide, Tata McGraw-Hill publishing company, New Delhi, 2003
c. ASM International, ASM Handbook, Vol. 5: Surface Engineering, 2003.

CLXXV. **Course Objectives**:

Upon successful completion of this course, each student should be able to understand:

eeee. Importance of surface engineering and industrial applications
ffff. Various coatings and their relative structures , properties and applications.
gggg. Substrate pre-treatment and cleaning.
hhhh. Operating principles and equipments of various coating methods.

**CLXXVI. Expanded Course Description**

**a. Expanded description of the course**

i. **General**: Historical perspective and future trends. Scope and application of surface engineering. Classification of surface engineering methods. Typical thickness and metallurgical structure produced by various surface engineering methods. Difference between surface coating and surface treatment.
ii. **Surface**: Substrate and pretreatment, role of surface cleanliness and surface finish. Type of contaminants and their sources. Methods of surface cleaning; abrasive cleaning, chemical cleaning, chemical polishing, electrolytic cleaning, electrolytic polishing, ultrasonic cleaning, etc. Criteria for selection of cleaning process. Cleaning of ferrous and non-ferrous metals and alloys.
iii. **Plating**: Principles of Electroless and electro-plating. Setup for electro-plating. Baths for electroless plating, Baths for electro-plating. Role of bath constituents. Structure of coating. Plating practices for electroplating of Cu, Ni, Cr, Zn, Sn, Cu-alloy, Sn-alloy, Ni-alloy, Cr-alloy, multi-layer alloy plating etc. Electroless plating of Ni, Cu and Au. Electroless plating of industrial alloys
iv. **Hot-dip**: Principle of hot- dip method. Structure of hot-dip coating. Batch process, its scope and limitations. Continuous process, its scope and limitations. Coating Zn, Zn-Al and Sn by hot-dip method. Industrial practices. Pre- and post surface treatments.
v. **Chemical conversion coatings**: Phosphatizing, chromatizing, ceramic coatings/linings and anodizing. Baths and role of their constituents.
vi. **Vacuum and atmosphere controlled coatings**: Principle and equipments for coating methods like, Thermal spray coating, Chemical vapour deposition (CVD), Plasma assisted CVD, Physical vapour deposition

(PVD), sputter, arc deposition, diffusion coatings and pulsed laser deposition.

vii. **Characterization**: Characterization of coatings; thickness, micro-structure, mechanical properties, stress determination, corrosion resistance, wear resistance

viii. **Industrial applications**: Surface engineering of polymers, metals and alloys.

**CLXXVII. Class Schedule**

Lecture: Three 60 minutes sessions per week

**CLXXVIII. Contribution of Course to Professional Component**

Lecture: Students learn to analyze corrosion situation and ways to prevent it.

CLXXIX. **Evaluation of Students**:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.

b. Grades: Relative grading

**CLXXX. Relationship of Course Objective to Program Outcomes**

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Do Experiments | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|---|
| a | | X | | | | | X | | |
| b | X | X | | X | | | X | | X |
| c | X | X | | | | | X | | |
| d | X | X | | X | | | X | | |

**MML387/MML478 OPERATION RESEARCH TECHNIQUES (3-0-0) 6 credits**

Course Outline

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical : | 4 |
| Course No.: | MML- 387 | Basic Science: | 0 |
| Course Title: | Operations Research Techniques | Engineering Topics: | 2 |
| Contact Hours | 3-0-0 | Design Content: | Yes |
| Credit | 6 | Other: | - |
| Revision Date: | March 2012 | Curriculum Designation: | DE |
| Revised By: | Dr. Ravindra V. Taiwade | Compliant: | Course Book 2012-2013 |

1. Catalog Description:

Quantitative approach to decision making, basic fundamentals of modeling, various models and solution methods of operations research like linear programming, transportation, assignment, project management project evaluation and review techniques (PERT) and critical path method (CPM), replacement and maintenance models etc.

