NATIONAL BOARD OF

ACCREDITATION

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

NATIONAL BOARD OF ACCREDITATION

Department of Chemical Engineering
Visvesvaraya National Institute of Technology
Nagpur

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(January, 2013)

Contents

Self Assessment Report (SAR) UG

PART A

I. Institutional Information

I.1. Name and address of the institution and affiliating university:

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY(VNIT),
SOUTH AMBAZARI ROAD, NAGPUR 440010

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

Dr. Narendra S. Chaudhari, Director VNIT.
Ph : 0712-2801370
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

I.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:

I.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.

I.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 154th largest agglomeration and 164th 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 the city. It is 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*

I.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 16 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., Industrial 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. 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	1956	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.	Metal and Materials Engineering	1965	92
09.	Mining Engineering	1982	32
	TOTAL		**738**
Post Graduate & Research Programs (M. Tech.)			
01.	Environmental Engineering	1966	20
02.	Water Resources Engineering	2011	20
03,	Construction Technology	2010	20
04.	Transportation Engineering	2011	20
05.	VLSI Design	2007	20
06.	Communication System Engineering	2012	20
07.	Computer Science Engineering	2007	20
08.	Industrial Engineering	1989	20
09.	Heat Power Engineering	2002	20
10.	CAD-CAM	2010	20
11.	Integrated Power System	1968	20
12.	Power Electronics & Drives	2010	20+5 SP
13.	Material Engineering	2006	20
14.	Structural Dynamics and Earthquake Engineering	2003	20
15.	Structural Engineering	1991	20
16.	Excavation Engineering	2012	
17.	Urban Planning	1988	20
	TOTAL		**320**
M Sc.			
01.	M Sc Chemistry	2013	20
02.	M Sc Mathematics	2013	20
03.	M Sc Physics	2013	20
	TOTAL		**60**

I.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:

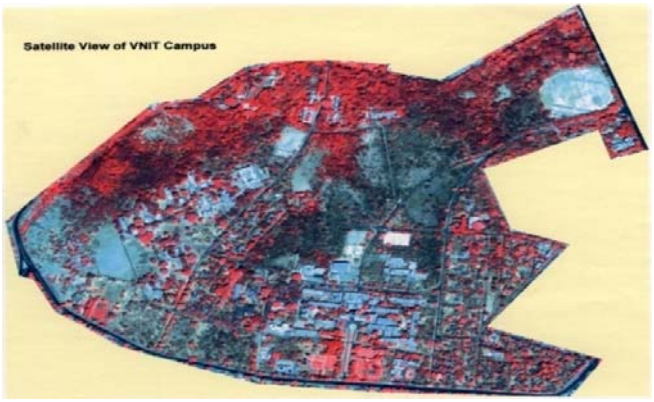
Sr.No	Name of UG & PG Programme(s)	Accreditation Status	Period of validity w.e.f. 10.02.2009
01.	B.Tech. Electronics & Comm. Engg.	Accredited	3 Years
02.	B.Tech. Mechanical Engg.	Accredited	3 Years
03.	B.Tech. Civil Engg.	Accredited	3 Years
04.	B.Tech. Computer Science & Engg.	Accredited	3 Years
05.	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. Ferrous Process Metallurgy	WITHDRAWN	
15.	M.Tech. Ferrous Process Metallurgy	WITHDRAWN	

(Total number of programmes Accredited vide this letter – Thirteen 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
	Total Increased Intake	**60**

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;

- 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.

I.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 (27 of 2007)

I.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.

I.6. Organisational Structure:

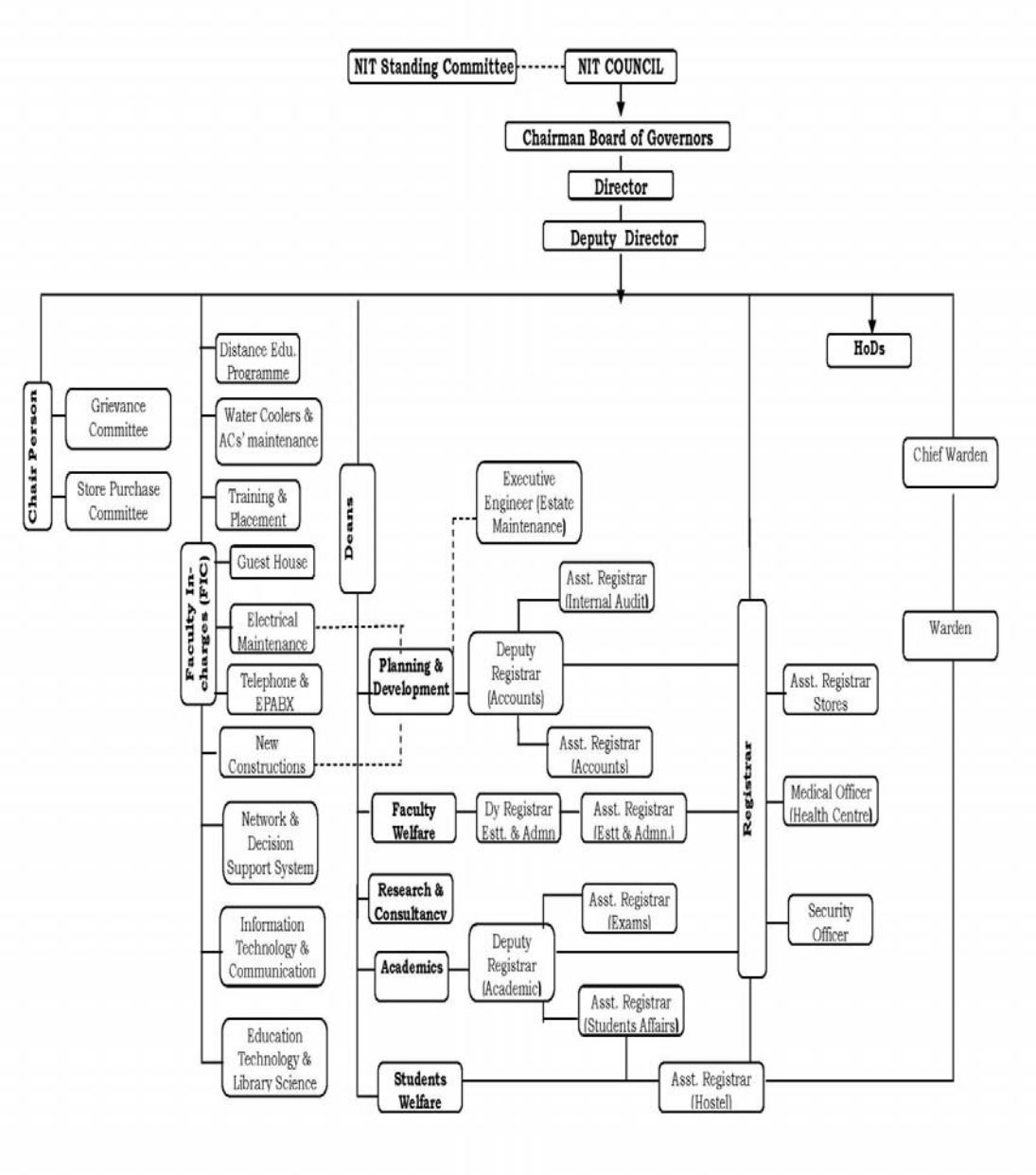
I.6.1 Administration

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.

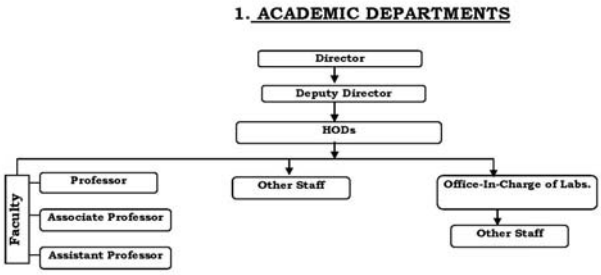
I.6.2 Flow Chart showing Institutional Administration

Figure - 1



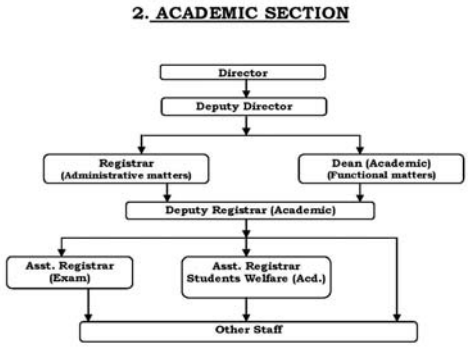
I.6.3 Flow Chart showing the hierarchy of Academic Departments

Figure - 2



	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.



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

* In consultation with Dean (Academic)

I.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)

I.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	-	-

I.9. External sources of funds:

(Rs. in Lacs)

Name of the External Source	CFY 2013-14	CFYm1 2012-13*	CFYm2 2011-12	CFYm3 2010-11
Plan	**3825=00**	**00**	**7500=00**	**2200=00**
Non Plan	**1620=00**	**3200=00**	**4249=00**	**1500=00**

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

* No funds under plan were received.

I.10 internally acquired funds:

(In Rupees)

Name of the Internall Source	CFY	CFYm1 2010-11	CFYm2 2011-12	CFYm3 2012-13
Students' fee	**2,70,14,268**	**8,62,01,169**	**100,32,5,522**	**17,79,67,064**
Interest & Other Income	**4,88,21,680**	**8,16,88,699**	**5,63,25,522**	**3,23,85,087**

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

I.11 Scholarships or any other financial assistance provided to students?

VNIT Nagpur is making available to its 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	CFYm1	CFYm2	CFYm3
Category				
Scholarship Assistance	**3,28,05,922**	**1,74,86,164**	**1,77,64,254**	**2,37,27,156**
Amount				

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.)

I.13 Total number of engineering students:

	CFY 2012-13	CFYm1 2011-12	CFYm2 2010-11	CFYm3 2009-10
Total no. of boys	2868	2636	2398	2142
Total no. of girls	708	583	500	457
Total no. of students	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.)

I.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		CAYm1		CAYm2		CAYm3	
		Min	Max	Min	Max	Min	Max	Min	Max
Teaching staff in engineering	M		131		122		123		119
	F		23		20		20		19
Teaching staff in sciences & humanities Physical Edu.	M		24		15		17		16
	F		7		7		7		7
Non teaching staff	M		9		10		10		12
	F		3		3		3		3

B. Contract Staff

Items	GENDER	CAY		CAYm1		CAYm2		CAYm3	
		Min	Max	Min	Max	Min	Max	Min	Max
Teaching staff in engineering	M	00	01	00	01	00	02	00	00
	F	00	00	00	00	00	00	00	00
Teaching staff in sciences & humanities	M	00	01	00	00	00	00	00	00
	F	00	00	00	00	00	00	00	00
Non teaching staff	M	00	73	00	75	00	77	00	76
	F	00	19	00	19	00	19	00	19

II. Departmental Information

II.1. Name and address of the department:

Department of Chemical Engineering
Visvesvaraya National Institute of Technology,
South Ambazari Road, Nagpur

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

Dr. K. L. Wasewar
Head and Associate Professor
Telephone : 07122801565, 07122801564, 07122801561
Email : head@che.vnit.ac.in, k_wasewar@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 Chemical Engineering	Started with 60. seats in 2006 Intake increases to 72 in 2008 Intake increases to 92 in 2009

II.4. Mission and Vision of the Department

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

Vision

To be a globally recognized chemical engineering program coupled with excellence in education, training, research and consultancy in chemical engineering and to serve as a valuable resource for industry and society.

Mission

- To provide students with updated knowledge in science and technology, to become competent and practising chemical engineers without compromising professional ethics and moral values.

- To undertake research of a calibre that is internationally recognized.
- To undertake collaborative projects which provide opportunities for long - term interaction with academia, industry and other research organisations.
- To develop infra-structure that promotes creativity and an entrepreneurial culture.
- To foster ethical leadership and activities that supports the administration, advancements, governance and regulation of chemical engineering education and the engineering profession.

II.5. List of the programmes/ departments which share human resources and/or the facilities of this programmes/ departments (in %): Nil

(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.)

II.6. Total number of students:

UG: ~ 370

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:

Items	**CAY**		**CAYm1**		**CAYm2**	
	Min	Max	Min	Max	Min	Max
Teaching Faculty with the Program	11+2*		08+2*		08+2*	
Non teaching Staff	7**		7**		7**	
Total	18+2*		15+2*		15+2*	

* Two faculty members of other department (Chemistry and Maths) take few core/elective subjects and laboratory.

** 3 office permanent staff + 4 laboratory assistant on adhoc basis

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

Item	Budgeted in CFY 2013-14	Actual Expenses in CFY (till…)2013-14 *	Budgeted in CFYm1 2012-13	Actual Expenses in CFYm1 *	Budgeted in CFYm2 2011-12	Actual Expenses in CFYm2
Laboratory equipment	Plan grant- 40,00,000 + Non Plan grant- 4 ,00,000	9,09,782	Plan grant- 50,00,000 + Non Plan grant- 3 ,00,000		Plan grant- 80,00,000 + Non Plan grant- 3 ,50,000	
Software		7,96,005		5,29,754		15,86,014
R&D						
Laboratory consumables		12,211		314663		259692
Maintenance and spares		8500		6750		27000
Training & travel						16000
Miscellaneous expenses for academic activities		7420		350		3169
Total	44,00,000	17,33,918	53,00,000	8,51,517	44,00,000	18,91,875

* 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.

III. Programme Specific information

III.1. Name of the Programme

UG in Chemical 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

B. Tech in Chemical Engineering

(List name of the degree title, as it appears on the graduate's certificate and transcript, and

Abbreviation used for the degree.)

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

Programme coordinator for the NBA:

Dr. K. L. Wasewar
Head and Associate Professor
Telephone : 07122801565, 07122801564, 07122801561
Email : head@che.vnit.ac.in, k_wasewar@rediffmail.com

Dr. Mahesh N. Varma
Assistant Professor
Telephone: 07122801570
Email: maheshnvarma@gmail.com

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

Program	Description
UG in Chemical Engineering	Started with 60 seats in 2006 Intake increases to 72 in 2008 Intake increases to 92 in 2009 Accredited in : New Department, first time applying for accreditations

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

This is new department started in 2006, first time applying for accreditations

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

Total strength of department is around 360 students

III.7. Minimum and maximum number of staff for the current and three previous

Academic years (1st July to 30th June) in the programme:

Items	CAY		CAYm1		CAYm2	
	Min	Max	Min	Max	Min	Max
Teaching Faculty with the Program	11+2*		08+2*		08+2*	
Non teaching Staff	7**		7**		7**	
Total	18+2*		15+2*		15+2*	

* Two faculty members of other department (Chemistry and Maths) take few core/elective subjects and laboratory.
** 3 office permanent staff + 4 laboratory assistant on adhoc basis

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):

Item	Budgeted in CFY 2013-14	Actual Expenses in CFY (till…) 2013-14	Budgeted in CFYm1 2012-13	Actual Expenses in CFYm1	Budgeted in CFYm2 2011-12	Actual Expenses in CFYm2
Laboratory equipment	Plan grant- 40,00,000 + Non Plan grant- 4 ,00,000	9,09,782	Plan grant- 50,00,000 + Non Plan grant- 3 ,00,000		Plan grant- 80,00,000 + Non Plan grant- 3 ,50,000	
Software		7,96,005		5,29,754		15,86,014
R&D						
Laboratory consumables		12,211		314663		259692
Maintenance and spares		8500		6750		27000
Training & travel						16000
Miscellaneous expenses for academic activities		7420		350		3169
Total	44,00,000	17,33,918	53,00,000	8,51,517	44,00,000	18,91,875

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)

INSTITUTE

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.

Mission

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.

DEPARTMENT OF CHEMICAL ENGINEERING

Vision

To be a globally recognized chemical engineering program coupled with excellence in education, training, research and consultancy in chemical engineering and to serve as a valuable resource for industry and society.

Mission

- To provide students with updated knowledge in science and technology, to become competent and practising chemical engineers without compromising professional ethics and moral values.
- To undertake research of a calibre that is internationally recognized.
- To undertake collaborative projects which provide opportunities for long - term interaction with academia, industry and other research organisations.
- To develop infra-structure that promotes creativity and an entrepreneurial culture.
- To foster ethical leadership and activities that support the administration, advancements, governance and regulation of chemical engineering education and the engineering profession.

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)

Displayed in the locations where the attention of stakeholders are prominent like

- Departmental part of institute website
- Flex board at the department entrance

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.)

After discussion in the departmental meeting, the task of preparing vision and mission was assigned to a committee comprising four faculty members. The first draft was shown to head of the department and after the needful corrections the second draft was discussed in the department faculty meeting and finalized.

The vision and mission of the institute involves the development of human resource with the enhancement of knowledge, research potential and responsibilities for fulfilling the societal needs. All these factors are meticulously included in the vision and mission of the department.

1.2 Programme Educational Objectives (15)

1.2.1. Describe the Programme Educational Objectives (PEOs) (2) (List and articulate the programme educational objectives of the programme under accreditation)

The Chemical Engineering Program at Visvesvaraya National Institute of Technology produces graduates with a basic understanding of chemical engineering principles along with problem solving, teamwork and communication skills necessary to succeed in diverse careers, including chemical engineering practice and academic research. The Programme has the following educational objectives:

- To prepare students for successful practice in diverse fields of chemical engineering such as pharmaceuticals, chemicals, polymers / advanced materials, energy, biotechnology and environmental engineering and in the fields of societal expectations on time.
- To prepare students for advanced studies in Chemical Engineering and its allied fields.
- To ensure our students are recognized for excellence and leadership and selected for high-ranking industrial, academic, government and other professional positions.
- To develop students' skills and awareness to become socially, ethically and morally responsible individual in all the challenges they take over in our communities and in the field of chemical engineering.

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)

Displayed in the locations where the attention of stakeholders are prominent like

- Departmental link of institute website
- Flex board at the department entrance

1.2.3. List the stakeholders of the programme (1)

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

The following is a list of the stakeholders that the Department of Chemical Engineering serves either directly or indirectly by providing information and technical expertise or by training future engineers and employees.

- Students
- Parents
- Alumni
- Employers:

i) Government (Central & state):

Chemical and allied industry, Academic and Research organizations

ii) Private Sector:

Industry: Software, Manufacturing

Consulting Firms: Design, Environmental

Utilities: Energy, water

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.)

After discussion in the departmental meeting, the task of preparing Programme Educational Objectives (PEOs) was assigned to a faculty member. The draft was discussed in the departmental meeting and after the needful corrections the PEOs are finalized.

The factors considered in framing the departmental vision and missions are included in the Programme Educational Objectives (PEOs).

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.)

PEOs	Mission of the institute
To prepare students for successful practice in diverse fields of chemical engineering such as pharmaceuticals, chemicals, polymers / advanced materials, energy, biotechnology and environmental engineering and in the fields of societal expectations on time.	To achieve high standards of excellence in generating knowledge.
To prepare students for advanced studies in Chemical Engineering and its allied fields.	To achieve high standards of excellence in propagating knowledge
To ensure our students are recognized for excellence and leadership and selected for high-ranking industrial, academic, government and other professional positions.	To provide an education that combines rigorous academics with joy of discovery.
To develop students' skills and awareness to become socially, ethically and morally responsible individual in all the challenges they take over in our communities and in the field of chemical engineering.	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.)

- Core courses to improve the fundamental concepts of science, mathematics and chemical engineering.

- Elective courses in diverse fields to enhance the knowledge in specific area of chemical engineering and its allied fields.
- Humanities courses to understand the ethical and moral values.
- Laboratory courses to deepen the practical knowledge.
- Credit seminars to enhance the oral and writing communication skills.
- Project work for developing creative thinking and strategic planning to solve the technical problems.

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.)

- Updating the course curriculum in regular intervals through Board of Studies (BOS) which includes experts from industry and academia.
- The department organizes seminar/invited talks on advanced chemical engineering areas through the seminar coordinator from the department.
- Class committee meeting, headed by the faculty, who is not the course coordinator for any of the courses for particular semester, will monitor the progress at regular intervals and take necessary actions for the improvement if required.
- Collecting students' feedback on particular course and course coordinator and do the needful improvement if required.
- Strict action against those who deviate from the rules and regulations governing ethical/moral behaviour in class rooms, exam halls.
- The institution encourages students with monetary support for attending technical competitions, conferences.
- The department motivates students to become member of students' chapter of a professional body. The main objective of the students' chapter is to conduct the activities of technical, educational and social interests to student chemical Engineers.

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)

- The data on regular recruitment of students from particular organization would ensure the excellence of performance of our graduated students in their organization.
- Collecting the feedback from our Alumni to evaluate the extent to which the knowledge and skills gained by them in the department helps in their career.

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;

- The data on regular recruitment from particular organization is collected from the Training and placement cell.
- Feedback from Alumni through electronic media is collected and considered for the constructive development of department.

b) The frequency with which these assessment processes are carried out. Once in a 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;

PEOs	Expected level of attainment	Evidence
To prepare students for successful practice in diverse fields of chemical engineering such as pharmaceuticals, chemicals, polymers / advanced materials, energy, biotechnology and environmental engineering and in the fields of societal expectations on time.	Number of students doing job in core chemical and its allied fields Batch 2010: Data to be collected Batch 2011: 40 Batch 2012: 34 Batch 2013: 41 Batch 2014:25 (Got placed till date)	Attached in file
To prepare students for advanced studies in Chemical Engineering and its allied fields.	Number of students opted for higher education. Batch 2010: Data to be collected Batch 2011: 5 Batch 2012: 8 Batch 2013: 8	Attached in file
To ensure our students are recognized for excellence and leadership and selected for high-ranking industrial, academic, government and other professional positions.	The evaluation process to be initiated as our department graduated only four batches of students till date	Not applicable
To develop students' skills and awareness to become socially, ethically and morally responsible individual in all the challenges they take over in our communities and in the field of chemical engineering.	The evaluation process to be initiated as our department graduated only four batches of students till date	Not applicable

a) 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

Evaluation process	**Results of the evaluation process**	**Extent to which the PEOs being attained**
Data on regular recruitment from particular organization	Around fourteen companies recruit our students regularly.	Attainment of PEO 1 : Excellence of the previously recruited students generates interest among the companies to recruit again.
Feedback from Alumni	Feedback from around 50 Alumni suggests that the knowledge gained through our courses lays the foundation for their respective areas.	Qualitatively PEO 1 and PEO 2 are attained to a greater extent. Quantification for this evaluation is under progress.

a) How the results are documented and maintained.

Report on each evaluation process is compiled and a document compiling all the results relating to each of the PEOs were prepared and filed.

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)

This is the first time that outcome based academic process has been operationalised. Therefore the process of refining PEOs will be in effect at the time of next accreditation

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)

(a) An ability to identify, formulates, and solve engineering problems:

Students will be able to (1) combine mathematical and/or scientific principles to formulate models of chemical, physical, and/or biological processes and systems relevant to chemical engineering, (2) apply concepts of integral and differential calculus and/or statistics to solve chemical engineering problems, and (3) apply the governing equations and underlying concepts of material balances, energy balances, thermodynamics, heat transfer, mass transfer, fluid flow, chemical reaction kinetics, reaction engineering, separations, process dynamics, and/or process control to chemical engineering problems

(b) An ability to design a system, component, or process to meet desired needs:

Students will be able to (1) analyze and synthesize chemical engineering unit operations, including integrated complex systems consisting of multiple unit operations, and (2) include constraints such as economic, health and safety, ethical, environmental, and social considerations in designing systems and processes.

(c) An ability to design and conduct experiments, as well as to analyze and interpret data:

Students will be able to (1) follow an experimental protocol with attention to safety, (2) operate laboratory and pilot scale equipment following a standard operating procedure, (3) use statistics to report confidence intervals, compare for significant differences, and judge whether an experimental variable has a significant effect on the measured outcome, (4) design and conduct an experiment which will test a given hypothesis, and (5) analyze and interpret experimental data.

(d) An ability to communicate effectively:

Students will be able to (1) produce effective written communication, (2) produce effective oral communication, and (3) adapt their presentation style and content to match the audience.

(e) An understanding of professional and ethical responsibility:

Students will be able to (1) understand ethical aspects of chemical engineering, (2) understand the impact of the profession on society, and (3) understand the importance of professional excellence and service to the profession.

(f) An ability to function on multidisciplinary teams:

Students will be able to (1) demonstrate the ability to describe chemical engineering problems and solutions to people in other disciplines, (2) gain knowledge of technical skills, issues, and approaches germane to disciplines outside of chemical engineering, (3) solve problems in cooperation with a group of colleagues from other disciplines, and (4) lead effectively by drawing out the skills in others.

(g) The broad education necessary to understand the impact of engineering solutions in a global and societal context:

Students will have an understanding of (1) global economic, environmental, demographic and political issues, (2) the impact of engineering decisions on the local and global environment, economy, and society, and (3) cultures other than that from which they originate.

(h) A recognition of the need for, and an ability to engage in lifelong learning:

Students will (1) be proficient in the use of a variety of informational and educational media such as traditional textbooks, scientific and technical journals, the library system as a whole, the internet, and educational software, (2) have an understanding of and exposure to the breadth and structure of the professional and technical support system that will be available to the students upon graduation; this includes professional and technical societies, the continuing education needed to maintain professional relevance, and professional registration systems, (3) have an awareness of the dynamic, evolving nature of science, engineering, technology, and

industry, and an understanding that learning does not end with a degree, and (4) have the ability to learn on their own.

(i) A knowledge of contemporary issues:

Students will be able to (1) identify and analyze current social, economic, political, and environmental issues, and (2) recognize the impact of technology on local, national, and international issues.

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)

- Pos are communicated to the stakeholders especially parents and Alumni through meetings.
- POs are published in our institution's website.
- POs are printed and posted in the department office.

2.1.3. Indicate processes employed for defining of the POs (5) (Describe the process that periodically documents and demonstrates that the POs are defined in alignment with the graduate attributes prescribed by the NBA.)

- Group of senior faculty members are identified by the Head, Chemical Engineering and given the task for formulating the program outcomes.
- These faculty members took the course objectives of various courses of Chemical Engineering and graduate attributes prescribed by the NBA as starting point and brain stormed to arrive at the first draft version of program outcomes.
- These statements are communicated to all the faculty members of Chemical Engineering department for their comments and review.
- A meeting of all faculty members is held to discuss the review comments.
- Updated version of program outcomes are formed after incorporating all relevant and agreed comments by the faculty members. This is sent to Head, Chemical Engineering for review and comments.

- The final version of the program outcomes are created after discussing with Head, Chemical Engineering.

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

(Indicate how the POs defined for the programme are aligned with the Graduate Attributes of NBA as articulated in accreditation manual.)

The defined Pos are a compact set of the usual ABET Pos and their correlations with graduate attributes is shown below. It should be noted that this structure of Pos is similar to ABET and in no way Deficient

Sr. No.	Program Outcomes	Graduate Attributes (Ref: General manual of accreditation, page 27)
a1.	An ability to identify engineering problems	1. Engineering knowledge
a2.	An ability to formulate engineering problems	
a3.	An ability to solve engineering problems	
b.	An ability to design a system, component, or process to meet desired needs	2. Problem analysis and 3. Design/development of solutions
c.	An ability to design and conduct experiments, as well as to analyze and interpret data	2. Problem analysis, 3. Design/development of solutions and 4. Conduct investigations of complex problems
d.	An ability to communicate effectively	10. Communication
e1.	An understanding of professional responsibility	8. Ethics
e2.	An understanding of ethical responsibility	
f.	An ability to function on multidisciplinary teams	9. Individual and team work and 11. Project management and finance

g.	The broad education necessary to understand the impact of engineering solutions in a global and societal context	6. The engineer and society and 7. Environment and sustainability
h.	A recognition of the need for, and an ability to engage in lifelong learning	5. Modern tool usage and 12. Life-long learning
i.	A knowledge of contemporary issues	7. Environment and sustainability

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)

PEO's	Program Outcomes (PO)								
	a.	**b.**	**c.**	**d.**	**e.**	**f.**	**g.**	**h.**	**i.**
1.	√	√	√			√			√
2.	√	√					√	√	√
3.			√	√	√		√	√	√
4.			√		√	√	√	√	√

2.2. Attainment of Programme Outcomes (40)

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

(Provide the correlation between the course outcomes and the programme outcomes. The strength of the correlation may also be indicated)

L=Laboratory; T=Theory; ▭ = Weak contribution; ■ = Strong contribution;

Contribution of Courses to Program Outcomes				Program Outcomes								
Type	Credit	Course No	Course Titles	a	b	c	d	e	f	g	h	i
Second Year (III Semester)												
T	6	CML263	Inorganic Chemical Technology	▭	■			▭				
T	6	CML262	Chemical Process Calculations	■					▭		■	
T	6	CHL261	Physical	▭	■						■	

			Chemistry & General Metallurgy									
T	6	CHL263	Organic Chemistry and Synthesis									
L	2	CHP263	Organic Chemistry and synthesis									
L	2	CHP261	Physical and Inorganic Chemistry									
Second Year (IV Semester)												
T	6	CML263	Fluid Mechanics									
T	6	CML264	Mechanical Operations									
T	6	CHL214	Organic Chemical Technology									
T	6	CML265	Chemical Engineering Thermodynamics									
L	2	CHP214	Organic Chemical Technology									
L	2	CMP264	Fluid Mechanics and Mechanical Operations –I.									
Third Year (V Semester)												
T	6	CML361	Mass Transfer – I									
T	6	CML363	Chemical Process Equipment Design									
T	6	CML362	Heat Transfer – I									
L	2	CMP364	Chemical Engineering Design and Drawing –I									
L	2	CMP365	Fluid Mechanics &Mechanical Operation –II									
Third Year (VI Semester)												
T	6	CML368	Chemical Reaction Engineering									
T	6	CML366	Mass Transfer – II									
T	6	CML466	Chemical Plant Design									
T	6	CML367	Heat Transfer – II									
T	6	CML371	Chemical Process									

			Modelling and Simulation									
L	2	CMP366	Mass Transfer									
L	2	CMP367	Heat Transfer									
L	2	CMP371	Chemical Process Modeling and simulation									
Final Year (VII Semester)												
T	6	CML461	Transport Phenomena									
T	6	CML462	Chemical Reaction Engineering – II									
T	6	CMP463	Process Control and Instrumentation									
L	2	CMP462	Chemical Reaction Engineering									
L	2	CMP463	Process Control and Instrumentation									
L	2	CMP464	Chemical Engineering Design &Drawing –II									
	4	CMD451	Project Phase-I									
Final Year (VIII Semester)												
	2	CMD453	Seminar and Group Discussion Program									
	8	CMD452	Project Phase-II									
List of Electives offered second, third and final year												
T	6	MAL205	Num. Methods & Prob. Theory									
T	6	CHL336	Polymer Engineering									
T	6	CML370	Environmental Engineering									
T	6	CML474	Plant Utility									
T	6	CML471	biotechnology and Biochemical Engineering									
T	6	CHL369	Green Chemistry and Engineering									
T	6	CML375	Analytical									

			Methods for Chemical Analysis									
T	6	CML374	Optimization Techniques									
T	6	CML376	Computational transport processes									
T	6	CML619	Computational methods in Chemical Engineering									
T	6	CML473	Safety and Risk Analysis									
T	6	CML374	Petroleum Refinery Engineering									
T	6	CML62O	Membrane Technology									
T	6	CML475	New and Renewable Energy Engineering									
T	6	CML47O	Computer Aided Design in Chemical Engineering									
T	6	CML621	Nanotechnology									
T	6	CML472	Advanced Separation Process									
T	2	CMP472	Separation Technology									
T	6	CML480	CFD for chemical engineers									
T	6	CML 380	Industrial Waste Treatment									
T	6	CMP 380	Industrial Waste Treatment Laboratory									
T	6	CML 333	Polymer Processing									
T	6	CML491	Project Planning and Management									
T	6	CML468	Ore and minerals processing									
T	6	CML299	Introduction to Computing software for									

			Chemical Engineers									
T	6	CML467	Materials in chemical Industries									

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.)

Sr. No.	Mode of Teaching	PO's Achieved
1.	Blackboard Teaching	(a) An ability to identify, formulate, and solve engineering problems (b) An ability to design a system, component, or process to meet desired needs
2.	Powerpoint Presentation	(d) An ability to communicate effectively
3.	Group Discussion	(f) An ability to function on multidisciplinary teams (d) An ability to communicate effectively
4.	Tutorial	(a) An ability to identify, formulate, and solve engineering problems (g) The broad education necessary to understand the impact of engineering solutions in a global and societal context
5.	Assignments	(a) An ability to identify, formulate, and solve engineering problems (g) The broad education necessary to understand the impact of engineering solutions in a global and societal context
6.	Quizzes	(a) An ability to identify, formulate, and solve engineering problems (g) The broad education necessary to understand the impact of engineering solutions in a global and societal context
7.	Practical	(c) An ability to design and conduct experiments, as well as to analyze and interpret data (e) An understanding of professional and ethical responsibility (h) A recognition of the need for, and an ability to engage in lifelong learning

8.	Industry Interaction	(g) The broad education necessary to understand the impact of engineering solutions in a global and societal context (h) A recognition of the need for, and an ability to engage in lifelong learning (i) A knowledge of contemporary issues
9.	Technical Events	(f) An ability to function on multidisciplinary teams (g) The broad education necessary to understand the impact of engineering solutions in a global and societal context (e) An understanding of professional and ethical responsibility (i) A knowledge of contemporary issues

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)

(Describe different types of course assessment and evaluation methods (both direct and indirect) in practice and their relevance towards the attainment of POs.)

Chemical Engineering department performs program outcomes assessment at two levels: Course level and Program level.

i) Course Level Assessment

Course level assessment is carried out by conducting sessional examinations, assignments, quizzes, laboratory exam, viva, etc. Each course has clearly defined objectives, a set of measurable outcomes and contributes to one or more of the program outcomes. The faculty member teaching the course is responsible for reporting any major issues that are revealed from outcomes assessment and initiating any appropriate changes to ensure that the course outcomes are met successfully. Tables below give the assessment processes and frequency of assessment.

ii) Program Level Assessment

Outcomes assessment from the program level is carried out by using a variety of assessment methods giving variable weightage:

1. Student and alumni surveys reflecting on program outcomes (25%).

2. Site visits to industry (10%).
3. Independent assessment by Department-level /Industry Representatives/Employer (40%).
4. Exit interviews from Graduating Seniors (25%).

Assessment processes of course work:

Sr. No.	Assessment Processes (Course work)	Frequency of assessment
1.	Sessional I Exam	Once in a semester
2.	Sessional II Exam	Once in a semester
3.	End Semester Exam	Once in a semester
4.	Assignments	Continuous (Entire semester)
5.	Class Tests	Continuous (Entire semester)
6.	Tutorials	Continuous (Entire semester)
7.	Seminar	Continuous (Entire semester)
8.	Presentation	Continuous (Entire semester)
9.	Orals	Continuous (Entire semester)
10.	Quizzes	Continuous (Entire semester)
11.	Industrial visit	Once in a semester for third and final year students
Attainment of program outcomes: 80% [PO (a), (b), (d), (e), (f), (g)]		

Assessment processes of laboratory work:

Sr. No.	Assessment Processes (laboratory work)	Frequency of assessment
1.	Laboratory Exam	Once in a semester
2.	Laboratory record	Continuous (Entire semester)
3.	Laboratory performance	Continuous (Entire semester)
4.	Viva	Continuous (Entire semester)
5.	Quizzes	Continuous (Entire semester)
Attainment of program outcomes: 80% [PO (b), (c), (e), (f), (h), (i)]		

2.2.4. Indicate the extent to which the laboratory and project course work are contributing towards attainment of the POs (10)
(Justify the balance between theory and practical for the attainment of the POs. Justify how the various project works (a sample of 20% best and average projects from total projects) carried as part of the programme curriculum contribute towards the attainment of the POs.)

Sr. No.	PO	% Achieved	Laboratory and Project course work
a.	An ability to identify, formulate, and solve engineering problems	100	Laboratory and Project course work
b.	An ability to design a system, component, or process to meet desired needs	100	Laboratory and Project course work
c.	An ability to design and conduct experiments, as well as to analyze and interpret data	100	Laboratory and Project course work
d.	An ability to communicate effectively	100	Project course work
e.	An understanding of professional and ethical responsibility	100	Project course work
f.	An ability to function on multidisciplinary teams	100	Laboratory and Project course work
g.	The broad education necessary to understand the impact of engineering solutions in a global and societal context	80	Project course work
h.	A recognition of the need for, and an ability to engage in lifelong learning	80	Project course work
i.	A knowledge of contemporary issues	80	Laboratory and Project course work

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)

Sr. No.	PO	Tools/Process	Goal for PO achievement
a.	An ability to identify, formulate, and solve engineering problems	Students study the subjects of basic sciences in their first year. Most of core subjects in Chemical Engineering are covered second and third year. The knowledge of these subjects can be assessed with Oral/Practical exam, university exams, Term work, Tutorials and Project work in final year.	70%

b.	An ability to design a system, component, or process to meet desired needs	This PO is mainly satisfied at the final year level in the project course work.	80%
c.	An ability to design and conduct experiments, as well as to analyze and interpret data	This PO is satisfied in laboratory course work at second, third and final year and project course work at final year.	80%
d.	An ability to communicate effectively	Assessment is mainly judge in the form of project course work in the department. Also it is judged at the time of placement activities in the final year of engineering. Also communication skills are observed at the time of oral exams.	70%
e.	An understanding of professional and ethical responsibility	Assessment is mainly judge in the form of project course work in the department. Also it is judged at the time of placement activities in the final year of engineering.	70%
f.	An ability to function on multidisciplinary teams	Assessment is mainly judge in the Laboratory and Project course work	80%
g.	The broad education necessary to understand the impact of engineering solutions in a global and societal context	Assessment is done in the form of oral/practical exam, University theory exam, Project competitions, Technical events, Paper presentations, Project course work, etc	80%
h.	A recognition of the need for, and an ability to engage in lifelong learning	Assessment is done in the form of oral/practical exam, University theory exam, Project competitions, Technical events, Paper presentations, Project course work, etc	80%
i.	A knowledge of contemporary issues	Assessment is done in the form of oral/practical exam,	80%

		University theory exam, Project competitions, Technical events, Paper presentations, Project course work, etc	

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.

Assessment processes of course work:

Sr. No.	**Assessment Processes (Course work)**	**Frequency of assessment**
1.	Sessional I Exam	Once in a semester
2.	Sessional II Exam	Once in a semester
3.	End Semester Exam	Once in a semester
4.	Assignments	Continuous (Entire semester)
5.	Class Tests	Continuous (Entire semester)
6.	Tutorials	Continuous (Entire semester)
7.	Seminar	Continuous (Entire semester)
8.	Presentation	Continuous (Entire semester)
9.	Orals	Continuous (Entire semester)
10.	Quizzes	Continuous (Entire semester)
11.	Industrial visit	Once in a semester for third and final year students
Attainment of program outcomes: 80% [PO (a), (b), (d), (e), (f), (g)]		

Assessment processes of laboratory work:

Sr. No.	**Assessment Processes (laboratory work)**	**Frequency of assessment**
1.	Laboratory Exam	Once in a semester

2.	Laboratory record	Continuous (Entire semester)
3.	Laboratory performance	Continuous (Entire semester)
4.	Viva	Continuous (Entire semester)
5.	Quizzes	Continuous (Entire semester)
Attainment of program outcomes: 80% [PO (b), (c), (e), (f), (h), (i)]		

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.