2. Course Coordinator: Dr. R. V. Taiwade, First Floor, last room, Old Building of Department.
3. Pre-requisites and Co-requisites: None
4. Textbook and /or Other Required Material
   a. Operations Research: Hamdy Taha, Prentice Hall (2007).
   b. Introduction to Operations Research: Syd Urry, Orient Longman Limited, Indian edition 1992.
   c. Operations Research: Theory and Applications: J. K. Sharma, Macmillan India Limited 1997.
   d. Operations Research: Heera and Gupta, S. Chand and Company, India.
   e. Operations Research: Rechard Bronson, Schaum's Outline Series, International Editions, McGraw-Hill, Singapore, 1982.
5. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

iiii. Basic knowledge of _rogrammi.

jjjj. Application of various models of operations research.

kkkk. Linear _rogramming Formulations and solution methods.

llll. Other models including transportation, assignment, replacement, CPM and PERT and their solution methods.

mmmm. Computer _rogramming related to OR models

nnnn. Knowledge of various software used in operations research studies.

5. Expanded Course Description

f. Expanded description of the course

Introduction to operations research and fundamentals of OR. Basic OR models and concepts of modeling.

Introduction to Linear programming. Linear programming Formulation: Product mix problems, Production planning problem, cutting stock problem etc. Linear programming Solution: Graphical method, Algebric method. Introduction to Simplex Algorithm. Linear programming Solution: Simplex Algorithm (introduction to Slack, Surplus and artificial variable) Simplex Algorithm; Maximization case, Minimization case. Big-M method, Two-Phase method, Sensitivity Analysis.

Formulation of Dual of LPP.

Introduction to Assignment model. Solution Methods of Assignment problem: Hungarian Method.

Introduction to Transportation Model. Solution methods of Transportation Problems: North-West corner method, Least cost method, Vogel's approximation method (VAM), Modified Distribution Method. Trans-shipment problems and solution.

Introduction to Project Management. Drawing of network CPM/PERT Network Analysis components and precedence relationships. Critical path analysis: forward pass, backward pass, float and critical path Estimation of project completion time, Cost analysis of project, Updating of project Allocations and updating of network.

Introduction to Replacement and maintenance model. Types of failures Replacement of items whose efficiency deteriorates with time Replacement of items that fail completely Introduction to inventory control models Analysis of single product deterministic model.

g. Typical laboratory experiments : --

CLXXXI. Class /Laboratory Schedule

a. Lecture: Three 60 minutes sessions per week

b. Laboratory: --

CLXXXII. Contribution of Course to Professional Component

a. Lecture: Students learn to understand/develop various operations research models and can apply it to numerous applications in engineering and management science.

b. Laboratory: --

CLXXXIII. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed. It comprises of two sessional exams, two class test/quizzes/home assignments and end semester exam. Precise distribution is announced in 1st lecture.

b. Grades: Relative grading

CLXXXIV. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|
| a | X | X | | X | X | X | | |
| b | X | X | | | X | X | | |
| c | X | X | | | X | X | X | |
| d | X | X | X | X | X | X | X | X |
| e | X | X | X | | X | | X | X |
| f | X | X | | | X | X | X | X |

## MML381 METAL WORKING AND PROCESSES (3-1-0) 8credits

**[EQUIVALENT TO MML371 (3-0-0) and MMP371 (0-0-2)]**

Course Outline

| **Course Information** | | **Unit Classification** | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical: | |
| Course No.: | MML-391 | Basic Science: | |
| Course Title: | Metal Working Processes | Engineering Topics: | |
| Contact Hours | 3-1-0 | Design Content: | |
| Credit | 6 | Other: | |

| | | | |
|---|---|---|---|
| Revision Date: | March 2012 | Curriculum Designation: | |
| Revised By: | Prof. A.R. Ballal | Compliant: | Course I 2 |

Engineering Stress – strain curve. True stress strain and flow curve, Important relations of flow curve. Concept of stress and strain in two and three dimensions. Principal stresses, Mohr's circle, Yield Criteria. Elastic behavior of metals/alloys, Atomistic model of elasticity, Elastic constants, Anisotropy in linear elastic behavior, Anisotropy ratios.

Basics of plastic deformation by slip, CRSS, dislocation movement and pinning, Concepts of strengthening mechanisms, Cold worked structure, Annealing and Recrystallization.

Fundamentals of Metal Working, Classification of processes, Metal working system. Mechanics of metal working, Deformation energy and slab analysis approach. Temperature Effects, Hot working, Strain rate effects. Effect of metallurgical structure. Friction and lubrication in working. Workability, Residual stress, Experimental techniques in working, Introduction to Computer aided working.

Rolling Processes, Definition, Classification products and processing sequences in hot and cold rolling mills. Rolling mills, Analytical aspects of rolling. Rolling load torque and power calculations, variables of rolling. Defects- causes and remedies.

Forging process, Main forging operation, Open and closed die forging. Forging equipments, special forging equipments for isothermal ring rolling, near net shape. Analytical aspects, Forging defects. Powder forging.

Extrusion processes, Direct and Indirect Extrusion, Extrusion tooling, Analysis of simple extrusion, variables of extrusion. Products and materials suitable for extrusion. Tube drawing operations and their analysis. Wire rod drawing operations, Analysis of wire rod drawing. Drawing load and energy calculations.

Sheet Metal forming operation, Formability concepts. Drawing, stretching deep drawing, analysis of basic process, LDR, diffuse necking and formability limit diagram. Anisotropy

**Text / Reference Books :**


1. Dieter,G.E., Mechanical Metallurgy, McGraw Hill Book Company; Metric Edition,1988.
2. Hosford W.F. and Caddell.Metal, Forming Mechanics and Metallurgy; Prentice Hall, 1983.
3. Dowling Norman E., Mechanical Behavior of Materials, Prentice Hall, 1999.
4. ASM Handbook Vol. 14.; Forming & Forging; Metals Handbook ($10^{th}$ Edn.) ASM Intl., 1996.
5. Roberts W.L.; Hot Rolling and Steels, Marcel Dekker, 1983.


**MML463 MICROSTRUCTURAL ENGINEERING (3-0-0) 6 credits**

Introduction to microstructure-property relationship; Measurement of microstructure,

stereology; texture, its measurement and relation to properties.

Linear and non-linear anisotropic properties, tensors, examples of electrical conductivity, heat flow, elasticity.

Role of chemistry, precipitation, annealing and plastic deformation in tailoring the microstructure and texture in steels (DQ, DDQ, EDDQ, TRIP, Dual Phase and electrical steels).

Microstructure/texture control in aluminium alloys (Al-Mg and Al-Mg-Mn).

Microstructure design to maximize toughness, co-relation of crack propagation to microstructure, orientation dependence of crack propagation, crack arresting steels.

Properties of grain boundaries, their description and nature.

Grain boundary engineering to improve corrosion resistance in stainless steels, lead-acid battery life enhancement and improvement in creep resistance and fatigue life.

**Text / Reference Books :**


1. Thermomechanical processing of metallic materials, Elsevier, Bert Verlinden, I. Samajdar and R. Doherty.
2. Recrystallization and related annealing phenomenon, Elsevier, Humphreys and Hatherly.


## MML445 ADHESIVE TECHNOLOGY (3-0-0) 6 credits

Introduction, Why use adhesives? Historical prospective, applications, Consumptions, advantages / disadvantages.

Joint design, Surface preparation / Surface treatments, FEA, Dispensing methods, curing techniques.

Theories of Adhesion, mechanisms of adhesions, correlation of bond strength with joint design, mechanical behaviour of adhesively bonded joints.

Types of adhesives, selection of adhesives, prototype testing, production scheduling, characteristics of adhesives

Testing of adhesives, NDT, Quality assurance, Failure investigations/analysis Environmental testing and Hazards

Case studies, Selection of adhesives for special surface properties, adhesives for composite structures, adhesives in bio-applications, Aerospace, defense, sports, construction applications etc.