Sr. No.	PO	Evaluation Processes	Analysis of PO achieved (%)	Documentation
a.	An ability to identify, formulate, and solve engineering problems	Students study the subjects of basic sciences in their first year. Most of core subjects in Chemical Engineering is covered second and third year. The knowledge of these subjects can be assessed with Oral/Practical exam, university exams, Term work, Tutorials and Project work.	90	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet
b.	An ability to design a system, component, or process to meet desired needs	This PO is mainly satisfied at the final year level in the project course work.	90	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet
c.	An ability to design and conduct experiments, as well	This PO is satisfied in	100	1. Assessment evidence with

	as to analyze and interpret data	laboratory course work at second, third and final year and project course work at final year.		each course coordinator 2. Student feedback 3. Each Semester Mark sheet
d.	An ability to communicate effectively	Assessment is mainly judge in the form of project course work in the department. Also it is judged at the time of placement activities in the final year of engineering. Also communication skills are observed at the time of oral exams.	95	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet
e.	An understanding of professional and ethical responsibility	Assessment is mainly judge in the form of project course work in the department. Also it is judged at the time of placement activities in the final year of engineering.	90	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet
f.	An ability to function on multidisciplinary teams	Assessment is mainly judge in the Laboratory and Project course work	95	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet

g.	The broad education necessary to understand the impact of engineering solutions in a global and societal context	Assessment is done in the form of oral/practical exam, University theory exam, Project competitions, Technical events, Paper presentations, Project course work, etc	80	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet
h.	A recognition of the need for, and an ability to engage in lifelong learning	Assessment is done in the form of oral/practical exam, University theory exam, Project competitions, Technical events, Paper presentations, Project course work, etc	80	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet
i.	A knowledge of contemporary issues	Assessment is done in the form of oral/practical exam, University theory exam, Project competitions, Technical events, Paper presentations, Project course work, etc	75	1. Assessment evidence with each course coordinator 2. Student feedback 3. Each Semester Mark sheet

Note : The Program outcomes concept has been introduced from this year only. As future surveys, assessment are done, the same will be documented.

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)

(Articulate with rationale the curricular improvements brought in after the review of the attainment of the POs)

- Curriculum development committee of the department make continuous improvement is the course syllabus based on program outcomes.
- Team of three faculty members is made to review syllabus of each subject keeping in mind the program outcomes of the department.
- The changes in the syllabus are circulated among all faculty members for their feedback during the departmental meeting.
- Final draft is shown to head of department. The modified syllabus is discussed with board of studies (BOS) members during BOS meeting and put up in the Senate meeting for final approval.

2.4.2. Indicate how results of evaluation used for improvement of course delivery and assessment (10)
(Articulate with rationale the curricular delivery and assessment improvements brought in after the review of the attainment of the POs)

- Class committee chairman of each class has been given responsibility of conducting class committee meeting one week after sessional 1, sessional 2 and end semester examination.
- In class committee meeting, faculty member has to fill the review form of their subject. The student members give their feedback on each subject to the faculty members during the class committee meeting.
- Class committee chairman is also responsible for collecting student's feedback on each course at the end of the semester.
- The end semester feedback is shown to each faculty members during the departmental meeting.
- The feedback during class committee meeting and end semester feedback is used by the faculty members for improvement of course delivery and assessment.

Sample of review form and feedback form is given below:

Sample format of Class committee meeting (Review Form)

1	Code and Title of the Course	
2	Name of the course coordinator	
3	Total no of classes scheduled	
4	Total no of classes engaged	
5	Any extra class/tutorial engaged	
6	% course covered and topics covered (Pl. enclosed marked syllabus, if required)	
7	Class tests / quizzes /assignments taken (Number and worth marks)	
8	Sessional-2	
	Maximum marks of the sessional	
	Min marks obtained by student	
	Max marks obtained by student	
	Avg. class marks	
	Total Number of students	
	No. of students scored less than avg. marks	
	Your suggestion for academically weak students (point above)	
9	No of students having attendance less than 75% till second sessional and action taken	
10	Whether attendance record was put on notice board? Mention date	
11	Coordinators opinion on overall class behaviour during lecture	
12	Whether any student was warned for misbehavior. If yes pl. give details.	
13	Coordinators opinion on performance of overall class based on sessionals/assignments conducted so far	
14	Any other information	

Date: Name and Signature of the faculty

Sample Feedback form:

Name of the Student (Optional) : _____

Class Roll No. (Optional) : _____ **Sem./ Course :** _____ **Session :** 200 - 200___

Please fill in the points (rating from 1 to 10) as per your opinion for each of the subjects below.

PART – A (Teachers Feedback)

Sr No	Criterion	Points	1 - 10	1 - 10	1 - 10	1 - 10	1 - 10	1 - 10
		Teachers Name						
		Subject Name						
1.	Were the course ideas presented clearly? *(1 : Not at All ..... 10 : Always Clear)*							
2.	Was the classroom delivery audible and understandable? *(1 : Not at All ..... 10 : Always So)*							
3.	Were classes conducted regularly and punctually? *(1 : Not at All ..... 10 : Always So)*							
4.	Was proper pace of teaching maintained? *(1 : Not at All ..... 10 : Always)*							
5.	General interaction of instructor with students. *(1 : Very Poor ..... 10 : Excellent)*							
6.	Were opportunities provided for questions and discussions? *(1 : Never..... 10 : Always)*							
7.	Were questions answered satisfactorily? *(1 : Never..... 10 : Always)*							
8.	Were tests evaluated objectively? *(1 : Never..... 10 : Always)*							
9.	Were test papers discussed in the class after the test? *(1 : Never..... 10 : Always)*							
10.	Was a course outline provided at the beginning? *(1 : Not at all ..... 10 : Clearly Provided)*							

PART – B (Course Evaluation)

1.	Did the course deepen your interest in the subject? *(1 : Not at all ..... 10 : Definitely, yes)*						
2.	Are sufficient number of reference books related to the course available in the library? *(1 : Not at all ..... 10: Definitely, yes)*						
3.	How did you find the course? *(1 : Boring ..... 10: very exciting)*						
4.	Did you work out numerical / home assignments regularly? *(1 : Not at all ..... 10: Always)*						
5.	Were manuals/ data sheets, write-ups etc. available in the labs? *(1 : Not at all ..... 10: Always)*						
6.	Was lab equipment functional while you were experimenting? *(1 : Not at all ..... 10: Always)*						
7.	Are the lab facilities adequate? *(1 : Not at all ..... 10: Always)*						
8.	Were you given proper assistance in the lab? *(1 : Not at all ..... 10: Always)*						
9.	Are the labs kept clean? *(1 : Not at all ..... 10: Always)*						
10.	Were sufficient numbers of practical conducted to illustrate important topics of the course content? *(1 : Not at all ..... 10: Always)*						

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

(Articulate with rationale how the results of the evaluation of the POs have been used to review/redefine the POs in line with the Graduate Attributes of the NBA.)

The board of studies (BOS) members have an opportunity to review the outcomes every year during BOS meeting. The assessment data is reviewed and revisions recommended for program enhancement during BOS meeting are approved during Senate meeting.

This outcome based process has been introduced this year for the first time. The results of future survey and assessments will be documented in due courses and utilised for revision of PO's.

3. Programme Curriculum (125)

3.1. Curriculum (20)

3.1.1. Describe the Structure of the Curriculum (5)

Course Code	Course title	Total number of contact hours (for Students)				Credits
		Lecture (L)	Tutorial (T)	Practical# (P)	Total Hours	
Second Year (III Semester)						
CML263	Inorganic Chemical Technology	3	0	0	3	6
CML262	Chemical Process Calculations	3	0	0	3	6
CHL261	Physical Chemistry & General Metallurgy	3	0	0	3	6
CHL263	Organic Chemistry and Synthesis	3	0	0	3	6
CHP263	Organic Chemistry and synthesis	0	0	4	4	2
CHP261	Physical and Inorganic Chemistry	0	0	4	4	2
Second Year (IV Semester)						
CML263	Fluid Mechanics	3	0	0	3	6
CML264	Mechanical Operations	3	0	0	3	6
CHL214	Organic Chemical Technology	3	0	0	3	6
CML265	Chemical Engineering Thermodynamics	3	0	0	3	6
CHP214	Organic Chemical Technology	0	0	4	4	2
CMP264	Fluid Mechanics and Mechanical Operations –I.	0	0	4	4	2
Third Year (V Semester)						
CML361	Mass Transfer – I	3	0	0	3	6

CML363	Chemical Process Equipment Design	3	0	0	3	6
CML362	Heat Transfer – I	3	0	0	3	6
CMP364	Chemical Engineering Design and Drawing –I	0	0	4	4	2
CMP365	Fluid Mechanics &Mechanical Operation –II	0	0	4	4	2
Third Year (VI Semester)						
CML368	Chemical Reaction Engineering	3	0	0	3	6
CML366	Mass Transfer – II	3	0	0	3	6
CML466	Chemical Plant Design	3	0	0	3	6
CML367	Heat Transfer – II	3	0	0	3	6
CML371	Chemical Process Modelling and Simulation	3	0	0	3	6
CMP366	Mass Transfer	0	0	4	4	2
CMP367	Heat Transfer	0	0	4	4	2
CMP371	Chemical Process Modeling and simulation	0	0	4	4	2
Final Year (VII Semester)						
CML461	Transport Phenomena	3	0	0	3	6
CML462	Chemical Reaction Engineering – II	3	0	0	3	6
CML463	Process Control and Instrumentation	3	0	0	3	6
CMP462	Chemical Reaction Engineering	0	0	4	4	2
CMP463	Process Control and Instrumentation	0	0	4	4	2
CMP464	Chemical Engineering Design &Drawing –II	0	0	4	4	2
CMD451	Project Phase-I	0	0	0	8	4
Final Year (VIII Semester)						

CMD453	Seminar and Group Discussion Program	0	0	0	4	2
CMD452	Project Phase-II	0	0	0	16	8
MAL205	Num. Methods & Prob. Theory	3	0	0	3	6
List of Electives offered second, third and final year						
CHL336	Polymer Engineering	3	0	0	3	6
CML370	Environmental Engineering	3	0	0	3	6
CML474	Plant Utility	3	0	0	3	6
CML471	biotechnology and Biochemical Engineering	3	0	0	3	6
CHL369	Green Chemistry and Engineering	3	0	0	3	6
CML375	Analytical Methods for Chemical Analysis	3	0	0	3	6
CML374	Optimization Techniques	3	0	0	3	6
CML376	Computational transport processes	3	0	0	3	6
CML619	Computational methods in Chemical Engineering	3	0	0	3	6
CML473	Safety and Risk Analysis	3	0	0	3	6
CML374	Petroleum Refinery Engineering	3	0	0	3	6
CML62O	Membrane Technology	3	0	0	3	6
CML475	New and Renewable Energy Engineering	3	0	0	3	6
CML47O	Computer Aided Design in Chemical Engineering	3	0	0	3	6
CML621	Nanotechnology	3	0	0	3	6
CML472	Advanced Separation Process	3	0	0	3	6
CMP472	Separation	3	0	0	3	6

	Technology					
CML480	CFD for chemical engineers	3	0	0	3	6
CML 380	Industrial Waste Treatment	3	0	0	3	6
CMP 380	Industrial Waste Treatment Laboratory	3	0	0	3	6
CML 333	Polymer Processing	3	0	0	3	6
CML491	Project Planning and Management	3	0	0	3	6
CML468	Ore and minerals processing	3	0	0	3	6
CML299	Introduction to Computing software for Chemical Engineers	3	0	0	3	6
CML467	Materials in chemical Industries	3	0	0	3	6

: Seminars, project work may be considered as practical

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

(Draw the schematic of the prerequisites of the courses in the curriculum)

1. Chemical Engineering Thermodynamics: - Physical Chemistry and General Metallurgy
2. Chemical Process Equipment Design: Physical Chemistry & General Metallurgy, Mechanical Operations
3. Mass Transfer-I - Chemical Process Calculations
4. Heat Transfer-I: Maths, Thermodynamics, Fluid Mechanics
5. Process Modelling and Simulation: Maths, Thermodynamics, Heat Transfer, Mass Transfer, Chemical Reaction Engineering, Fluid Mechanics
6. Chemical Reaction Engineering – II: Chemical Reaction Engineering – I
7. CML366 Mass Transfer-II - Chemical Process Calculations, Mass Transfer-I
8. Petroleum Refinery Engineering: Mass Transfer-I, Mass Transfer-II

9. Safety and Risk Analysis: Chemical Process Calculations, Fluid Mechanics, Mechanical Operations, Chemical Engineering Thermodynamics
10. Heat Transfer -II: Maths, Thermodynamics, Fluid Mechanics
11. Membrane Technology: Heat Transfer-I, Fluid Mechanics
12. New & Renewable Energy Engineering: Thermodynamics, Heat Transfer-I
13. Process Control and Instrumentation: - Mathematics
14. Biotechnology & Biochemical Engineering: - Mass Transfer, Chemical Reaction Engineering
15. Ore and Mineral Processing: Mechanical Operations
16. Computational methods in Chemical Engineering: Heat Transfer-I, Mass Transfer-I, Chemical Reaction Engineering – I
17. Transport Phenomena: Heat Transfer-I, Mass Transfer-I, Heat Transfer-II, Mass Transfer-II, Fluid Mechanics
18. CFD for Chemical Engineers: Numerical methods, Fluid mechanics
19. Project Phase – II: Project Phase – I

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

(Justify how the programme curriculum satisfies the program specific criteria specified by the American professional societies relevant to the programme under accreditation)

Contribution of Courses to Program Outcomes					
Type	**Credit**	**Course No**	**Course Tiles**	**Strongly contributing**	**Weakly contributing**
Second Year (III Semester)					
T	6	CML263	Inorganic Chemical Technology	b	a, e
T	6	CML262	Chemical Process Calculations	a, h	f
T	6	CHL261	Physical Chemistry & General Metallurgy	b, h	a
T	6	CHL263	Organic Chemistry and Synthesis	b	e
L	2	CHP263	Organic Chemistry and synthesis	b, c, f	

L	2	CHP261	Physical and Inorganic Chemistry	c, f	
Second Year (IV Semester)					
T	6	CML263	Fluid Mechanics	a, h	f
T	6	CML264	Mechanical Operations	a, h	f
T	6	CHL214	Organic Chemical Technology	b	e
T	6	CML265	Chemical Engineering Thermodynamics	a, b, h	c
L	2	CHP214	Organic Chemical Technology	c, f	e
L	2	CMP264	Fluid Mechanics and Mechanical Operations –I.	b, c, f	
Third Year (V Semester)					
T	6	CML361	Mass Transfer – I	a, b, h	f
T	6	CML363	Chemical Process Equipment Design	a, b, h	
T	6	CML362	Heat Transfer – I	a, b, h	f
L	2	CMP364	Chemical Engineering Design and Drawing –I	b, c, f	
L	2	CMP365	Fluid Mechanics &Mechanical Operation –II	b, c, f	
Third Year (VI Semester)					
T	6	CML368	Chemical Reaction Engineering	a, b, h	f
T	6	CML366	Mass Transfer – II	a, b, h	f
T	6	CML466	Chemical Plant Design	a, b, h	f
T	6	CML367	Heat Transfer – II	a, b, h	f
T	6	CML371	Chemical Process Modelling and Simulation	a, h	f
L	2	CMP366	Mass Transfer	b, c, f	
L	2	CMP367	Heat Transfer	b, c, f	
L	2	CMP371	Chemical Process Modeling and simulation	b, c, f	
Final Year (VII Semester)					
T	6	CML461	Transport Phenomena	a, h	f

T	6	CML462	Chemical Reaction Engineering – II	a, b	
T	6	CMP463	Process Control and Instrumentation	a, h	f
L	2	CMP462	Chemical Reaction Engineering	b, c, f	
L	2	CMP463	Process Control and Instrumentation	b, c, f	
L	2	CMP464	Chemical Engineering Design &Drawing –II	b, c, f	
L	4	CMD451	Project Phase-I	a, b, c, d, f	
Final Year (VIII Semester)					
L	2	CMD453	Seminar and Group Discussion Program	d, f	a, b, c
	8	CMD452	Project Phase-II	a, b, c, d, f	
T	6	MAL205	Num. Methods & Prob. Theory	a	
List of Electives offered second, third and final year					
T	6	CHL336	Polymer Engineering	b	
T	6	CML370	Environmental Engineering	b, c, e, h	
T	6	CML474	Plant Utility	a	d
T	6	CML471	biotechnology and Biochemical Engineering	g, i	
T	6	CHL369	Green Chemistry and Engineering	b, g, i	
T	6	CML375	Analytical Methods for Chemical Analysis	b, c	
T	6	CML374	Optimization Techniques	a, c	
T	6	CML376	Computational transport processes	a	
T	6	CML619	Computational methods in Chemical Engineering	a	
T	6	CML473	Safety and Risk Analysis	b, e, g	i
T	6	CML374	Petroleum Refinery Engineering	b, g	

T	6	CML62O	Membrane Technology	g, i	
T	6	CML475	New and Renewable Energy Engineering	g, h, i	a, b
T	6	CML47O	Computer Aided Design in Chemical Engineering	a, b	
T	6	CML621	Nanotechnology	g, i	d
T	6	CML472	Advanced Separation Process	a, g, i	
T	2	CMP472	Separation Technology	b, c, f	
T	6	CML480	CFD for chemical engineers	a, b, g, i	
T	6	CML 380	Industrial Waste Treatment	b, c	a
T	6	CMP 380	Industrial Waste Treatment Laboratory	c	a
T	6	CML 333	Polymer Processing	b, c	f, g, h
T	6	CML491	Project Planning and Management	d, f	a
T	6	CML468	Ore and minerals processing	b, c	a, e, f
T	6	CML299	Introduction to Computing software for Chemical Engineers	a, g, i	
T	6	CML467	Materials in chemical Industries	b, c	e, f

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

Programme curriculum grouping based on different components

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total number of credits	POs	PEOs
Mathematics	10- 15 %	30-48	30-48	(a), (b)	i, ii, iii
Sciences	10-15 %	30-48	30-48	(a), (c), (f)	i, ii, iii
Computing	10-15 %	30-48	30-48	(a), (b), (c), (f), (g)	i, ii, iii
Humanities	3-5 %	12-18	12-18	(d), (e), (g), (h), (i)	i, iv
Professional core	60-65 %	192-210	192-210	(a), (b), (c), (d), (e) (f), (g), (h), (i)	i, ii, iii, iv

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

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

During the core subjects the detail theoretical explanation is given to the students and complex numerical are solved in classes. All the core chemical engineering subjects are design in such a way that it will covers maximum possible knowledge required for good chemical engineers. To fulfil the need of chemical engineers some of the subjects are divided in two parts so that students can get the good exposure. Some core subjects are purely application based so that students can apply their knowledge efficiently and effectively. Overall it is observed that most of

the programme outcomes are take care by the entire core subject curriculum. The outline impacts of some of important core subjects are listed below.

The core subject 'Mechanical Operation' covers various mechanical operations used in process industry. The emphasis is on mechanical separation methods such as screening, filtration, sedimentation, transportation of solids etc and associated equipments used for achieving these methods.

The core subject 'Chemical Process Equipment Design' covers the methods and procedure adopted in designing process equipment. The emphasis here is on specifying the function, operation and size of the equipment and also on the choice of the material of construction and strength considerations.

In continuation of 'Chemical Process Equipment Design' we have core subject 'Chemical Plant Design' which specifically targets the application of knowledge gain in 'Chemical Process Equipment Design'. Students are given the knowledge about actual designing of process equipments and unit operation in this subject. More over students are updated with the various important factor related to economics of process chemical plant in this subject.

The core subject, 'Chemical Reaction Engineering – II' covers the application of 'Chemical Reaction Engineering – I' in understanding, flow pattern and non-ideal behaviour, heterogeneous catalytic, fluid – fluid, fluid – particles reactions and reactors. The emphasis here is on specifying the performance of specific cases for reaction engineering.

The core subject 'Process Modelling and Simulation' covers fundamental Laws, principles and uses as well as formulation of mathematical model. It also covers various mathematical models related to chemical engineering systems. The subject covers practical knowledge of simulation examples of core chemical engineering systems formulated by FORTRAN

The core engineering subjects (Mass Transfer-I and Mass Transfer-II) give learning and understanding skills towards the problems related to separation &

purification and in turn the approach to solve it by applying the concepts/principles learned in the curriculum.

The core subject 'Heat transfer-I' covers fundamental principles and applications of the three basic modes of conduction convection and radiation and how to identify, formulate, and solve engineering problems. The core subject 'Heat transfer-II' covers the fundamental theory for the analysis of heat transfer processes occurring in heat exchangers, evaporators, jacketed vessels, boilers, furnaces and reactors, reboilers, agitated vessels with and without coils, packed and fluidized beds.

The core subject 'Process Control and Instrumentation' provides introduction to process control and in depth discussion on process modelling. The methods of analysis used in the control area are so different from the previous experiences of students that the materials comes to be regarded as a sequence of special mathematics techniques, rather than the integrated design approach to a class of real and practically significant industrial problems.

The core subject 'Transport Phenomena' provides the good knowledge about the similarity and its application in the area of momentum transfer, heat transfer and mass transfer.

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)

Department of chemical engineering has very strong interaction with the reputed process industry and research organization. We all arrange the industrial visit every year so the student can understand and apply their classroom knowledge to greater extent. Some of the students are taking their internship during the winter and summer vacation

3.5. Curriculum Development (15)

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

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

Department of chemical engineering has very streamline procedures for designing programme curriculum. The need of all stockholders will be taken into account for designing. With permission of Board of Study (BOS), department head will form the local curriculum development committee (LCDC) To start with, LCDC, study the structure and components of similar courses offered by top universities of India and abroad. Then inputs are taken from interaction with the industry and interaction with alumni. LCDC then propose the suitable modification in programme curriculum which is then discussed with all departmental faculty in meeting for suitable input and modification. Further head will then form the full CDC which consists of all LCDC members and three members from outside dealing the similar programme preferably from IIT's, NIT's and IISc's. All the input related to modification will further discussed in full CDC and then it is taken to Board of Study (BOS) for any suggestions and changes. All these inputs are than proposed in VNIT Senate for final approval. After this final approval the programme curriculum is implemented in the department.

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

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

Students Feedback is taken at the end of the semester and every effort are met to improve and satisfy the need of the hour and students. The meeting of Board of Study (wherein Experts of R&D, Industry and Academia are invited) used to be conducted on regular basis to address the desired inputs for updating the syllabus. In addition, inputs from the students and faculty in Class Committee meetings, and input

of the faculty members in Department meetings are used to improve the 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

Here in continuation sample syllabus format of only one theory course and on laboratory course is show. The syllabus of all course listed above is shown at the end in appendix

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML 461**
Course Title	**: Transport Phenomena**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

This course mainly deals with application of knowledge gain by students in fluid mechanics, heat transfer and mass transfer. This subject also covers the topic which shows the similarity between fluid mechanics, heat transfer and mass transfer

II. Pre-requisites: Fluid mechanics, Heat Transfer and Mass Transfer

III. Textbooks:

1) R.B. Bird, W. Stewart and E.N Lightfoot, Transport Phenomena, John Wiley & Sons, 2nd Edition, 2006

2) C.O. Bennet and J.E. Myres, Momentum, Heat & Mass Transfer, McGraw Hills, 3rd Edition, 1994

3) R. Brodkey and H. C. Hershey, Transport Phenomena – A Unified Approach, volume 1, McGraw Hill Book Co., 2nd Edition, 1988

4) C.J. Geankoplis, Transport Processes and Separation Process Principles, Prentics Hall India Ltd., 4th edition, 2003

5) G.S. Laddha and T.E. Degaleesan, Transport Phenomena in Liquid Extraction, Tata McGraw Hill Book Co., 1st edition, 1978

IV. Objectives:

1) To understand the theoretical similarities between heat, mass and momentum transfer

2) To understand the shell balance approach for momentum transfer

3) To understand the shell balance approach for heat transfer

4) To understand the shell balance approach for mass transfer

5) Application for differential equation for shell balance modeling

V. Outcomes:

1) Student will understand the analogical correlation between heat, mass and momentum transfer. Using this information they can solve the problem in any area (e.g. momentum transfer) using corresponding logical data in other area (like head and mass transfer).

2) Velocity profile equation derived for given case can be used to estimate various important properties in momentum transfer.

3) Temperature profile equation derived for given case can be used to estimate various important properties in heat transfer.

4) Concentration profile equation derived for given case can be used to estimate various important properties in mass transfer.

5) Student can develop model equations for important properties in the area of momentum, heat and mass transfer.

VI. Expanded Course description:

Definition of transport properties, their measurement and estimation, velocity distribution in laminar and turbulent flow, shell momentum balances, flow of non-Newtonian fluids, development of boundary layer, flow over flat plates, and velocity profiles.

Similarity between heat, momentum and mass transport and mass transport and various analogies. Application of heat, momentum and mass transport concepts to various to various disciplines of engineering and technology.

One-dimensional equation of motion and continuity, Euler and Navier–stokes equation, dimensional analysis of equation change.

Shell balance approach for developing equations for momentum, heat and mass transport, Temperature distribution in solids and fluids in laminar flow, development of thermal boundary layer.

Concentration distribution in solids and in fluids in laminar flow, equations of change for multi component systems.

VII. Class Schedule : 3 Classes a week each of 55 minutes

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√		√	
2	√	√				√	√	√	
3	√	√				√	√	√	
4	√	√				√		√	
5	√	√						√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	20
End Semester Exam	3 hours	50

X. Chamber Consultation Hours

To be announce in the class

XI. Notice

To be announce in the class

Course Coordinator
CML461

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR

DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP 462**
Course Title	**: Chemical Reaction Engineering (Lab)**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

This course mainly deals with the understanding the basic fundamental principles of chemical reaction engineering by performing different experiments

II. Pre-requisites:

Chemical reaction engineering I, Chemical Reaction Engineering II

III. Textbooks:

1) Chemical Reaction Engineering, Octave Levenspiel, John Wiley & Sons, Singapore, 1998 3rd Edition
2) Elements of Chemical Reaction Engineering, Fogler H.S., Prentice-Hall, NJ, 2006, 4th Edition
3) Chemical Engineering Kinetics, Smith J. M., McGraw Hill, N Y, 1981, 3rd Edition

IV. Objectives:

1) To understand the basic principle of chemical reaction engineering

V. Outcomes:

1) Students will understand the basic of chemical engineering and its practical application.

VI. Expanded Course description:

1) Three CSTRS Connected in Series

Aim: Study the kinetics of reaction for all the combination for given three CSTR in series

2) PFR & CSTR in Series
Aim: Study the kinetics of reaction for all the combination for given PFR and CSTR in series

3) Isothermal Continuously Stirred Tank Reactor
Aim: To Study the performance of isothermal continuous stirred tank reactor for the reaction ethyl acetate and NaOH

4) Isothermal Plug Flow Reactor
Aim: To Study the performance of isothermal continuous stirred tank reactor for the reaction ethyl acetate and NaOH

5) R.T.D. Studies in Plug Flow Reactor
Aim: To plot the F-Curve and C- Curve for given Plug Flow Reactor

6) Semi Bath Reactor
Aim: To determine overall order of Reactions for bimolecular reactions

7) R.T.D. Studies in Series & Parallel CSTR
Aim: To plot the F-Curve and C- Curve for given Plug Flow Reactor

8) Adiabatic Batch Reactor
Aim: To study the kinetics of reaction adiabatically

9) Isothermal Batch Receiver
Aim: To find the Arrhenius constant

10) R.T.D. Studies in Packed Bed Reactor
Aim: To plot the F-Curve and C- Curve for given packed bed reactor

11) Condensation Polymerization Reactor
Aim: To study the polymerization reaction in given condensation polymerization reactor

12) Fluidized Bed Reactor
Aim: To study the performance of fluidized bed reactor.

VII. Total Experiments to be conducted : Any eight out of above list

VIII. Lab Schedule: Two hours per week.

IX. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1			√			√	√		

X. Evaluation of students

Component	**Duration**	**Weightage**
Internal	2 hrs per week	40
Assignments and Objective Test	-	30
Final Submission and viva	--	30

XI. Chamber Consultation Hours

To be announced in the class.

XII. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CMP 462

4. Students Performance (75)

Admission intake in the programme

Item	CAY (2013-14)	CAYm1 (2012-13)	CAYm2 (2011-12)	CAYm3 (2010-011)
Sanctioned intake strength in the program (N)	92	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)	86	88-6	87-10	88-5
Number of admitted students in 2nd year in the same batch via lateral entry (N2)	-	-	+2	-
Total number of admitted students in the program (N1+N2)	86	82	79	83

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 (2013-2014)	86	-	-	-	-
CAYm1 (2012-13)	82	74	70	72	65
CAYm2 (2011-12)	79	74	73	66	48
CAYm3(2010-11)	83	69	67	55	52
CAYm4(LYG) (2009-10)	73	62	52	54	57
CAYm5(LYGm1) (2008-09)	54	42	46	48	-
CAYm6(LYGm2) (2007-08)	58	39	48	-	-

*: Successfully completed implies zero backlogs

Success rate = 20 × mean of success index (SI) for past three batches
SI= (Number of students who graduated f r o m 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 (CAYm4) (2012-13)	LYGm1 (CAYm5) (20011-12)	LYGm2 (CAYm6) (2010-2011)
Number of students admitted in the corresponding First year + laterally admitted via lateral entry in 2nd year	73	54	58
Number of students who have graduated in the stipulated period	65	48	52
Success Index (**SI**)	0.890	0.888	0.896
API	7.441	7.411	7.5

Average SI = **0.891**

Success Rate = 20* Average SI = ...**17.82.....**

4.2. Academic Performance (20)

Item	LYG (CAYm4)	LYGm1 (CAYm5)	LYGm2 (CAYm6)
Approximating the API by the following mid –point analysis			
9< no. of student with CGPI<10.0	4	1	1
8< no. of student with CGPI<9	14	13	18
7< no. of student with CGPI<8	25	18	22
6< no. of student with CGPI<7	20	11	7
5< no. of student with CGPI<6	2	5	4
Total	65	48	52
Approximating API by Mid –CGPA	483.72	355.76	394.08
Mean of CGPA/ Percentage of all the students (API)	7.441	7.411	7.578

Assessment = 2 x API =2 x 7.47 = **14.95**
Av. Assessment for three years

4.2.1. Placement and Higher Studies (20)

Assessment Points = 20 × (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 (2012—13)	LYGm1 (2011-12	LYGm2 (2010-11)
Number of admitted students corresponding to LYG including lateral entry (N)	73	54	58
Number of students who obtained jobs as per the record of placement office (x1)	41	34	40
Number of students who found employment otherwise at the end of the final year (x2)	2	3	3
x = x1 + x2	43	37	43
Number of Students who opted for higher studies with valid qualifying scores/ranks (y)	6	5	7
Assessment Point	13.835	16.018	17.844

Average assessment points = _____**15.899**_____

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).

- Professional Chapter: IIChE students Chapter, VNIT Nagpur was inaugurated on 17th January 2013. It is functioning under the mentorship of Nagpur regional centre of IICHE. This chapter will encourage the students to do co- curricular activities in the field of chemical engineering.

- Engineering event : The event of 'Turboflex' was organized in collaboration with IICHE student chapter in 'Axis' the technical festival of VNIT Nagpur during September 21st to 23rd 2013.

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

- Poster session exclusively for student was arrange in National Conference on Green Chemistry 2013

4.3.3. Publication of technical magazines, newsletters, etc. (3)

- Publication of department newsletter ' C-NAPSE' (Publised on 17th January 2013 in the department of chemical engineering)

(Instruction: The institution may list the publications mentioned earlier along with the names of the editors, publishers, etc.).

4.3.4. Entrepreneurship initiatives, product designs, and innovations (3)

- Around 100 student of our department are active members of E- cell at institute level. In E- cell students interact with successful entrepreneurs (at national /international level) through organizing talks and Panel discussion. Four student of chemical engineering are in core organizing committee of national conference to be held in 10-12 January 2014 by E –cell.

(Instruction: The institution may specify the efforts and achievements.)

4.3.5. Publications and awards in inter-institute events by students of the programme of study (3)

Year	EVENT / CONFERENCE DETAILS
2012-13	• One Paper published by Pavana Sindhu (final year) ,'Synthesis and Characterization of Pindolol Imprinted Polymer', Journal of Transactions of the Indian Institute of Metals Volume-66, Issue-4, pp-349-352. • Ist Prize in paper presentation at LIT Nagpur

	Surfocorrenza Polyimpetus-2k13a technical event • Best Poster Award in National Conference on Green Chemistry 2013 • Ist prize in Technodox Axis 13 • 1st prize in Elixir 2013 paper on job attrition in organized by data meghe Institute. • 1st prize in Axis 2013 in the event 'Who is the Best' • Winners at the city level for Chemical engineering quiz competition under Azeotropy 2013 organized by IIT Bombay
2011-2012	• 2nd Prize in Technodox Axis12 • Presented poster in workshop organised by National Chemical Laboratory Pune • One Paper published in International Conference by Sai Kiran on 'Thermo Physical Characterization of Paraffin based Fe_3O_4 Nanofluids, in (NUiCONE 2012,International Conference) • One Paper published in journal by Sai Kiran (final year student)on Thermo –physical properties of water bases Fe_3O_4 nanofluids, in Carbon Science and technology (ASI) ISSN 0974 – 0546 accepted on 10/8/12. • One Paper published in journal by Kartik Totlani, Raj Mehta, Comparative study of adsorption of Ni (II) on RHA and Carbon Embedded Silica obtained from RHA, Chemical Engineering Journal, 181-182 (2012)376–386
2010-2011	• Ambuj Kumar Singh, Saurabh P Singh, , Modelling of

	gravel filtrations bed' Proceedings of International Conference On Challenges and Applications of Mathematics In Science and Technology at NIT Rourkela on 11-13 January 2010 • Jyoti S. Mahale, , Estimation of flash points for alcoholic group organic compounds, Proceedings of International Conference On Challenges and Applications of Mathematics In Science nd Technology at NIT Rourkela on 11-13 January 2010 • Ankur Rastogi, Sudhir Rai, , Modelling of thermal convection in fluid superposed porous layers heated from below, Proceedings of International Conference On Challenges and Applications of Mathematics In Science and Technology at NIT Rourkela on 11-13 January 2010 • Prithwish Chatterjee, Shashi Bhushan Sinha, , Viscosity co-relation of oils with temperature, Proceedings of International Conference On Challenges and Applications of Mathematics In Science and Technology at NIT Rourkela on 11-13 January 2010 • Amit Kumar, Chinmay Pathak, Sachin Mandavgane, Viscosity co-relation of coolant with temperature, Proceedings of International Conference On Challenges and Applications of Mathematics In Science and Technology at NIT Rourkela on 11-13 January 2010

(Instruction: The institution may provide a table indicating those publications, which fetched awards to students in the events/conferences organized by other institutes. A tabulated list of all other student publications may be included in the appendix.)

5. Faculty Contributions (175)

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

Name of the faculty	Qualification, university, and year of graduation	Designation and date of joining the institution	Distribution of teaching load (hrs/week)			Number of research publications in journals and conferences since joining	IPRs	R&D and Consultancy work with amount	Holding an incubation unit	Interaction with outside world
			1st Y	UG	PG					
Dr. K. L. Wasewar	PhD ICT Mumbai 2004	Associate Professor 30-12-2008		27(2010) 27(2011) 23.5 (2012) 21(2013)		SCI/SCIE : 38 Other : 33 Ind. Conf. : 46 Abroad Conf. : 09		Rs. 8.6 lakh (2008-10) Rs. 22 lakh (2010-2013) Rs. 56180/- (2013)		02
Dr. S. A. Madavagane	PhD LIT Nagpur 2008	Associate Professor 13-05-2010 Assistant Professor 28-11-2008 to 12-05-2010		12(2010) 10(2011) 10(2012) 10(2013)		SCI/SCIE : 07 Other : 01 Ind. Conf. : 20		Rs. 22.01 lakh (2010-13) Rs. 22.06 lakh (2012-14) Rs. 22.6 lakh (2013-16)		
Dr. A. S. Chaurasia	PhD BITS Pilani, 2004	Associate Professor 27-11-2012		18.5 (2013)		Ind. Conf. : 05				02
Dr. D. Z. Shende	PhD VNIT, Nagpur 2012	Assistant Professor 18-07-2008		23(2010) 22(2011) 23(2012) 21(2013)		SCI/SCIE : 08 Other : 03 Ind. Conf. : 09		Rs. 22 lakh (2010-2013) Rs. 56180/- (2013)		01

Prof. A. P. Rathod	PhD (Ongoing) VNIT, Nagpur	Assistant Professor 22-07-2008		28(2010) 28(2011) 28(2012) 22(2013)		SCI/SCIE : 04 Other : 02 Ind. Conf. : 05 Abroad Conf. : 03	Nil	Nil	Nil	Nil
Dr. S. S. Sonawane	Ph.D. UDCT NMU,2000	Assistant Professor 24-11-2008		32(2010) 26(2011) 22(2012) 10(2013)		SCI/SCIE : 17 Other : 10 Ind. Conf. : 29 Abroad Conf. : 06				
Prof. S. M. Kodape	Ph.D.(pursuing) Sant Gadge Baba University Amravati,	Assistant Professor 24-11-2008		20(2010) 20(2011) 20(2012) 20(2013)		Ind. Conf. : 05 Abroad Conf. : 01				
Prof. S. P. Tajane	PhD (Ongoing) VNIT, Nagpur	Assistant Professor 28-11-2008		33(2010) 31(2011) 24(2013)		Ind. Conf. : 01		Rs. 22.6 lakh (2013-16)		
Dr. M. N. Varma	PhD IISc Bangalore 2009	Assistant Professor 01-06-2009		23.5 (2010) 25(2011) 25(2012) 23.5 (2013)		SCI/SCIE : 02 Abroad Conf. : 02		Rs. 22 lakh (2010-2013) Rs. 56180/- (2013))		
Dr. Vidyasagar S.	Ph.D., IIT Madras, 2008	Assistant Professor 09-04-2012		8.5(2012) 16.5 (2013)		SCI/SCIE : 03				01
Dr. VijayaKumar R. P.	PhD, IIT Bombay, 2011	Assistant Professor 11-05-2012		09(2012) 27(2013)		Ind. Conf. : 02 Abroad Conf. : 01				

(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)

STR is desired to be 15 or superior
Assessment = 20 × 15/STR; subject to maximum assessment of 20
STR= (x + y + z)/N1
where, x = Number of students in 2nd year of the programme
y = Number of students in 3rd year of the programme
z = Number of students in 4th year of the programme
N1 = Total number of faculty members in the programme (by considering fractional load)

Year	x	y	z	x+y+z	N1	STR	Assessment (Max. is 20)
2010-11	74	60	60	194	08+2*	19.4	15.5
2011-12	84	74	60	218	08+2*	21.8	13.8
2012-13	85	84	74	243	11+2*	18.7	16.1
						Average Assessment	**15.1**

* Two faculty members of other department (Chemistry and Maths) take few core/elective subjects and laboratory.

For Item nos. 5. 2 to 5. 8, the denominator term (N) is computed as follows:

N = Maximum {N1, N2}
N1 = Total number of faculty members in the programme (considering the fractional load)
N2 = Number of faculty positions needed for student-teacher ratio of 15.

Year	N1	N2	N = Max (N1, N2)
2010-11	10	12.9	12.9
2011-12	10	14.5	14.5
2012-13	13	16.2	16.2

5.2. Faculty Cadre Ratio (20)

Assessment = 20 × CRI
where, CRI = Cadre ratio index
= 2.25 × (2x + y)/N; subject to max. CRI = 1.0
where, x = Number of professors in the programme
y = Number of associate professors in the programme

Year	x*	y+	n	CRI	Assessment
2010-11	2+1	5+1	12.9	1 (2.1)	20 (41.9)
2011-12	2+1	5+1	14.5	1 (1.9)	20 (37.2)
2012-13	3+1	8+1	16.2	1 (2.4)	20 (47.2)
				Average Assessment	20 (42.1)

* Associate Professor
+ Assistant Professor

5.3. Faculty Qualifications (30)

Assessment	=	3* FQI
Where CRI	=	Faculty Qualification Index
	=	$(10x+6y+4z_O)/N2$ Such that , $x+y+ z_O <= N2$; and $z_O <= z$
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

Year	x	y	n	FQI	Assessment
2010-11	5+2	3	12.9	6.8	20.5
2011-12	5+2	3	14.5	6.1	18.2
2012-13	11+2	2	16.2	8.8	26.3
				Average Assessment	21.7

5.4. Faculty Competencies correlation to Programme Specific Criteria (15)

(Provide evidence that program curriculum satisfies the applicable programme criteria specified by the appropriate American professional associations such as ASME, IEEE and ACM. You may list the programme specific criteria and the competencies (specialisation, research publication, course developments etc.,) of faculty to correlate the programme specific criteria and competencies)

- The Chemical Engineering curriculum is comparable with various top US universities.
- Faculty members are specialized in various fields of chemical engineering such as Process Intensification, Separation Processes, Environmental Engineering, Polymer Engineering, Membrane Separation Technology, Supercritical Extraction, Nanotechnology, Reaction Engineering etc.
- Department of Chemical Engineering have sufficient number of research publications in the areas relevant to different courses in curriculum (more than 40 international referred journals in last three years).