**Text / Reference Books :**


1. The mechanism of adhesion, Elsevier, A.V. Pocius
2. Handbook of adhesive technology, VCH publisher, A. Pizzy and K.L. Mittal.


## MMD 402 PROJECT PHASE – II 8 credits

| Course Information | | Unit Classification | |
|---|---|---|---|
| Department: | Metallurgical and Materials Engineering | Math/Numerical : | Yes |
| Course No.: | MMD- 402 | Basic Science: | 2 |
| Course Title: | **PROJECT PHASE – II** | Engineering Topics: | 4 |
| Contact Hours | 0-0-4 | Design Content: | Yes |
| Credit | 8 | Other: | - |
| Revision | March 2012 | Curriculum | DC |

| Date: | | Designation: | |
|---|---|---|---|
| Revised By: | Dr. Ravindra K Paretkar | Compliant: | Course Book 2012-2013 |

a. Catalog Description:

Project work is based on a study of some engineering or technology problem. Students learn to analyse problem, use various equipments for testing, analyse results, make project report, present seminar and face viva voce examination.

6. Course Coordinator: Dr. R. K. Paretkar, First room, Old Building of Department.
7. Pre-requisites and Co-requisites: None
8. Textbook and /or Other Required Material
   a. As needed
9. Course Objectives:

Upon successful completion of this course, each student should be able to understand:

a. Analysing problem.
b. Design of experiments.
c. Work on various equipments.
d. Process data and analyse results.
e. Prepare project report
f. Presentation their work.

5. Expanded Course Description

Based on whole syllabus

b. Typical laboratory experiments : --

CLXXXV. Class /Laboratory Schedule

a. Lecture: -
b. Laboratory: -- Work without any fixed time slot

CLXXXVI. Contribution of Course to Professional Component

a. Lecture:
b. Laboratory: Learn to make plan of research, use various equipments and make sense of the data.

CLXXXVII. Evaluation of Students:

a. Evaluation: A process of continuous evaluation is followed.
b. Grades: Relative grading

CLXXXVIII. Relationship of Course Objective to Program Outcomes

| Course Objective | Use of Modern Tools of Discipline | Use of Maths, Science, Engg and Tech. | Work on Team | Do Technical Problems | Effective Communication | Life Long Learning | Professional, Ethics, Social Responsibility | Quality, Continuous Improvement |
|---|---|---|---|---|---|---|---|---|
| a | X | X | x | | X | X | | |
| b | X | X | x | | X | X | | X |
| c | X | X | x | | X | X | | x |
| d | X | X | X | X | X | X | X | X |
| e | X | X | X | | X | x | X | |
| f | X | X | x | | X | X | | |

Annexure 2

**VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR**

PHYSICAL VERIFICATION CERTIFICATE

TO WHOM SO EVER IT MAY CONCERN

This is to certify that the physical verification of all buildings and connected ancillaries has been carried out during the year 2012-13 and found in order.

Engineer

Date: 10/07/2013

## Annexure 2

### Minutes of the Faculty Meeting held on 17th Feb 2011.
### Following members were present:

| | | | |
|---|---|---|---|
| AP Patil | SU Pathak | RC Rathod | RK Khatirkar |
| SG Sapate | RV Taiwade | DV Moghe | AA Likhite |
| AR Ballal | RK Paretkar | SN Paul | VK Didolkar |
| DR Peshwe | AD Chopde | JG Bhatt | YY Mahajan |

1. Action taken report on minutes of meeting held on 3/2/10: Head informed that Rs. 1,20,000/- have been sanctioned for purchase of chemicals. He also informed that BoS has to decide OC and HM course for MME students as soon as possible so that a proposal could be put up before senate for consideration. Dr. VK Didolkar informed that OC Rural Technology students had not attended 8.00 AM class on 17th, he also informed that he could not yet sent a note for students through respective HOD. He was asked to send notice immediately. About course revamp and preparing scheme of examination, Head informed the house that TOR was sent by email, there is no response from anybody therefore he has invited, by email, choices of subjects and interest; so that a group of interested persons can be made. He requested all to give him this information within a week. About data on Dept. Website, Head informed that individual faculty can upload relevant information by himself. Prof. DRP advised YYM to discuss with Mr. Ashish Tiwari and if needed send the Thesis Abstract data to him. About conducting experiments in few subjects; it was general opinion that there very little scope of introducing laboratory experiments in those subjects. Prof. DV Moghe informed that in IIT Bombay students perform software simulated experiments in TP lab. Head suggested that Dept. should explore possibility of tie-up with Heat Transfer lab of Dept. of Mech. Engg. Prof SUP mentioned that very good design problems are solved in laboratory turns of SP&AFT, however, it can be supplemented with visit to local industries. Prof. AR Ballal informed that after breakdown of rolling machine, even that experiment cannot be performed. Head requested the concerned faculties to work out if few experiments can be designed and, if yes, then enlist required equipments/instruments.
2. Child care leave of Mrs. Seema R. Naikwade: After refusing CCL to Mrs. SRN, through a confidential note Director has requested HoD to reconsider her application for a period of 21/2/11 to 18/3/11. The note mentions that sincere efforts shall be made to provide replacement during her absence, as desired by the Dept. Head apprised about his personal meeting with Director and proposed that as the LA is in dire need of leave, let us recommend as requested by Director. If a replacement is provided then it is fine, if not then we will have to adjust as many labs we can with existing staff and other labs can be conducted on extra turns on return of the LA. All agreed to this proposal.
3. Content of various courses: All were requested to review the course content of courses of their interest or also the content of the course they would like to tech in near future.
4. Choices of the courses for next year: All are requested to submit their choices of subjects for next year (both the semesters) by 23rd Feb.

5. Students' feedback: RKK has worked out the feedback summery. It was circulated and all have noted it.
6. Matter of two LAs not making tensile specimens: No senior faculty had discussed with LAs their difficulties in this respect. Head said that it is high time for us to ask for a person with proper skills transferred to the Dept. from amongst the existing staff of other Departments of VNIT. He also said that he will press for getting LA Mr. Manapure transferred back to Dept. Prof. DV Moghe pointed out that this should not lead to transfer of Mrs. V Patankar. Head said that he would report her inability but will not ask for her transfer from Dept.
7. Transfer of supporting staff including Sr. Assistant: The Director has invited suggestions regarding transfer of supporting staff. It was decided to request for good persons.
8. Display of 1st sessional marks and attendance: Valuation of almost all courses is over.
9. UG project dates: The final viva shall be conducted on 29-30th April and students shall submit their thesis by 15th April.
10. Any other point:
    a. Prof. DVM pointed out that all other departments are opened at 8.00 AM by supporting staff, we should also do so. Head pointed out that we had to adopt present practice due to dodgy behavior of Mr. Ambalwar. So long he is in Dept. faculty members will have to open class rooms at 8.00 AM. As soon as, we get a good hand, we will get back to old practice. Until then please bear with this practice.
    b. Prof. DVM informed that two companies namely, Stollberg and Vesuvius are coming in 1st week of March. Prof DR Peshwe informed that Diffusion Engineers are coming on 1st March. Head informed that Nelcast wish to come little later instead of coming on 21st March; and they need a contact person at VNIT as they are coming for the first time. Prof. DR Peshwe agreed to help them out.

## Minutes of the faculty meeting held on 24th March 2011

A faculty meeting was conveyed to discuss following agenda

1. Minutes of earlier faculty meeting.
2. Scheme of examination
3. Class Committee Meeting.
4. Any other point with permission of the Chair.

### Following members were present

| | | | | |
|---|---|---|---|---|
| AP Patil | AD Chopde | RK Paretkar | RV Taiwade | SG Sapate |
| DV Moghe | YY Mahajan | AA Likhite | JG Bhatt | AR Ballal |
| SN Paul | RC Rathod | VK Didolkar | | |

1. Action taken report on earlier faculty meeting.

Choices of subjects for next year have been received but syllabus of subjects has not yet been received. All were requested to expedite it. About transfer of Mrs. V Patankar, Head informed that she had asked for transfer saying that she is repeatedly asked to do heavy, industrial, mechanical and hazardous work. She is temporary posted to Chemical Engineering Dept. Interview for Technician/Machinist were conducted (committee recommended three persons in the list 1st-Machinist, 2nd -Diploma-Met. and 3rd - Diploma-Mech.) but no appointment has been done so far, as it is not considered to be a replacement for Mrs. Patankar.