- Course development is done through various inputs received from students' feedback, experts from academic and industry, faculty members, various meeting related to academic etc.
- On regular basis faculty members undergone workshop/training programme in different fields of chemical engineering to upgrade their skills.
- Various experts from reputed academic and research institutes and industries have been visited regularly and have the interaction with faculty members and students. Through this interaction faculties get motivated to diversify their skills.

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 faculty	Max. 5 per faculty		
	2010-11	2011-12	2012-13
Dr. K. L. Wasewar	5	5	5
Dr. S. A. Madavagane	--	--	3
Dr. A. S. Chaurasia	--	--	5
Dr. D. Z. Shende	5	5	5
Prof. A. P. Rathod	3	5	5
Dr. S. S. Sonawane		--	5
Prof. S. M. Kodape	5	5	5
Prof. S. P. Tajane	--	--	5
Dr. M. N. Varma	--	3	5
Dr. Vidyasagar S.	--	5	5
Dr. VijayaKumar R. P.	--	--	5
Sum	18	28	53
N(Number of faculty positions required for an STR)	12.9 – 2*	14.5 – 2*	16.2 – 2*
Assessment = 3x Sum/N	5.0	6.7	11.2
Average assessment			7.6

* Two faculty members of other department (Chemistry and Maths) take few core/elective subjects and laboratory.

5.6. Faculty Retention (15)

Assessment = 3 × RPI/N
where RPI = Retention point index
= Points assigned to all faculty members

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

Item	2010-11	2011-12	2012-13
Number of faculty with experience of less than l year (X_0)	0	0	0
Number of faculty with 1 to 2 years experience	0	0	0
Number of faculty with 2 to 3 years experience	1	0	0
Number of faculty with 3 to 4 years experience	0	1	
Number of faculty with 4 to 5 years experience	3	0	3
Number of faculty with more than 5 years experience (X_5)	4	7	8
N	10.9	12.5	14.2
RPI = X1+2X_2 + 3X_3 + 4X_4 + 5X_5	34	38	52
Assessment	9.4	9.1	11.0
Average assessment			9.8

5.7. Faculty Research Publications (FRP) (20)

Assessment of FRP = 4 × (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 (contributing to FRP)	FRP points (Max. 5 per faculty)		
	2010-11	2011-12	2012-13
Dr. K. L. Wasewar	5	5	5
Dr. S. A. Madavagane	2	4	1
Dr. A. S. Chaurasia	--	--	--
Dr. D. Z. Shende	5	--	5
Prof. A. P. Rathod	2	--	--
Dr. S. S. Sonawane	5	1	5
Prof. S. M. Kodape	--	--	--
Prof. S. P. Tajane	--	--	--
Dr. M. N. Varma	--	--	5
Dr. Vidyasagar S.	--	--	--
Dr. VijayaKumar R. P.	--	--	3
Sum	19	10	24
N(Number of faculty positions required for an STR of 15)	10.9	12.5	14.2
Assessment FRP = 4x Sum/N	7.0	3.2	6.8
		Average assessment	5.6

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)		
	2010-11	2011-12	2012-13
	--	--	--
	--	--	--
Sum	--	--	--
N	--	--	--
Assessment FIPR = 2x Sum/N	--	--	--
		Average assessment	00

5.9. Funded R&D Projects and Consultancy (FRDC) Work (20)

Assessment of R&D and consultancy projects = 4 × (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 (contributing to FRDC)	**FRDC points (Max. 5 per faculty)**		
	2010-11	2011-12	2012-13
Dr. K. L. Wasewar Dr. M. N. Varma Dr. D. Z. Shende	5	5	5
Dr. S. A. Madavagane	5	5	5
Sum	10	10	10
N	10.9	12.5	14.2
Assessment FPPC = 4x Sum/N	3.7	3.2	2.8
Average assessment			3.2

5.10. Faculty Interaction with Outside World (10)

FIP = Faculty interaction points

Assessment = 2 × (Sum of FIP by each faculty member)/N (Instruction: A faculty member gets maximum 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 (contributing to FIP)	**FIP points**		
	2010-11	**2011-12**	**2012-13**
Dr. K. L. Wasewar	5	5	5
Dr. S. A. Madavagane	--	--	--
Dr. A. S. Chaurasia	--	--	5
Dr. D. Z. Shende	--	5	5
Prof. A. P. Rathod	--	--	--
Dr. S. S. Sonawane	--	--	--
Prof. S. M. Kodape	--	--	--
Prof. S. P. Tajane	--	--	--
Dr. M. N. Varma	--	--	--
Dr. Vidyasagar S.	--	--	5
Dr. VijayaKumar R. P.	--	--	--
Sum	5	10	20
N	10.9	12.5	14.2
Assessment FIP = 2x Sum/N	0.9	1.6	2.8
Average assessment			1.8

6. Facilities and Technical Support (75)

Description of class rooms, faculty rooms, and conference halls: Entries in the following

Room Description	Usage	Shared/ Exclusive	Capacity	Room Equipped with
Class Room No: CHE 002	Class room For Final Year	Exclusive	120	38 desk & benches in good condition, green board, Projector & screen, PA system, podium, table, chair, inbuilt cupboard and shelves, fans, exhaust fans, tube lights, glass windows , curtains.
Class Room No: CHE103	Class room For Third Year	Exclusive	120	38 desk & benches in good condition, green board, Projector & screen, PA system, podium, table, chair, inbuilt cupboard and shelves, fans, exhaust fans, tube lights, glass windows , curtains.
Class Room No : CHE104	Class room For Second Year	Exclusive	120	38 desk & benches in good condition, green board, Projector & screen, PA system, podium, table, chair, inbuilt cupboard and shelves, fans, exhaust fans, tube lights, glass windows , curtains.
Tutorial Room No: CHE003	Used for Second, Third and Final year	Shared	80	25 desk & benches in good condition, green board, Projector & screen, PA system, podium, table, chair, inbuilt cupboard and shelves, fans, exhaust fans, tube lights, glass windows , curtains.
Tutorial Room No: CHE004	Used for Second, Third and Final year	Shared	80	25 desk & benches in good condition, green board, Projector & screen, PA system, podium, table, chair, inbuilt cupboard and shelves, fans, exhaust fans, tube lights, glass windows , curtains.
Seminar Room No: CHE004	Seminar for UG, PG, PhD, Guest/Expert Lectures, students	Shared	30	30 well equipped chairs in good condition, table, white board, Projector & screen, podium, inbuilt cupboard and

	Activity, Technical activity			shelves, air conditioner, fans, tube lights, glass windows, curtains.
Meeting Room No: CHE004	Departmental meeting, class committee meetings, BOS meetings, interaction with outside technical expert, for counseling the students	Shared	25	25 well equipped chairs with rectangular type of table arrangements, green board white-board, projectors & screen, watch, curtains, air conditioner, proper air conditioner, fans.
Faculty Room No: CHE007,CHE008, CHE009,CHE010, CHE013,CHE014, CHE015,CHE016, CHE113,CHE114, CHE115,CHE116, CHE 107,CHE 108, CHE 109, CHE 110	For academic work, Discussion, Counseling of Students	Exclusive	1/room	Computer with internet connection UPS, printer, almirah, inbuilt cupboards/shelves, book rack ,telecom facility, pin/writing board All necessary electric appliances
HOD Cabin & Office No: CHE001	Administration, Meeting with faculty, personal usage & accommodation, Discussion and counseling of Students and faculty, For academic work of HOD, to monitor the Departmental activities, to monitor work assign to respective faculties.	Exclusive	10	Computer with internet connection, printer, table, chairs, sofa set, almirah, A.C., inbuilt cupboards/shelves for record keeping, book rack., air conditioner, fan, Xerox machine, fax machine, scanner,
Research Room No : CHE101,CHE102,CHE117	Used for UG, PG, PhD students for research work, analysis the sample	Exclusive	5/ room	Computer with internet connection, printer, table, chairs, air conditioner, fan, sophisticated analytical instruments such as GC,HPLC,UV Spectrometer, TG, DSC, DMA etc.

6.1. Class rooms in the department (20)

6.1.1. Adequate number of rooms for lectures (core /electives), seminar, tutorials, etc., for the programme.

- Department has Three classrooms for conducting lectures.
- Eight number of laboratories for conducting practical.
- One seminar room is available in the department.
- Two tutorial rooms are available in the department.
- Three research rooms.
- Lift and slope ramp for handicapped students
- Store rooms for consumables.

Room Description	Number	Shared / Exclusive	Area	Capacity
Class Rooms	03	Exclusive	188.48 sq. m. (per classroom)	120
Tutorial Room	02	Exclusive	95.914 sq. m. (per room)	90
Laboratories	08	Exclusive	91.725 sq. m. (per laboratory)	20 students / Batch
Departmental Seminar Room	01	Exclusive	46.24 sq. m.	30
Departmental Meeting Room	01	Exclusive	46.24 sq. m.	30

6.1.2 Teaching aids multimedia projectors, etc.

For teaching learning process following facilities are available in the department.

- Green board
- Projector & Screen/laptop
- Internet connection
- PA system

6.1.3 Acoustics, classroom size, conditions of chairs,/benches, air circulation, lighting, exits, ambience, and other amenities/facilities

A conducive and spacious class rooms equipped with the following facilities are available:

- Green board
- Projector & Screen/laptop
- Internet connection
- PA system
- Class room size: min 188.48 sq m
- Well maintain desk and benches
- Proper air circulation and lighting
- Glass Windows ,curtains
- Audibility and the overall ambiance are good for conducting lectures

6.2 Faculty rooms in the department (15)

6.2.1. Availability of individual faculty rooms.

- The department has one well equipped HOD cabin of area 21.041 sq.m & office area 14.966 sq.m.
- The cabin is spacious enough to accommodate 10 people for conducting faculty and departmental meeting.
- HOD cabin has a waiting lounge for visitors, staff and students.
- Faculty rooms can accommodate 4 people (1 faculty + 3 visitors).
- Faculty rooms are equipped with following facilities are available in the department:
- Desktop (Per Faculty)
- Printer
- Internet connection
- Telecom facility
- Inbuilt cupboards/shelves
- Almirah
- Book Rack

6.2.2 Room equipped with white/black, computer, internet, and other such amenities/facilities

HOD Cabin and faculty rooms are equipped with following facilities is available in the department:

- Desktop
- Internet connection
- Printer
- UPS Backup
- Telecom facility
- Table and Chairs
- Inbuilt cupboards/shelves
- Writing/pin board

6.2.3. Usage of room for discussion/ counseling with students

Department has implemented a teacher guardian scheme for all semesters. Under this scheme: Discussion/counseling with students is done by respective faculties which are assigned for a particular group of students. Under this scheme an informal meeting of the guardian faculty with the students is set up monthly in classroom/tutorial room/faculty room/ laboratory. In the meeting counseling regarding personal problem, carrier planning, preparation for competitive examinations, professional ethics, etc are being discussed by the faculties and students.

6.3 Laboratories in the department to meet Curriculum and the Pos (25)

6.3.1. Adequate, well- equipped laboratories to meet the Curriculum Requirements and the POs (10)

Department has eight (08) laboratories equipped with PC and internet connection, UPS backup, drain line, first-aid box and fire extinguisher in order to fulfill the curriculum requirements.

Laboratory description in the curriculum	Exclusive use/Shared	Space area, No of Students	Number of Experiments	Quality of Instruments	Laboratory Manual
Fluid Mechanics (CHE019)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	13	Excellent	Yes
Heat Transfer (CHE020)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	10	Excellent	Yes
Mechanical Operation (CHE021)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	13	Excellent	Yes
Mass Transfer (CHE022)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	18	Excellent	Yes
Separation technology & Analytical Technology (CHE118)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	08	Excellent	Yes
Modeling Simulation (CHE119)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	37 PC	Excellent	Yes
Chemical reaction Engineering (CHE120)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	12	Excellent	Yes
Process Control & Instrumentation(CHE121)	Exclusive	(Area: 91.725 sq.m), 20 students (Per Batch)	11	Excellent	Yes

6.3.2. Availability of computing facilities in the department (5)

The department has separate computing facilities for performing practical of modeling simulation and performing projects work in any allotted on softwares available in the lab. with following facilities:

Sr. No.	Item	Specification	Number/Quantity
01	Computers	Core 2 Duo	37
02	Internet connection	Lease Line 40 -70 Mbps	37
03	Printer	Laser jet	01
04	Projector	Overhaed	01
05	Softwares	Chemcad, Aspen Hysis, Unisim, Matlab etc.	04

6.3.3. Availability of laboratories with technical support within and beyond working hours (5)

- The laboratories are available to the students anytime during the working hours. Lab in-charge and the concerned Lab assistant are available full time to provide technical support to the students.
- The laboratories are also available to the students beyond the working hours as and when required along with the technical support from the faculties and technical assistants.
- Laboratories and Seminar room are available beyond the working hours especially for conducting experiments related to UG project works and for conducting add-on courses and workshops

6.3.4. Equipment to run experiments and their maintenance, number of students per experimental setup, size of laboratories, overall ambience, etc.(5)

- All the laboratories are well equipped with uninterrupted power supply.
- Regular and preventive maintenance of the equipments is carried out at the beginning and at the end of each term.
- Number of students per experimental set up is 3-4
- A good light ventilation exhaust and drainage facilities is provided in the laboratories.
- The equipments are spaced appropriately in each laboratory.

- Each laboratory is provided with computer, internet connection, UPS backup , Printer
- Provision of water and drainage line in each laboratory
- Each lab is attached with two store rooms ,area of each 9 sq.m & 8.31 sq.m.

Name of the Laboratory	Size (Sq.m)	Major Equipment
Fluid Mechanics	(Area: 91.725 sq.m),	• Packed bed • Venturimeter • Orifice meter • Pitot tube • Loss due to pipe fittings • Fluidized bed characteristics • Impact of jet on vanes • Study of pressure measurement • Flow measurement through notch • Two phase flow • Pipe friction • Wind tunnel • Jet loop reactor
Mechanical Operation	(Area: 91.725 sq.m)	• Jaw crusher • Vibrating screen • Plate and frame filter press • Ball mill • Sieve shaker • Vacuum filter • Rotary vaccum filter • Froth floatation cell • Magnetic separator • Power consumption in agitated vessel • Cyclone separator • Drag coefficient apparatus • Centrifuge
Mass Transfer	(Area: 91.725 sq.m),	• Packed bed absorption column • Fluidized bed dryer • Steam distillation • Solid liquid extraction (packed

		bed) • Solid gas diffusion Apparatus • Liquid Liquid Extraction column • Cooling tower • Wetted wall column • Sieve tray distillation column • Vaccum tray dryer • Adsorption column • Atmospheric tray dryer • Rotory dryer • Liquid Liquid extraction in spray tower • Liquid air diffusion apparatus • Packed distillation column • Vapor-Liquid equillibrium set up • Batch crystallizer
Heat Transfer	(Area: 91.725 sq.m),	• Shell and tube heat exchanger • Plate type heat exchanger • Heat Tranfer in agitated vessel • Heat Transfer through lagged pipe • Stefan Boltzman Apparatus • Emissivity Measurement Apparatus • Parallel flow counter flow heat exchanger • Heat Transfer Through Forced Convection • Heat Transfer Through Natural Convection • Open pan evaporator
Separation technology & Analytical Technology	(Area: 91.725 sq.m),	• FTIR • UV-VIS Spectrophotometer • HPLC • Membrane Bioreactor • GC • GCMS • Aerobic Fermentor • Pervaporation reactor

Computer Lab for Modeling & Simulation	(Area: 91.725 sq.m),	(PC-35) Computers with latest config. • Gravity flow tank • Three CSTR in series (open loop) • Three CSTR in series (closed loop) • Non isothermal CSTR • Complex Reaction scheme(Batch reactor) • Second order complex batch reactor • Series-parallel scheme • Semi-batch reactor model
Chemical Reaction Engineering	(Area: 91.725 sq.m),	• Cascade CSTR • Combined Flow Reactor • Isothermal CSTR • Isothermal PFR • RTD Study in PFR • Isothermal Semi Batch Reactor • RTD Study in CSTR • Adiabatic Batch Reactor • Liquid Phase Chemical Reactor • Emulsion Polymerization Reactor • Condensation Polymerization Reactor • Packed Bed Reactor
Process Control & Instrumentation	(Area: 91.725 sq.m),	• Interacting and Non interacting system • Flapper Nozzle Trainer • Study of first order& second order system • Control valve characteristics • Water temperature control System Trainer • Level Measurement set up by air purge method • Determination of time constant of thermocouple and thermometer

		• Temperature measurement • Multi process control system trainer • Pressure control trainer • Muffle furnace with PID controller

6.4 Technical manpower support in the Department (15)

All the supporting staff has given a time bound promotions as per fulfillment of their experience. They are periodically deputed for skill-up gradation through-

- Workshops and seminars
- Professional courses
- Advanced training programmes on sophisticated equipment and instruments.

Name of the Technical Staff	Designation (Pay-Scale)	Exclusive/ Shared Work	Date of Joining	Qualification		Other Technical skills gained	Responsibility
				At joining	Now		
B.M. Raut	Sr Assistant (12250) /-	Exclusive	July 1984	S.S.C	Same	-	Office Work
G.B. Ambalwar	Lab Attendant/Supporting Staff (9840) /-	Exclusive	Sept 1987	IXth Pass	Same	-	Office Work
P. S . Tiwari	Lab Attendant/Supporting Staff (8600) /-	Exclusive	Jan 1994	IXth Pass	Same	-	Office Work

6.4.1. Availability of adequate and qualified technical supporting staff for programme specific laboratories

Well experienced following technical supporting staffs are available for up-keep and maintenance of laboratories and departmental nonacademic work. Laboratory Assistant: 04

Laboratory	Technical supporting Staff	Number of experiments	Work Responsibilities
Fluid Mechanics & Mechanical Operation	D. M. Gautam	24	Lab Maintenance Practical Assistance
Heat Transfer & Mass Transfer	A. V. Shambharkar	29	Lab Maintenance Practical Assistance
Process Control Instrumentation & Modeling Simulation	V. M.Zodpe	20	Lab Maintenance Practical Assistance
Separation technology Analytical technology & chemical Reaction Engineering	D. U. Devikar	19	Lab Maintenance Practical Assistance

6.4.2 Incentives, skill-up gradation and professional advancement

All the supporting staff has given a time bound promotions as per fulfillment of their experience. They are periodically deputed for skill-up gradation through-

- Workshops and seminars
- Professional courses
- Advanced training Programmes on sophisticated equipment and instruments

Name of the Technical Staff	Designation (Pay-Scale)	Exclusive/ Shared Work	Date of Joining	Qualification		Other Technical skills gained	Responsibility
				At joining	Now		
D.M. Gautam	Lab Assistant (Rs.14900 Consolidated)	Shared work	25 Aug 2010	MSc. M.Phil. (Chemistry)	Same	Dip. in IT	Lab Maintenance, other official work
D.U. Devikar	Lab Assistant (Rs.14900 Consolidated)	Shared work	25 Aug 2010	B.E. (Chemical Engg)	Same		Lab Maintenance, other official work
V.M. Zodpe	Lab Assistant (Rs.14900 Consolidated)	Shared work	12 July 2011	B.E. (Chemical Engg)	Same		Lab Maintenance, other official work
A.V. Shambharkar	Lab Assistant (Rs.14900 Consolidated)	Shared work	6 Aug 2012	Poly, B.E. (Chemical Engg.)	Same		Lab Maintenance, other official work

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

Students' Admission

Admission intake (for information only)

Item	CAY 2012-13	CAYm1 2011-12	CAYm2 2010-11	CAYm3 2009-10
Sanctioned Intake Strength in the Institute (N)	738	738	738	652
Number of students admitted on merit basis (N1)	713	724	713	617
Number of students admitted on management quota / otherwise (N2)	48	14	45	54
Total number of admitted students in the Institute (N1+N2)	761	738	758	671

(Instruction: The intake of the students during the last three years against the sanctioned capacity may be reported here.)