2. Modification in Scheme of Examination and to decide date of next BOS meeting: In view of DE to be permitted in place of OC, scheme of examination will require some modification. Besides all the schemes (complete with Syllabus) are to be submitted for Senate's approval. All were requested to send soft copy of syllabus for compilation to rajesh.khatirkar@gmail.com . All agreed that the BOS meeting for the purpose would be held on 31st March. It was decided that during 28-30th March in the afternoon, the scheme will be discussed and changes as suggested shall be incorporated. Head requested all to participate in the exercise, so that a workable scheme can be prepared for BOS meeting on 31st March 2011.

3. Next Class Committee meeting: It is decided to hold next Class Committee meeting on 7th April.

4. Any other point with permission of Chair:

- Feed Back form: SGS, DVM, VKD and RVT shall co-ordinate this activity for 4th, 6th, 8th Sem. B. Tech.(MME) and 2nd Sem. M. Tech.(ME) batches, respectively.
- Prof. DVM pointed out the necessity to be strict about attendance. Head clarified that the matter of attendance and detention is exclusively between student and teacher. Students have been given enough warnings and as such 100% attendance is expected. So it is student's responsibility if he/she has less attendance and is detained.
- Absentee test: There is no provision of absentee test in academic calendar. It is entirely up to the teacher to take absentee test/viva or not.
- Marks distribution for courses with 3-0-2 load and 8 credits shall be 3:1 (i.e. 75 for Theory and 25 for Lab).

Dr. A. P. Patil
Prof. and Head

**Department of Metallurgical & Materials Engineering**

Note: Date: 18-09-2015

**Departmental Meeting**

Departmental Meeting will be held as per the following Schedule

Date / Day : **18th September, 2015**
Time : **3:30 PM**
Venue : **Conference Room, MEC**

All Faculty Members are requested to attend the same.

**(Dr. D. R. Peshwe)**
**Professor & HoD**

Copy to,
All Faculty Members

## Name of the Faculty Members:

| | | | | | |
|---|---|---|---|---|---|
| **DRP** | | **SUP** | | **APP** | |
| **SGS** | | **SNP** | | **JGB** | |
| **AAL** | | **DVM** | | **ARB** | |
| **RKK** | | **RCR** | | **RVT** | |
| **YYM** | | **MMT** | | **AKS** | |

**Department of Metallurgical & Materials Engineering**

**Note:** **Date: 23-09-2015**

**Subject: - Special Lecture by IIT Chennai Faculty Members for B.Tech. Final Year Students.**

All B.Tech. final year students are hereby informed that Prof. B. S. Murty and Prof. A. P. Deshpande will deliver the lecture on direct Ph.D. Program started recently at IIT Madras, Chennai.

**Date:** **30th September, 2015**
**Time:** **1:30 to 2:30 PM**
**Venue:** **Physics Assembly Hall, Department of Physics**.

All interested students should attend the lecture as per the above schedule.

**( Dr. D. R. Peshwe )**
**Professor &**
**HoD, MME.**

To,

All HoD's for display on SNB & FNB and necessary action

**Department of Metallurgical & Materials Engineering**

**Note:** **Date: 29-09-2015**

All Head of the Departments are requested to display the enclosed notices on students notice board for the special lecture on direct Ph.D. Program started recently at IIT Madras, Chennai which is scheduled as follows:

**Date:** **30th September, 2015**
**Time:** **1:30 to 2:30 PM**
**Venue:** **Physics Assembly Hall, Department of Physics**.