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)	2012-13	2011-12	2010-11	2009-10
01	1-20000	410	436	411	367
02	20000-40000	136	137	130	105
03	40000-60000	49	30	47	29
04	60000-80000	48	38	38	36
05	80000-100000	27	37	29	22
06	100000-150000	21	19	26	25
07	150000-200000	8	12	10	14
08	200000-300000	9	6	4	11
09	300000-400000	1	3	4	1
10	400000-500000	1	2	3	0
11	500000-600000	2	1	2	0
12	600000-700000	1	1	0	0
13	Admitted without AIEEE ranks (foreign nationals)	48	15	45	53
	Total	**761**	**737**	**749**	**663**

(Instruction: The admission quality of the students in terms of their ranks in the entrance examination may be presented here.)

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. S.S. Umare	Ph.D/M.Sc./M.Phil	Professor	23/8/96	Chemistry	--	30	70
2.	Dr. J.D. Ekhe	Ph.D/M.Sc../M.Phil	Associate Professor	24/7/96	Chemistry	--	53.3	46
3.	Dr. (Mrs.) Anupama Kumar	Ph.D/M.Sc./M.Phil	Associate Professor	7/1/2000	Chemistry	--	50	50
4.	Dr. Sujit Kumar Ghosh	Ph.D/M.Sc.	Associate Professor	4/7/12	Chemistry	21	--	79
5.	Dr. (Mrs.) Ramani V. Motghare	Ph.D/M.Sc.	Assistant Professor	17/05/06	Chemistry	18	82	--
6.	Dr. Chayan Das	Ph.D/M.Sc./Net	Assistant Professor	30/05/06	Chemistry	28	10	62
7.	Prof. Atul V. Wankhede	M.Sc./Net	Assistant Professor	26/05/09	Chemistry	88	--	12
8.	Dr. Sangesh P. Zodape	Ph.D/M.Sc.	Assistant Professor	02/04/12	Chemistry	--	--	100
9.	Dr. Umesh Rohidas Pratap	Ph.D/M.Sc.	Assistant Professor	25/5/12	Chemistry	88	--	12
10	Dr. (Mrs.) Sonali Umre	Ph.D/M.Sc.	Assistant Professor		Chemistry	91.67	--	8.33
11	Shri Parag Panse	M.Tech.	Assistant Professor		Chemistry	89.66	--	10.34
12	Dr. V.K. Deshpande	Ph.D/M.Sc.	Professor & Head	03/08/88	Applied Physics	68.6	15.7	15.7
13	Dr. R.S. Gedam	Ph.D/M.Sc.	Associate Professor	28/08/98	Applied Physics	40	30	30
14	Dr. B.R. Snkapal	Ph.D/M.Sc.	Associate Professor	10/05/12	Applied Physics	37	--	63
15	Dr. G. Hemachandra	Ph.D/M.Sc	Associate	22/05/12	Applied	84	--	16

		.	Professor		Physics			
16	Dr. (Mrs.) S.R. Patrikar	Ph.D/M.Sc.	Assistant Professor	16/05/06	Applied Physics	74	--	26
17	Dr. (Mrs) A. V. Deshpande	Ph.D.	Assistant Professor	16/05/06	Applied Physics	52	12	36
18	Dr. (Mrs.) S.M. Giripunje	Ph.D/M.Sc.	Assistant Professor	07/10/08	Applied Physics	53	--	47
19	Dr. K. Mohan Kant	Ph.D/M.Sc./M.Tech	Assistant Professor	14/06/12	Applied Physics	71.5	--	28.5
20	Dr. G.P. Singh	Ph.D.	Professor	27/03/95	Mathematics	15	35	50
21	Dr. P. Pramod Chakravarthy	Ph.d.	Associate Professor	31/05/06	Mathematics	25	25	50
22	Dr. M. Devakar	Ph.D.	Assistant Professor	24/11/08	Mathematics	25	25	50
23	Dr. Pallavi Mahale	Ph.D.	Assistant Professor	27/11/08	Mathematics	--	50	50
24.	Dr. G. Naga Raju	Ph.D.	Assistant Professor	1/7/10	Mathematics	25	25	50
25.	Dr. R. P. Pant	Ph.D.	Assistant Professor	25/6/12	Mathematics	25	25	50
26	Dr. Pradip Roul	Ph.D.	Assistant Professor	13/8/12	Mathematics	25	25	50
27	Dr. Malabika Adak	Ph.D.	Teaching Assistants	16/7/13	Mathematics	40	20	40
28	Mrs. Shweta Jain	M.Phil	Teaching Assistants	17/7/13	Mathematics	40	20	40
29	Mr. Mohd. Ahmed	M.Sc.	Teaching Assistants	18/7/13	Mathematics	50	50	--
30	Mr. Pravin Sayre	M.Sc.(Net Qualified)	Teaching Assistants	16/7/13	Mathematics	75	25	--
31	Mr. Samala Ratan	M.Sc.	Teaching Assistants	22/7/13	Mathematics	100	--	--
32	Mr. S. R. Bhide	Ph.D.	Associate Professor	12/7/84	Electrical Engg.	12	56	32
33	Mr. Prasad Venikar	(Research Scholar)		09/07/12	Electrical Engg.	46.15	53.84	--
34	Mr. S. S. Bhatt	Ph.D.	Associate Professor	01/04/87	Electrical Engg.	33.33	48.15	18.51
35	Mr. M. Irfan	(Research Scholar)		01/07/11	Electrical Engg.	21.43	78.57	--
36	Mr. V. B. Borghate	Ph.D.	Associate Professor	01/08/85	Electrical Engg.	25.93	55.56	18.52
37	B. S. Umre	Ph.D.	Associate Professor	02/07/84	Electrical Engg.	14.82	74.7	11.11
38	M. A. Choudhary	Ph.D.	Associate Professor	17/07/08	Electrical Engg.	14.82	55.56	29.63

39	P. S. Kulkarni	Ph.D.	Associate Professor	16/03/95	Electrical Engg.	32.14	53.57	10.71
40	M. R. Ramteke	Ph.D.	Associate Professor	05/03/95	Electrical Engg.	33.33	55.56	11.11
41	A. S. Junghare	Ph.D.	Associate Professor	07/03/95	Electrical Engg.	16.00	84.00	--
42	S. R. Tambay	Ph.D.	Associate Professor	03/08/81	Electrical Engg.	7.41	2.96	29.62
43	V. S. Kale	Ph.D.	Associate Professor	01/12/99	Electrical Engg.	14.82	62.96	22.22
44	N. R. Patne	Ph.D.	Lecturer	18/05/06	Electrical Engg.	31.03	68.96	--
45	H. M. Suryawanshi	Ph.D.	Professor	11/07/89	Electrical Engg.	11.11	33.33	55.55
46	M. V. Aware	Ph.D.		17/12/90	Electrical Engg.	00.00	72.22	27.78
47	S. Patnaik	Ph.D.	Associate Professor	01/06/12	Electrical Engg.	25.93	62.96	11.11
48	R. J. Satputaley	M.Tech.		18/07/08	Electrical Engg.	31.03	58.62	10.34
49	A. Dhabaley	M.Tech.		16/05/05	Electrical Engg.	27.59	44.83	27.59
50	M. S. Ballal	Ph.D.	Associate Professor	04/04/12	Electrical Engg.	14.82	85.19	--
51	Sathyan	Ph.D.		09/07/12	Electrical Engg.	46.15	53.84	--
52	D. Khare	Ph.D.		01/01/13	Electrical Engg.	61.54	38.46	--
53	Amarendra	Ph.D.		01/07013	Electrical Engg.	76.92	23.08	--
54	M. Thakre	Ph.D.		03/01/12	Electrical Engg.	61.54	38.46	--
55	M. Pandey	Ph.D.			Electrical Engg.	66.62	33.33	--
56	Rambabu	M.Tech.		16/07/13	Electrical Engg.	64.5	35.5	--
57	Ashok Kumar	M.Tech.		16/07/13	Electrical Engg.	64.5	35.5	--
58	Chandra Sekhar	M.Tech.		16/07/13	Electrical Engg.	00	100	--
59	Dr. S. V. Bopshetty	Ph.D	Associate Professor	18/07/80	Mech. Engg.	30	30	30
60	Dr. A. B. Andhare	Ph.D.	Associate Professor	31/07/08	Mech. Engg.	0	0	30
61	Mr. M. S. Kotambkar	M.Tech.	Assistant Professor	27/7/06	Mech.Engg.	55	55	55

62	Mr. A. A. Thakre	M.Tech.	Assistant Professor	03/08/06	Mech. Engg.	50	50	50
63	Mr. P. V. Kane	M.Tech.	Assistant Professor	02/12/08	Mech.Engg.	45	45	45
64	Dr. L. M. Gupta	Ph.D.	Professor	18/10/89	Applied Mechanics	11	47	42
65	Dr. M. M. Mahajan	Ph.D.	Professor	17/08/92	Applied Mechanics	0	65	35
66	Dr. R. K. Ingle	Ph.D.	Professor	14/09/92	Applied Mechanics	10	30	60
67	Dr. G. N. Ronghe	Ph.D.	Professor	01/07/89	Applied Mechanics	0	32	68
68	Dr. O. R. Jaiswal	Ph.D.	Professor	30/10/98	Applied Mechanics	37	47	16
69	Dr. R. S. Sonparote	Ph.D.	Associate Professor	11/08/92	Applied Mechanics	9	56	35
70	Dr. S. V. Bakre	Ph.D.	Professor	16/05/06	Applied Mechanics	23	35	42
71	Dr. Sangeeta Gadve	Ph.D.	Associate Professor	08/06/12	Applied Mechanics	75	0	25
72	Dr. D. Datta	Ph.D.	Assistant Professor	15/06/10	Applied Machanics	54	15	31
73	Dr. Ratnesh Kumar	Ph.D.	Assistant Professor	17/04/12	Applied Machanics	57	14	29
74	Mr. S. B. Borghate	M.Tech.	Assistant Professor	30/08/98	Applied Machanics	31	54	15
75	Mr. A. Y. Vyavhare	M.Tech.	Assistant Professor	14/06/06	Applied Machanics	26	59	15
76	Mr. A. P. Khatri	M.Tech.	Assistant Professor	28/11/08	Applied Machanics	100	0	0
77	Dr. M. Ghosal	Ph.D.	Associate Professor	16/08/88	Humanities & S. Science	11.11	--	88.89
78	Dr. G. N. Nimbarte	Ph.D.	Associate Professor	24/11/8	Humanities & S. Science	100	--	--
79	Radhika Sudhir	M.A.	Teaching Assistant	27/07/13	Humanities & S. Science	100	--	--
80	Navneet Utlawar	M.A.	Teaching Assistant	19/07/13	Humanities & S. Science	100	--	--
81	Priyanka Bansod	M.A.	Teaching Assistant	15/07/13	Humanities & S. Science	100	--	--
82	A. S. Mokhade	M.Tech.	Associate Professor	00/08/96	Computer Science & Engineering	50	25	25
83	Mrs. Deepti Shrimankar	M.Tech.	Assistant Professor	26/11/08	Computer Science & Engineering	39	61	

84	Mrs. Saroj Bhagchandani	M.E.	Teaching Assistant	00/07/13	Computer Science & Engineering	100	--	--
85	Varsha Dhote (Pandagre)	M.Tech.	Teaching Assistant	00/8/13	Computer Science & Engineering	100	--	--
86	Anita Ahirwar	M.Tech.	Teaching Assistant	00/7/13	Computer Science & Engineering	100	--	--
87	Renuka Gowardhan	M.Tech.	Teaching Assistant	00/7/13	Computer Science & Engineering	100	--	--

(Instruction: The institution may list here the faculty members engaged in first year teaching along with other relevant data.)

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	696	37.0	18.81	12.54
CAYm1	676	36.18	18.68	12.45
CAY	699	37.18	18.80	12.53
Average	690.33	36.78	18.76	12.507

= 10.00

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

Assessment of qualification = 3 × (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	53	27	2	27.84	37.70
CAYm1	55	28	1	27.04	40.27
CAY	59	25	3	27.96	40.30
Average Assessment of faculty qualification					39.4

Max = 15

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 Around 18 students per practical batch	This is a hardware laboratory	Hands-on experiment where students first wire-up and then conduct the experiment. Experiments are designed to verify circuit laws and demonstrate and reinforce concepts taught in theory classes	Good quality instruments are used. Adequate numbers of instruments are available.	Lab manuals are available for all the experiments.
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 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 a s 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: **NO**

- **Some of the faculties engage tutorials as per their lesson plan.**

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

Type of mentoring: Professional guidance / career advancement / course work specific / laboratory specific / total development

Number of faculty Mentors:- 03 (01 Class Committee Chairman/class) + 09 (03Faculty Advisor/class) =12

Number of Student per Mentor: - A group of students (preferably 30 - 40) are allotted to a faculty advisor. Class committee chairman take care of whole class.

Frequency of meeting:- Thrice a semester.

Various Academic Bodies (departmental level)

1. Class Committee:-

A class committee is framed for group of courses, which are offered by a large number of students simultaneously or group of courses recommended by BoS.

Constitution:-

HOD constitutes the class committee chairman and members.

Chairman: Class committee chairman who does not teach any course prescribed for given class.

Class coordinator: Faculty of the same department who teach at least one course prescribed for given class.

Members: All course coordinators of courses covered in the group, minimum four students (more than 7.5 CGPA is recommended).

Responsibilities:-

a) To review of conduct of the course and result of first sessional after first sessional examination.

b) To review of conduct of the course and result of second sessional after second sessional examination.

c) To identify the problems of students regarding academics and resolve it by corrective measures.

2. Faculty advisor (FA):-

A group of students (preferably 30 - 40) are allotted to a faculty advisor. FA is from same department itself, in which the student is enrolled. FA is allotted in the first year and the student shall have same FA till he/she completes the programme. FA responsibility used to be allotted on rotation basis.

Responsibilities:

a) FA acts as local guardian for all academic and disciplinary activities.

b) To approve the registration/enrolment of student.

c) To monitor the progress of student and act as his / her mentor, periodically.

d) Any application made by a student is forwarded by FA with recommendation.

e) Any action taken against student is communicated to the FA.

f) When a student leaves the Institute on completion of programme or without completing the programme, is communicated to FA.

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

Feedback collected for all courses: YES

Specify the feedback collection process: Class committee chairman of the same department who does not teach any course prescribed for the particular semester, used to collect the feedbacks from the students at the end of that semester.

Percentage of students participating: 70-80 %

Specify the feedback analysis process: There is a prescribed format of feedback analysis (Teacher and course evaluation form). This exercise is meant to collect student's opinion of different facets of education being imparted in the department. It includes list of 20 questions and student has to give the rating from 1 to 10 as per their opinion. On the basis of data from all the feedbacks, evaluation sheet is prepared. And this evaluation sheet is submitted to the head of the department by Class committee chairman.

Basis of reward / corrective measures, if any: In feedback system there is space for comments/ and suggestions about teacher and course. Student can give the suggestion in this block. By studying the comments and feedback in the departmental meeting, all information passes on to respective teacher and asks them to implement on the suggestion if it is required.

Number of corrective actions taken in the last three years:

- Changes made in curriculum.
- Adopted advanced teaching gadgets/tools.

(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).

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.)

AXIS is a national-level technical festival held at the Visvesvaraya National Institute of Technology in Nagpur, India. Axis the largest technical festivals in central India, being organized annually at the end of September. Events at the festival include coding competitions (Cypher), architectural event (DEVISE), robotics event (Robotix), and paper presentations (Technodox).Axis is an entirely student-organized fest organised by VNITians. The managers can be broadly categorized into two sections—The Core and Individual Event Managers. The events managers deal with the events that are conducted; like competitions, exhibitions, lectures, workshops. The Core deals with issues like accounts, infrastructure, marketing, hospitality, publicity and media.

Quiz fest, whose inception was back in 2007, is VNIT's own quizzing and literary spectacular. One of the few of its kind, and Central India's largest, Quiz fest is an exposition of knowledge and provides an ideal platform for highly-skilled participants to pit their wits against each other. Quiz fest is an entirely student organized fest.

Industrial Visit: Each department is allotted every year with a budget for Industrial visits for the students so that they can learn about the Industrial work environment and also can enhance their knowledge of their discipline.

IIChE Student Chapter:-Under this head students along with faculty in charge arrange expert lecture from Industry/outside resource person, quizzes, competitions, seminars and concessionary celebration.

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.)

The library and information resources centre is automated and users LIBSYS software. Students and faculty access library information through ON LINE PUBLIC ACCESS CATALOUGUE indexed databases called EI-COMPENDEX PLUS, DISSERTATION ABSTRACTS INTERNATIONAL and SAE Technical Papers are on campus-wide network of 10/100 Mbps lines and are available round the clock.

Library is the most avid place for the students to learn and being updated with the present technology. VNIT's Library is one of the best and Hi-tech Libraries which caters an enormous number of books both on coursework as well as on other disciplines also.

- More than 1.25 Lakh books
- Subscription to about 200 Journals/ Periodicals
- Audio Video Learning Materials, CDs
- INDSET Facility; access to many e-journals
- Technical enquiry & referral services to other libraries
- Multimedia Learning centre
- Round the clock reading facility for students

Internet Facility: Internet facility is available throughout in every department as well as in every hostel in the campus. It serves as one of the best source for students to learn as well as being updated with today's world.

- Computer centre is having more than 100 computers with access to INDSET and NPTEL
- Multimedia Learning centre
- 1Gbps Netwrok across the campus
- 10 Mbps internet bandwidth for the institute

Projects: Self interested projects are one of the prime ways of learning for the students as it caters both technical and analytical skills to the student. Every department has various research projects and World class Labs for the students to undertake the projects or carryout the research work if students desire to work on any specific topic..

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)

Training and placement: Students Placement is handled by the Training & Placement Section (T&P). T&P section actively coordinates with corporate sectors for providing high quality placement services to the students. Necessary guidance is provided by the department to the students for career planning and personality development by means of workshops and presentations. The T&P section assists the students in securing internship in industries/ organizations of their interest. About 70 to 80 companies visit VNIT every year and more than 90 percent of eligible students are recruited.

E-Cell: The Entrepreneurship Cell is a non-profit organization run by the students of VNIT Nagpur that aims at manifesting the latent entrepreneurial spirit of the young students. E-Cell hosts various workshops, speaker sessions, innovative games, competitions for aspiring entrepreneurs and support them by providing necessary resources such as seed mentoring, consultancy and networking.

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)

Institute Gathering: Annual Institute gathering generally takes place in the month of January where every department competes with each other on various avid areas which includes debate, street play, drama, rally, sports, singing, instrumental, arts etc. Every student and faculty participates actively in this gathering. It’s one of the best times to build a bond among each other and come out as a family.

Departmental Gathering: Generally takes place in the month on October. The main motto lies in bonding between senior and junior and increasing interaction among the students and faculty members.

Aarohi: Largest inter-collegiate cultural program of central India. It generally held in the month of February every year. Events like band, dance and personality contest are organised in the festival. Participation comes from many colleges from throughout the nation.

Students can opt NCC.

In addition to these activities on campus various clubs are in operation for different causes wherein students from Chemical engineering Department participate on a high namely

- Clubs on Campus:
- Prayaas- Social initiative program
- ACM- Association for computer machinery VNIT chapter
- Club Capture- Photography club
- HallaBol- Dramatics club
- Eyes only- The Newsletter of VNIT
- Grooves- Dancing community of VNIT
- Gym Community
- Lynx- Adventure club
- Entrepreneurship cell
- Iridescence- Art club
- IEEE VNIT Chapter
- Mag.com- Magazine committee
- Octaves- Music club
- Aegon- Debate club
- Quiz Pro Co. - Quiz club
- Thalassemia Awareness society

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)

Games & Sports: Physical education is a part of curriculum with specific credit in UG programme (Subject like Yoga and Sports).

- Dedicated Physical Education Department
- High standard Cricket ground, Tennis lawn, basketball court, volleyball ground
- Modern gymnasium for boys and girls
- Inter departmental competitions during annual gathering
- Coaching facilities available for different games
- Regular participations in national and state level competitions
- Student amenity centre to be operative soon

8. Governance, Institutional Support and Financial Resources (75)

8.1. Campus Infrastructure and Facility (10)

8.1. A Campus

New 1000 Seat Boys Hostel

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.

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 16 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., Industrial 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. 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	9	3508	2986
Hostel for Girls	2	522	555

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 entirelyby 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 Professorin 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)

(i)	Board of Governors	--	Annexure - A
(ii)	Senate	--	Annexure - B
(iii)	Finance Committee	--	Annexure - C
(iv)	Building & Works Committee	--	Annexure – D

(A) Board of Governors

Sr. No	Name	Designation
1.	Dr. S. K. Joshi, Distiguished Scientist, New Dellhi-	Chairman
2.	Smt. Amita Sharma (IAS), New Delhi.	Member
3.	Shri A. N. Jha, Jr. Secretary & F., HRD, New Delhi.	Member
4.	Prof. (Mrs.) Joyshree Roy, Prof. DOE, Kolkata	Member
5.	Shri. Pramod Chaudhary, Executive Chairman, PUNE	Member
6.	Prof. S.C . Sahasrabudhe, Director, D.A.I.I.C.T. Gandhinagar	Member
7.	Pfor. A. G. Kothari, Prof. EED, NGPUR	Member
8.	Mr. I. L. Muthreja, Assott. Prof. M.E.D., Ngpur	Member
9.	Dr. T. Srinivasa Rao, Director, VNIT, Napgpur	Member
10.	Dr. B. M. Ganveer, Registrar, VNIT, Nagpur.	Secretary

(B) Senate

1.	Dr. N. S. Chaudhari, Director, VNIT, Nagpur	Chairman
2.	Prof. S. V. Bhat, Deptt. of Physics, IIS, Bangalore – 560 012	Member
3.	Dr. T. S. Sampath Kumar, Asso. Prof., Deptt. of M.M.S.	Member
4.	Prof. (Ms.) R. B. Nair, HD,. H & S.S.,IIT, Delhi	Member
5.	Dr. Rajesh Gupta, Dean (Planning & Development), VNIT, Nagpur	Member
6.	Dr. R. K. Ingle, Dean (Faculty Welfare), VNIT, Nagpur	Member
7.	Dr. Animesh Chatterjee, Dean (Research & Consultancy), VNIT, Nagpur	Member
8.	Dr. R. M. Patrikar, Dean (Academics), VNIT, Nagpur	Member
9.	Dr. A. P. Patil, Dean (Students Welfare), VNIT, Nagpur	Member
10.	Dr. S. V. Bakre, Head, Deptt. of Applied Mechanics, VNIT, Nagpur	Member
11.	Prof. L. M. Gupta, Professor of Structural Engineering, VNIT, Nagpur	Member
12.	Prof. O. R. Jaiswal, Professor of Structural Engineering, VNIT, Nagpur	Member
13.	Dr. M. M. Mahajan, Professor of Structural Engineering, VNIT, Nagpur	Member
14.	Dr. G. N. Ronghe, Professor of Structural Engineering, VNIT, Nagpur	Member
15.	Dr. S. A. Mandavgane, Head, Chemical Engg. Deptt., VNIT, Nagpur	Member
16.	Dr. V. A. Mhaisalkar, Head, Civil Engg. Deptt. , VNIT, Nagpur	Member
17.	Dr. A. D. Pophale, Professor of Civil Engg., VNIT, Nagpur	Member
18.	Dr. Y. B. Katpatal, Professor of Civil Engg., VNIT, Nagpur	Member
19.	Dr. H. M. Suryawanshi, Head, Deptt. of Electrical Engg., VNIT, Nagpur	Member
20.	Dr. A. G. Kothari, Professor of Electrical Engg., VNIT, Nagpur	Member
21.	Dr. M. V. Aware, Professor of Electrical Engg., VNIT, Nagpur	Member

22.	Dr. K. L. Thakre, Professor of Electrical Engg., VNIT, Nagpur	Member
23.	Dr. K. D. Kulat, Head, Deptt. of Electronics Engg., VNIT, Nagpur	Member
24.	Dr. A. G. Keskar, Professor of Electronics & Comm., VNIT, Nagpur	Member
25.	Dr. R. B. Deshmukh, Professor of Electronics Engineering, VNIT, Nagpur	Member
26.	Dr. A. S. Gandhi, Professor of Electronics Engineering, VNIT, Nagpur	Member
27.	Dr. S. R. Sathe, Head, Deptt. of Computer Sc. & Engg., VNIT, Nagpur	Member
28.	Dr. C. S. Moghe, Professor of Computer Science Engg., VNIT, Nagpur	Member
29.	Dr. I. K. Chopde, Head, Deptt. of Mechanical Engg., VNIT, Nagpur	Member
30.	Dr. P. M. Padole, Professor of Mechanical Engg., VNIT, Nagpur	Member
31.	Dr. A. M. Kuthe, Professor of Mechanical Engg., VNIT, Nagpur	Member
32.	Dr. S. G. Sapate, Head, Deptt. of Met. & Mat. Engg., VNIT, Nagpur	Member
33.	Dr. R. K. Paretkar, Professor of Met. & Mat. Engg., VNIT, Nagpur	Member
34.	Dr. S. U. Pathak, Professor of Met. & Mat. Engg., VNIT, Nagpur	Member
35.	Dr. D. R. Peshwe, Professor of Met. & Mat. Engg., VNIT, Nagpur	Member
36.	Dr. R. R. Yerpude, Head, Deptt. of Mining Engg., VNIT, Nagpur	Member
37.	Prof. S. Shringarputale, Professor of Mining Engg., VNIT, Nagpur	Member
38.	Ms. Alpana Dongre, Head, Deptt. of Architecture, VNIT, Nagpur	Member
39.	Dr. V. S. Adane, Professor of Architecture, VNIT, Nagpur	Member
40.	Dr. (Mrs.) Sujata Patrikar, Head, Deptt. of Appl. Physics, VNIT, Nagpur	Member

41.	Dr. V. K. Deshpande, Professor of Applied Physics, VNIT, Nagpur	Member
42.	Dr. (Mrs.) Anupama Kumar, Head, Deptt. of Chemistry, VNIT, Nagpur	Member
43.	Dr. S. S. Umare, Professor of Chemistry, VNIT, Nagpur	Member
44.	Dr. G. P. Singh, Head, Deptt. of Mathematics, VNIT, Nagpur	Member
45.	Dr. (Ms) M. Ghoshal, Head, Deptt. of Humanities, VNIT, Nagpur	Member
46.	Dr. S. B. Thombre, Professor of Mech. Engg & i/c T&P, VNIT, Nagpur	Member
47.	Dr. D. H. Lataye, Chief Warden, VNIT, Nagpur	Member
48.	Dr. B. M. Ganveer, Registrar, VNIT, Nagpur	Secretary

(C) Finance Committee

1.	**Dr. S. K. Joshi,** Distinguished Scientist (CSIR) & Vikram Sarabhai Professor of JNCASR, New Delhi.	Chairman
2.	Shri Rajesh Singh, Director Deptt. Higher Eduction, New Delhi	Member
3.	Shri Navin Soi, Driector, Ministry HRD, New Delhi.	Member
4.	Prof. S. C. Sahasrabudhe, Director D.A.I.I.C.T., Gandhinagar	Member
5.	**Prof. A. G. Kothari,** Professor, Electrical Engineering Department, VNIT, Nagpur	Member
6.	Dr. N. S. Chaudhari, Director, VNIT, Nagpur	Member
7.	**Dr. B. M. Ganveer** Registrar, VNIT, Nagpur	Member-Secretary

(D) Building & Works Committee

1.	Dr. N. S. Chaudhari, Director, VNIT, Nagpur	Chairman
2.	Shri Rajesh Singh, Director Director HMHRD, New Delhi	Member
3.	Shri Navin Soi, Director IFD, New Delhi	
4.	**Prof. S. C. Sahasrabudhe, Director D.A.I.T, Gandinagar**	Member

5.	**Dr. Rajesh Gupta** Dean (P&D), V.N.I.T., Nagpur	Member
6.	**Mr. R. K. Naik,** Superintending Engineer (Civil), Central P.W.D., , Nagpur–440 006	Member
7.	**Shri Arvind Garg,** Suptd. Engineer (Electrical) NAGPUR – 440006	Member
8.	**Chief Engineer,** Public Works Department, NAGPUR – 440001	Member
9.	**Supdt. Engineer (Electrical),** Public Works Department, NAGPUR – 440001	Member
10.	**Dr. B. M. Ganveer** Registrar, VNIT, 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:To ascertain the Goal reservation policy is observed scrupulously. No meeting of Special Cell held during current year i.e. 2013.

2) Stores Purchase Committee: To assist the Director in procurement of item/equipment/material costing beyond 10 Lakhs.Total 3 meetings are held during current year i.e. 2013

3) Grievance Cell : To address the Grievances of all the employees.No meeting was held during current year 2013.

4) Women's Cell : To address the Grievances of working women.Two meetings held during 2013.

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	Dean (R&C)	Upto 10 Lakhs

	Research, Projects, Schemes and Consultancy Funds		
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) 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 Upto Rs. 2

	Bill Electricity/bill, Water bill etc., [ii] Purchases of equipment, uniform, consumables, stationeries, spares & accessories. for registry/requirement for departments not covered above within allotted grant of the year.	Registrar	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. S. R. Sathe
* Dean (Faculty Welfare) -- Dr. R. K. Ingle
* Dean (Research and consultancy) -- Dr. H. M. Surywanshi
* Dean (Academics) -- Dr. O. R. Jaiswal
* Dean (Students Welfare) -- Dr. G. P. Singh

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. B. M. Ganveer, Registrar
First Appellate Authority	--	Dr. S. R. Sathe, Dean, (P&D)
Second Appellate Authority	--	Dr. N. S. Choudhary, 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

Item	Budgeted in CFY (2013-14)	Expenses in CFY (till 30-09-2013)	Expenses in (2012-13)	Expenses in (2011-12)
Infrastructural built-up	2,65,54,000	36,13,35,022	2,81,64,291	15,95,93,770
Library	1,50,00,000	36,13,208	1,90,18,807	1,29,71,122
Laboratory equipment	7,40,50,000	1,72,15,522	4,32,85,956	3,99,33,386
Laboratory consumables	9,00,000	3,28,380	34,54,624	14,68,336
Teaching and non teaching staff salary	18,68,00,000	24,03,26,847	44,34,60,400	30,58,08,851
R&D				
Training & travel	3,00,000	8,25,317	11,52,857	12,93,657
Other, specify	2,76,52,000	3,35,20,388	7,88,07,806	6,16,68,294
Total	30,47,02,000	65,71,64,684	61,7340,741	58,27,37,416

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 utilisation of allocated funds is satisfactory as can be seen from table above 8.3

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 2013-14	Actual Expenses in CFY (till…)2013-14 *	Budgeted in CFYm1 2012-13	Actual Expenses in CFYm1 *	Budgeted in CFYm2 2011-12	Actual Expenses in CFYm2
Laboratory equipment	Plan grant-40,00,000 + Non Plan grant-4 ,00,000	9,09,782	Plan grant-50,00,000 + Non Plan grant-3 ,00,000		Plan grant-80,00,000 + Non Plan grant-3 ,50,000	
Software		7,96,005		5,29,754		15,86,014
R&D						
Laboratory consumables		12,211		314663		259692
Maintenance and spares		8500		6750		27000
Training & travel						16000
Miscellaneous expenses for academic activities		7420		350		3169
Total	44,00,000	17,33,918	53,00,000	8,51,517	44,00,000	18,91,875

* 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.)

Adequate budget is allotted for overall development as details given in 8.4

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.)

Funds are utilized properly for development as details given in 8.4

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, timings 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)

	Number of new titles added	Number of new editions added	Number of new volumes added
CAYm2 2010-11	950	4,365	1,08,694
CAYm1 2011-12	2,226	4,034	1,13,806
CAYm 2012-13	1060	6,049	1,27,383

SUBJECT WISE TITLES (TILL 31ST MARCH 2011)

Sr.No.	Subject	Title	Volume
01.	A. M.	281	416
02.	Archi.	5019	8728
03.	Chemical	2386	3989
04.	Che.	3085	6138
05.	Civil	8529	7741
06.	ComSc	7741	10748
07.	Electro	5022	8094
08.	Clectri	6133	13254
09.	Hum	1223	1782
10.	Math	2982	5497
11.	Mech.	6960	13449
12.	Met.	6007	9179
13.	Min.	4648	6422
14.	Phy.	1616	6270
15.	L.S. & H.	99	99
TOTAL		**61711**	**108694**

SUBJECT WISE TITLE (TILL 31ST MARCH 2012)

Sr.No.	Subject	Title	Volume
01.	A. M.	355	605
02.	Archi.	5154	8937
03.	Chemical	2512	4352
04.	Che.	3182	6398
05.	Civil	8667	15016
06.	ComSc	7990	11286
07.	Electro	5093	8347
08.	Electri.	6475	14130
09.	Hum	1476	2307
10.	Math	3176	5911
11.	Mech.	7055	13710
12.	Met.	6193	9526
13.	Min.	4661	6461
14.	Phy.	1793	6665
15.	L.S. & H.	155	155
TOTAL		**63937**	**113806**

SUBJECT WISE TITLES (TILL 31ST MARCH 2013)

Sr.No.	Subject	Title	Volume
01.	A. M.	440	2176
02.	Archi.	5265	9350
03.	Chemical	2634	4986
04.	Che.	3261	8079
05.	Civil	8780	15730
06.	ComSc	8079	14130
07.	Electro	5267	9962
08.	Clectri	6531	15165
09.	Hum	1488	2744
10.	Math	3236	6548
11.	Mech.	7118	14449
12.	Met.	6239	10114
13.	Min.	4676	6856
14.	Phy.	1806	7145
15.	L.S. & H.	177	177
TOTAL		**64997**	**127311**

8.5.3. Scholarly journal subscription (3)

Details		CFY 2013	CFYm1 2012	CFYm2 2011	CFYm3 2010
Science	As soft copy	00	02	02	01
	As hard copy	18	21	20	17
Engg. And Tech.	As soft copy	736	00	04	01
	As hard copy	51	86	106	110
Pharmacy	As soft copy	x			
	As hard copy				
Architecture	As soft copy	00	00	00	00
	As hard copy	16	18	24	24
Hotel Management	As soft copy				
	As hard copy				

(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	
CFYm2 2011	41.42 Lacs (4813)	48,49,686.00	2,31,158.00		
CFYm1 2012	53.32 Lacs (5112)	49,73,906.00	1,56,054.00		
CFY 2013	77.67 Lacs (13505	21,61,376.00	60,62,510.00		

Virtual Class Room:

DETAILS ;-

Money Given By National Informatics Center (NIC);-

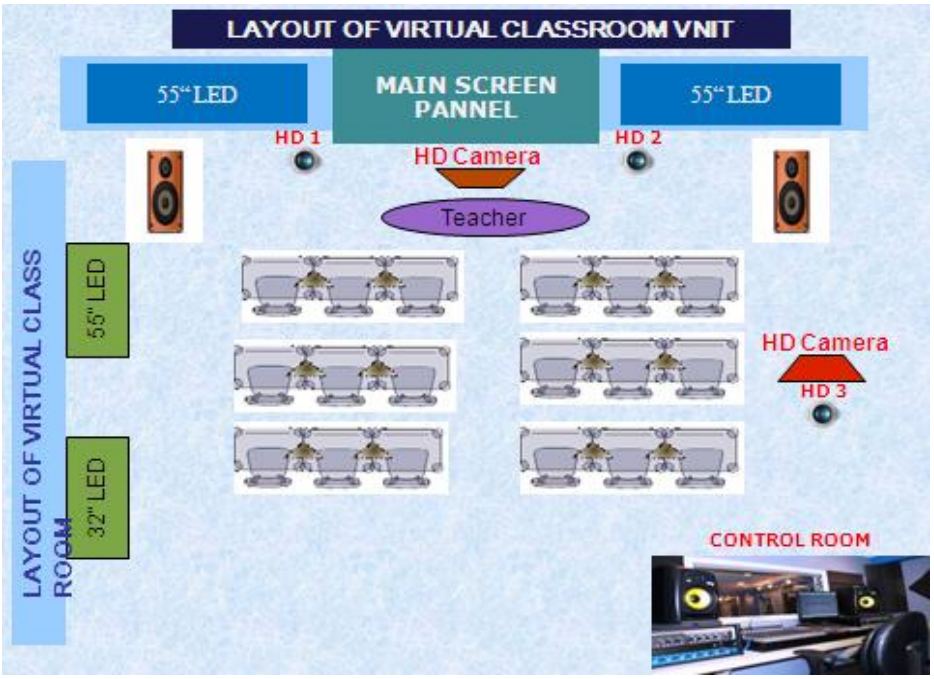
- Total Project Cost of Virtual Class-Room -- Rs. 32,26,524/-
- Civil Work for Virtual Class Room -- Rs. 10,00,000/-
- Technical Assistant for Virtual Class Room -- Rs. 1,80,000/-
- Bandwith;-

  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. Internet (5)

Name of the Internet provider: BSNL, Reliance, NKN (National Knowledge Network)
Available bandwidth: Broadband
Access speed: 10 Mbps, 45 Mbps. 75 Mbps, 100 Mbps
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.)

8.6.1 Network Center Information;-

Network Center provides a variety of Services. Network Center administers and manages the entire Campus Computer Network which includes departments, sections computer center, administrative building, library, Guest house, health center, NCC Sectin and Auditorum along with Network Center and quarters.

Network Center has three leased line (LL) connections 10 Mbps 75 Mbps and 42 Mbps which is distributed all over campus like departments, sections, computer center, administrative building. Guest house, health center, NCCSection, Auditorium and quarters along with Network Center, Currently NKN LL provided by NMEICT for Internet is 50 Mbps.

Network Centre monitors bandwidth usage continuously and any problems in usage are rectified with the help of ISP (Internet Service Provider)

Network Center has in-house web server, mail server, proxies and application server along with oracle server. We provide Web-based Email open source that enables all the users to assess their mailbox from anywhere (inside or outside VNIT Nagpur) via the Internet, an institute wide. We mostly 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 also host mirrors of freeware softwares for all campus users. The documentation is also provided for special purpose software regarding installation on end user computer. Powerlingo language software is available for the benefit of students.

The centralized installation of quick Heal Antivirus software is provided for all campus users.

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 Processor.