**( Dr. D. R. Peshwe )**
**Professor &**
**HoD, MME.**

To,

All HoD's for display on SNB & FNB and necessary action

**Department of Metallurgical & Materials Engineering**

Note: Date: 02-12-2015

**Departmental Meeting**

Departmental Meeting will be held as per the following Schedule

Date / Day : **3rd December, 2015**
Time : **11:00 AM**
Venue : **Meeting Room**

All Faculty Members are requested to attend the same.

**(Dr. D. R. Peshwe)**
**Professor & HoD**

Copy to,
All Faculty Members

**Name of the Faculty Members:**

| | | | | | |
|---|---|---|---|---|---|
| **DRP** | | **SUP** | | **APP** | |
| **SGS** | | **SNP** | | **JGB** | |
| **AAL** | | **DVM** | | **ARB** | |
| **RKK** | | **RCR** | | **RVT** | |
| **YYM** | | **MMT** | | **AKS** | |

**Department of Metallurgical & Materials Engineering**

**MME/**

**Note:** **Date: 07-05-2014**

**Departmental Meeting**

Faculty meeting will be held today at 4.00pm in HOD's Room of Metallurgical & Materials Engg. Deptt..

1) Dr. D. R. Peshwe
2) Dr. S. G. Sapate
3) Dr. J. G. Bhatt
4) Dr. R. K. Khatirkar

**Agenda:**

Scrutiny Meeting for the Post of Assistant Professor (contract).

All above faculty members are requested to attend.

**Department of Metallurgical & Materials Engineering**

Note: Date: 17-07-2014

**Faculty Meeting**

Faculty Meeting will be held as per the following Schedule

Date / Day: **Friday 18th July, 2014**
Time: **4:00 pm**
Venue: **Conference Room**

**Agenda:**

- Review of the EVEN Semester January - June 2014.
- Plan of Work for the Current Semester July - December 2014.

All Faculty Members are requested to please attend.

(Dr. R. K. Paretkar)
Professor &
Head of Department, MME.

Copy to,
All Faculty Members

**Department of Metallurgical & Materials Engineering**

**Note:** **Date: 21-04-2015**

**Mr. Vincent Shantha Kumar S** will be sharing the message from **Honorable President of India** and his experiences which he gained during his 07 days stay at **Rashtrapati Bhavan**

All Students, Teaching Staff and Non-Teaching Staff are cordially invited for the presentation.

**Date:** **Thursday 23rd April 2015**
**Time**: **11:00 AM**
**Venue:** **Conference Hall, MEC**

**(Dr. D. R. Peshwe)**
**Professor &**
**Head of Department**

**Department of Metallurgical & Materials Engineering**

**Note:** **Date: 20-01-2016**

**Minutes of the Departmental Meeting**

The Urgent Faculty Meeting was convened today at 4.00PM in HOD's Room of Metallurgical & Materials Engineering Department.

**Agenda:**

To discuss for the continuation of M.Tech (3 Year) program for the Academic Session 2016-17, with reference Note No: Dean (Acd)/ 365 dated: 19.01.2016

The following faculty members attended the meeting**:**

1. Dr. A. P. Patil
2. Dr. S. G. Sapate
3. Dr. S U Pathak
4. Dr. S. N. Paul
5. Prof. D. V. Moghe
6. Dr. J .G. Bhatt
7. Dr. A. A. Likhite
8. Dr. R. C. Rathod
9. Dr. R. K. Kahtirkar
10. Dr. R. V.Taiwade
11. Prof. Y Y Mahajan
12. Dr. A. K. Srivastav

**Resolution:**

After thorough discussion it was unanimously resolved to convey to Dean (Acd) that
i) It would be premature to review the M.Tech. (3 Year) program at the moment and that
ii) Let us gather sufficient experience about its utility as it is meant to provide skilled man power to the department and to motivate the scholars to continue with research leading to Ph.D.

**(Dr. A. P. Patil)**
**Professor &**
**I/c Head of Department**

**Department of Metallurgical & Materials Engineering**

Note: Date: 08-02-2016

**Faculty Meeting**

Faculty Meeting will be held as per the following Schedule

Date / Day: **Monday**, **08 February, 2016**
Time: **3:00 PM**
Venue: **Conference Room**

**Agenda:**

- Regarding NBA.

All Faculty Members are requested to please attend.

**(Dr. D. R. Peshwe)**
**Professor &**
**Head of Department, MME**.

Copy to,
All Faculty Members

**Department of Metallurgical & Materials Engineering**

**Date: 20.05.2016**

# URGENT

## Faculty Meeting

Faculty Meeting will be held as per the following Schedule

Date / Day: **Monday**, **23rd May, 2016**
Time: **12:00 PM**
Venue: **Anti- Chamber**, **HoD Room**

**Agenda:**

-

- Regarding Laboratory Space Requirements in Proposed Academic Block.

All Faculty Members are requested to please plan for UG Lab Space, PG Lab Space, and Research Lab Space requirement for their laboratories.
Requirement for any New Lab can also be submitted.

**(Dr. A. P. Patil)**
**Professor &**
**I/C Head of Department**.

**Department of Metallurgical & Materials Engineering**

**Note:** **No. MME/ 2015 /**
**Date: 28-05-2015**

**Sub: Departmental Meeting.**

All the faculty members are requested to attend the departmental meeting on **3rd June, 2015** at **11:00 AM** at **Conference Hall, MEC**, to discuss the new proposed scheme.

**( Dr. D. R. Peshwe )**
**Professor &**
**Head of the Department**

Department of Metallurgical & Materials Engineering

Note: Date: 02-04-2014

Sub: Departmental Meeting on Thursday 03-04-2014 at 3:00pm

Agenda:

1) List of reputed journals
2) Recruitment norms (over and above BOG approved system)
3) Area of specification
4) Information about HOD meeting held on 01-04-14 project
5) PG/UG seminar – Internal evaluation dates
6) List of students with & less than 50% marks attendance problem.

(Dr. D. R. Peshwe)
I/C Head of Department

Copy to,
All Faculty Advisors

**Department of Metallurgical & Materials Engineering.**

**NOTE:** **Date: - 10-09-2014**

**Faculty Meeting**

Faculty meeting will be held as per the following schedule.

**Date /Day : Thursday 11th September, 2014**
**Time : 11:45 AM.**
**Venue : Conference Room.**

**Agenda :**

1) Briefing on the HOD's meeting held on 7th August and 4th September, 2014
2) Inputs on agenda of BoS meeting scheduled on 19th September, 2014

All faculty members are requested to please attend.

**(Dr. R. K. Paretkar)**
**Professor &**
**Head of Department, MME**

**Copy to,**
**All Faculty Members**

**Department of Metallurgical & Materials Engineering.**

**MME/BoS/2014/**

**NOTE:** **Date: - 03-09-2014**

**Subject: - BoS (MME) Meeting Academic Year 2014-2015.**

Day / Date: Friday, 19th September 2014.
Time: 11:30 AM.
Venue: MEC Conference Room.

All BoS Members are requested to make it convenient to attend the meeting, as above.

**Agenda:-**

1) Introduction of New Elective Courses in B. Tech (MME) / M. Tech (ME), Scheme of Examination.
2) Brain storming on possible changes essential in the existing scheme of examination (valid till 2015-2016) and on proposals for modifications in scheme for the students admitted in the academic year 2014-2015.
3) Any other item with permission of chair.

Encl: 1) Scheme of Instruction and Syllabus for Undergraduate Studies.
2) Scheme of Instruction and Syllabus for Postgraduate Studies.

(Dr. R. K. Paretkar)
Head of Department &
Chairman BoS (MME).

**Copy To:-**

1) Dr. N. B. Ballal, Professor. (Metallurgical & Materials Science, IIT Bombay, Mumbai)
2) Shri R. Agrawal, Nagpur.
3) Dr. P. M. Padole, Professor. (Department of Mechanical Engineering, VNIT, Nagpur)
4) Dean (Acd) for information.
5) To all BoS (MME) Members.