The approximate cost of hardware is around 1 crore 60 lakhs only (Rs. 1,60,00,000/-) The approximate cost of software is rupees Two Lakh eighty thousand only (Rs. 280000/-) Computer Hardware AMC is outsourced. The cost of annual maintenance charges on computer hardware is approximately two lakhs (Rs. 2,00,000)

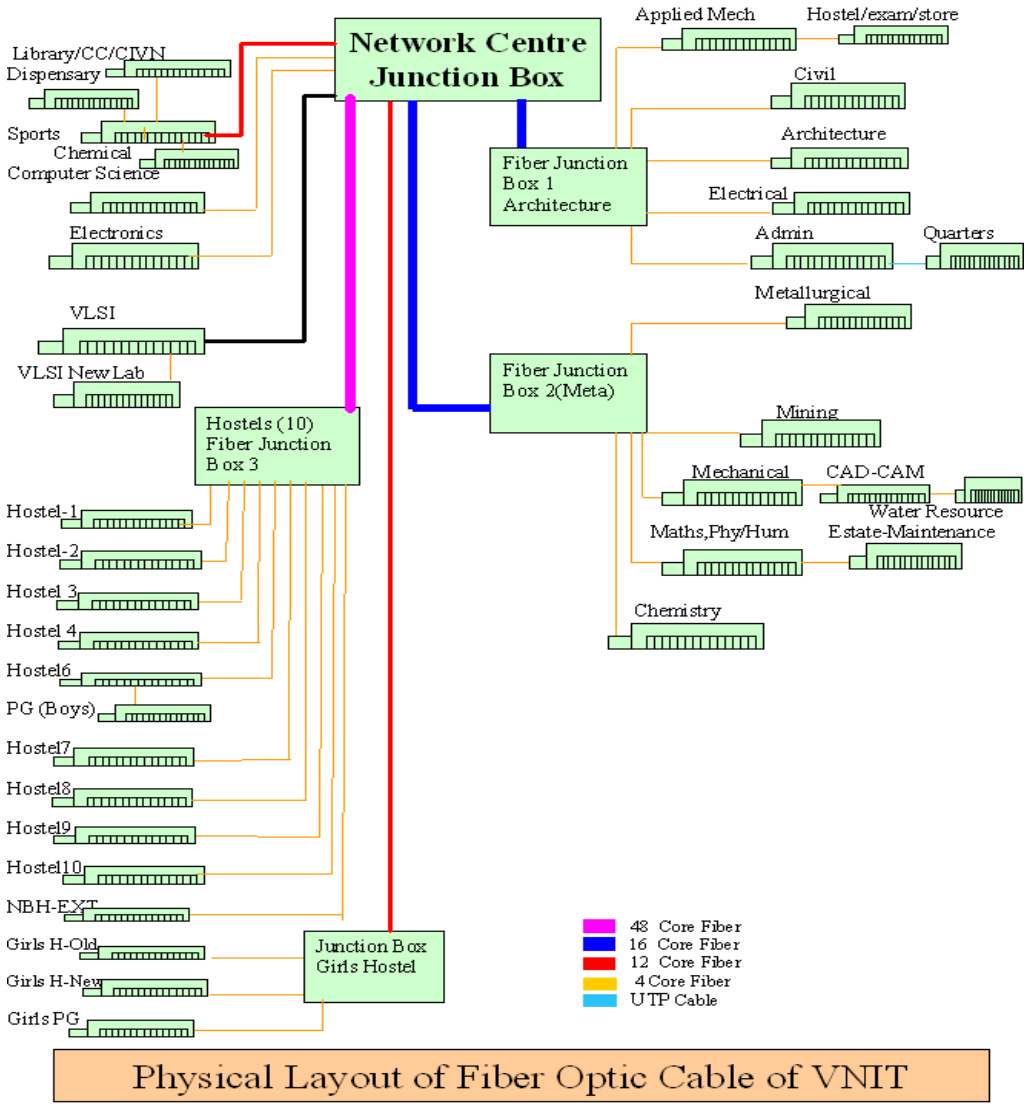
The annual charges of Reliance LL are approximately twenty five lakhs (Rs. 25,00,000) and that of BSNL LL is around ten lakhs (Rs. 10,00,000/-)

Network Center has one permanent staff and three adhoc staff - 11 and recurring charges is as under –

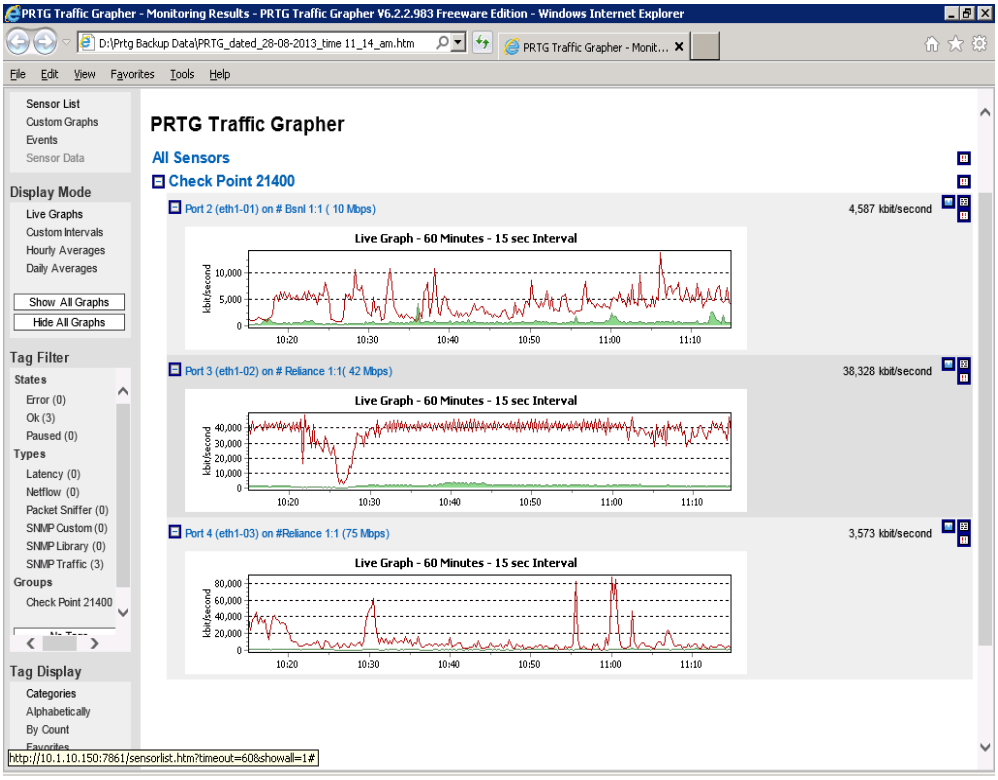
AMC	--	2.0 L
Reliance LL	--	25.0 L
BSNL	--	10.0 L

8.6.2 Physical Layout of Fiber Optic Cable of VNIT

Figure I



8.6.3 PRTG Traffic Grapher
Figure II



8.7. Safety Norms and Checks (5)

8.7.1. 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

8.7.2. Fire-fighting measurements: 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.

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.

8.7.3. Safety of civil structure (1)

Being a publicity 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 Incharge 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

8.7.4. 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.)

8.8. 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.)

8.8.1 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 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 Homeopathy & yoga are 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. Availability of dietician addresses menu planning for balanced diet in the mess besides giving dietary advice for modern epidemic of obesity, diabetes & cardiovascular problem. First aid facility is provided at all hostels.

8.8.2 Physical Education facilities:

Sports and Games are essentials components of Human Resource Development, helping 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.

The Institute aims at all round development of the students. This can be seen from the importance given to the Physical Education. Classes for Physical Education have been included in regular Time Table so as to ensure development of Physical Fitness of the students. Physical Education programs also include general health and safety information in addition to providing opportunities for students to learn how to cooperate with one another in a team setting.

Participation of students in different games

The Institute encourages the students by exposing them to various Inter University Tournaments such as West Zone Inter University, All India Interuniversity, Inter-NIT tournaments and also in local inter-collegiate tournaments. The institute has won many championships in Football, Cricket, Badminton, Table Tennis, Chess, Volleyball and Kho-Kho events in All India Inter NIT Tournaments since 2009

Krik Mania:

This is an Invitational Cricket Tournament being organized since last 20 years by the Institute students under the guidance of the Department of Physical Education at local level.

Intramural and Krida Diwas:

This is a unique program of event inter-section tournaments for different games conducted for first year B.Tech./B.Arch. students which goes round the year. The department celebrates the birth anniversary of the great Hockey legend Major Dhyanchand on 29th of August every year and on the same day the intramural program is also inaugurated.

Medical examination:

The Department of Physical Education coordinates for compulsory Medical Examination for all the first year B. Tech. /B. Arch. students with our Medical Officer Dr. S. Batra. and his team.

Physical Efficiency Test:

Compulsory for every first year B. Tech./B.Arch. Components of physical fitness such as abdominal strength, respiratory endurance, flexibility of hip joint and hamstring muscles and speed are measured by applying suitable tests of fitness.

Felicitation of the students:

The department of Physical Education recognizes the efforts taken by first year students and felicitates them during the valedictory function of the intramural tournament.

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

Planned Sports Infrastructure in near future:

Indoor Badminton Stadium with four Wooden sprung Surfaced Badminton courts, Table Tennis hall, Yoga hall, Class room, Sports Medicine Research Lab.

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) + (a+b+c)*(5/3)

9.1. Improvement in Success Index of Students (5)

From 4. 1

Items	**LYG** (2012-13)	**LYGm1** (2011-12)	**LYGm2** (2010-11)	**Assessment**
Success Index	0.890	0.888	0.896	5

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

From 4. 2

Items	**LYG** (2012-13)	**LYGm1** (2011-12)	**LYGm2** (2010-11)	**Assessment**
API	7.441	7.411	7.578	38

9.3. Improvement in Student - Teacher Ratio (5)

From 5. 1

Items	**CAY** (2012-13)	**CAY m1** (2011-12)	**CAY m2** (2010-11)	**Assessment** (Average for past 3 years)
STR	18.7	21.8	19.4	20

9.4. Enhancement of Faculty Qualification Index (5)

From 5. 3

Items	**LYG** (2012-13)	**LYGm1** (2011-12)	**LYGm2** (2010-11)	**Assessment** (Average for past 3 years)
FQI	8.8	6.1	6.8	7

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

From 5.7and 5.9

Items	**LYG** (2012-13)	**LYGm1** (2011-12)	**LYGm2** (2010-11)	**Assessment** (Average for past 3 years)
FRC	6.8	3.2	7.0	6
FPPC	2.8	3.2	3.7	3

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.
Self Sponsored STTP on Advanced Separation Processes	Toshvin Analytical	Organized	One week	Experts from Toshvin Analytical, DRDO, ICT, LIT etc.	Faculty, Research Scholars, PG/UG students of VNIT and other institutes	Very good feedback from the participants
Short Term Course On Nanotechnology Applications in	Under TEQUIP-II	Organized	Three days	Experts from NIT,NCL and NEERI etc.	Faculty, Research Scholars of VNIT	Very good feedback from the participants

Engineering & Technology						
Short term course on Process Simulation using CHEMCAD	Under TEQUIP-II	Organized	Three days	Experts from Distichemi Process Engineering Pvt. Ltd, NEERI etc.	Faculty, Research Scholars of VNIT	Practical hands on to every participant about CHEMCAD Software about chemical, Petrochemical, Biotechnological, Polymer aspects modeling, simulation and synthesis of the process.
FDP on Analytical Equipments for Chemical Analysis	Under TEQUIP-II	Organized	Three days	Experts from NIT, NEERI, Toshvin Analytical etc.	Faculty, Research Scholars of VNIT	Very good feedback from the participants
Workshop on 'How to write a research paper'	Under TEQUIP-II	Organized	One day	IISc Bangalore	Faculty, Research Scholars of VNIT	Very good feedback from the participants
Workshop on 'Writing a Research proposal' and expert lecture to research scholars	Under TEQUIP-II	Organized	One day	NCL Pune	Faculty, Research Scholars of VNIT	Very good feedback from the participants
Workshop on 'Improving the Research Skills'	Under TEQUIP-II	Organized	One day	NCL Pune	Faculty, Research Scholars of VNIT	Very good feedback from the participants
National Conference on Green Chemistry and Engineering	Under TEQUIP-II	Organized	One day	Experts from Toshvin Analytical, DRDO, ICT, NCL, LIT etc.	Faculty, Research Scholars, students of VNIT and outside world	Very good feedback from the participants
Expert lecture and seminar on 'Separation Technology'	Under TEQUIP-II	Organized	One day	IIT Kharagpur	Faculty, Research Scholars of VNIT	Very good feedback from the participants
Workshop on 'Academic and Research Upgradation in Chemical Engineering'	Under TEQUIP-II	Organized	One day	ICT Mumbai	Faculty, Research Scholars of VNIT	Very good feedback from the participants

Assessment = The participants gave very good feedbacks and put demands to organize such modules in future too.

9.7. New Facility Created (15)

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

- The department has done modifications/upgradations in the UG laboratories and research laboratories to suit the present need of the specific laboratory.
- The department has acquired much more sophisticated instruments/equipments, computing facilities and softwares for UG/PG/Research purposes on continuous basis. It is strengthening further also for future.
- The department has put sufficient focus on using teaching aids and recent technology advancements in Teaching-Learning Process to meet out the POs.

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

Specify the overall improvement: The department of Chemical Engineering is starving hard to achieve the international standards of education and achieving it in stages.

Specify the strength / weakness	Improvement brought in	Contributed by	List of PO(s), which are strengthened	Comments, if any
CAY (2013-14)	Floated more no. of electives, organised STTPs, workshops and conferences, acquired more sophisticated instruments/equipments,	Faculty of Chemical Engg., VNIT Nagpur; TEQIP-II, IITs, IISc, NITs, NCL,	(c), (d), (e), (f), (g), (h) and (i)	The department is achieving the higher standards in stages.

	computing facilities and softwares, use of new teaching aids, Guest Lectures, strengthened in T&P activities and interaction with Industry.	ICT		
CAYm1 (2012-13)	Floated more no. of electives, organised STTPs, workshops and conferences, acquired more sophisticated instruments/equipments, computing facilities and softwares, conducted Curriculum Development Committee Meeting and updated the syllabus and curriculum, Guest Lectures, strengthened in T&P activities and interaction with Industry, use of new teaching aids, strengthened in books and e-resource.	Faculty of Chemical Engg., VNIT Nagpur; TEQIP-II, IITs, IISc, NITs, NCL	(c), (d), (e), (f), (g), (h) and (i)	The department is achieving the higher standards in stages
CAYm2 (2011-12)	Use of new teaching aids, strengthened in books and e-resource, acquired more sophisticated instruments/equipments, computing facilities and softwares, Guest Lectures, strengthened in T&P activities and interaction with Industry	Faculty of Chemical Engg., VNIT Nagpur and outside experts	(c), (d), (e), (f), (g), (h) and (i)	The department is achieving the higher standards in stages
.....				

Declaration

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:

APPENDIX – SYLLABUS

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML264**
Course Title	**: Mechanical Operation**
Course Type	**: core**
Course Credits	**: 06**

I. Course description:
Understand Properties and characterization of particulate soilds and mechanical separation methods such as screening, filtration, sedimentation, transportation of solids, agitation etc and associated equipments used for achieving these methods.

II. Pre-requisites: None

III. Textbooks:
1. McCabe W.L., Smith J.C. and Harriot P., Unit Operations of Chemical Engineering McGraw Hill, New York 2001. 6th Edition
2. Chattopadhyay O.P., Unit Operations of Chemical Engineering, Vol. 1 & 2, Khanna Publications, New Delhi, 1996.
3. Coulson J. M. and Richardson J.F; Chemical Engineering Vol. 1& 2 Publishers: Butter worth – Heinemann Ltd. 2001-2002.
4. Christie J. GeanKoplis Transport processes & Unit Operation Prentice hall International
5. Badger & Banchero Introduction to Chemical Enginerring Mc-Graw- Hill Education
6. G.G. Brown Unit Operation John Willey
7. Hiremath R.S & Kulkarni A.P.,. Mechanical Operations Vol I Everest Publication

IV. Objectives:
1) To impart the basic concepts of mechanical operations
2) To develop understanding about size analysis, size reduction and solid handling
3) Understand mechanical separation methods such as filtration, sedimentation, transportation of solids etc and associated equipments used for achieving these methods
4) The students are exposed to basic theory, calculations and machinery involved in various solid handling operations

V. Outcomes:
Upon successful completion of this course Students will be able to solve different problems involving hydro-mechanical operations and expand their knowledge in this subject. Students will increase their proficiency in oral and written communications. Students will have gained experience in working within a team of their colleagues.

VI. Expanded Course description:
1. *Properties of particulate solid and equipment for size reduction :*
Surface area distribution of powders, size reduction and separation, crushing, grinding equipments and their characteristics, open and close circuit grinding.

2. Size Analysis:

Particle size distribution, Screen analysis, mechanical classifiers classification.

3. *Filtration and centrifugal separation:*
Principles of filtration and theory, filtration equipments and their characteristics, pressure and vacuum filters, compressible and non compressible cake and their effect on filtration rate, centrifugal separation equipments and their principles of operation as well as the characteristics, optimum filtration cycle, membrane filtration.

4. Motion of particles through fluid:
Drag coefficient, free settling and hindered settling, gravity settlers, sedimentation theory and principle of operation. Batch and continuous thickeners as well as the design procedures, sedimenting centrifuges.

5. Agitation and mixing:
Introduction to agitation and mixing of solids and liquids fundamentals, mixing and agitation equipments and their operational characteristics, power consumption in mixing and agitation, different types of agitators and their selection criteria.

6. Handling of solids:
Storage and conveying of solids, bins, hoppers, silos and their operational characteristics, Loading and unloading of solids, different types of conveyors and elevators for solid materials. Dust collectors, cyclone separators, electrostatic precipitators, bag filters, operational characteristics of these and other similar dust separators. (4-Hr)

VII. Class Schedule : Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√						√	√	
2	√	√					√	√	
3	√	√					√	√	
4	√	√				√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours
To be announced in the class.
XI. Notice
Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML264

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML265**
Course Title	**: Chemical Engineering Thermodynamics**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:
It helps chemical engineer to evaluate thermodynamic properties and how much heat is evaluated by a particular reaction in a reactor. This course introduces chemical engineering thermodynamic theory and applications in the areas of volumetric properties of fluids, heat effects, thermodynamic properties of fluids, thermodynamics of solutions, and physical and chemical equilibria. The data collected for various parameters such as temperature, pressure, humidity, fugacity, enthalpy etc will help to assign stability and reaction operating conditions as and when required.

II. Pre-requisites: Physical Chemistry and General Metallurgy

III. Textbooks:

1. A text book of chemical engineering thermodynamics, **Narayanan K.V**., PHI
2. Introduction to Chemical Engineering Thermodynamics, **Smith J.M**., McGraw Hill
3. Chemical Engineering Thermo dynamics**, Rao Y.V.C**. University press (INDIA) Ltd.
4. Thermodynamics for Chemical Engineers, **Bett K.E., Rowlinson J.S. and Saville G**., MIT Press America
5. Chemical Engineering Thermodynamics, **Dadge B.F**. McGraw Hill Co.

IV. Objectives:
The objectives are:
1. To provide an introduction to chemical engineering thermodynamics as a fundamental component of chemical engineering,
2. To acquire the students with the knowledge for thermodynamic treatment of pure fluids and solutions
3. To understand the thermodynamics of phase equilibria and chemical reaction equilibria.
4. To provide the knowledge of working of Carnot cycle, refrigeration, compressors and nozzles.

V. Outcomes:
At the end of this course student will
1. Understand the laws of thermodynamics.
2. be able to calculate changes in U, H, and S for ideal gases, and also for nonideal gases.
3. understand the utility of fugacity as a transformation of the chemical potential.
4. understand the criteria for chemical reaction equilibria.

5. Be able to understand the working of Carnot cycle, refrigeration, compressors and nozzles.

VI. Expanded Course description:

Laws of thermodynamics for closed and open system, concepts of entropy, entropy changes, reversible and irreversible processes, equilibrium concept, Maxwell's relations, P-V-T behaviour of pure substances, Heat of reaction and effect of temperature on heat of reaction.

Thermodynamic properties of fluids, their calculations using equations of state, partial molar quantities, fugacity, chemical potential, activity coefficients, free energy estimation, Gibb's Duhem Theorem.

Vapour-liquid, vapour–solid and liquid–liquid phase equilibrium for ideal and non ideal systems, Criteria for chemical reaction equilibrium
flow of compressible fluids in pipes and nozzles.

Refrigeration cycle, carnot refrigerator, gas and vapour compression refrigeration, choice of refrigerants, absorption refrigeration, heat pumps, compressors, single stage and multistage, expansion engines, liquification processes

VII. Class Schedule

Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√						√	
2	√	√	√		√	√		√	
3	√	√	√					√	
4	√	√		√				√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	55

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator CML265

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Course information
Department : Chemical Engineering
Course Number : CML 262
Course Title : Chemical Process Calculations
Revision Date : 01.09.2012
Revised by : S A Mandavgane
Course Type : Core
Course Credits : 06

Catalog Description

Fundamental concepts, gas relationship, molarity, molality, normality, partial pressure, pure component volume and the related calculations.

Humidity and saturation and their applications fundamental concepts of material balance. Material balance in various unit processes and unit operations. Material balance with chemical reactions

Energy balance related to various process equipments. Calculation of standard heat of reaction from heat of formation and heat of combustion, thermo chemistry, energy balance in various unit operations, heat of solutions, heat of neutralization etc.

Fuels and combustion calculation, proximate and ultimate analysis, adiabatic reaction temperature, air to fuel ratio, complex processes calculation

Prerequisites and Co-requisites

Students are expected to have a good understanding of material and energy balance in different chemical processes and unit operations.

Course Objectives of Chemical Process Calculations:

1) To understand the fundamental concepts and calculations of process calculation.
2) To understand the material balance in various unit processes and unit operations.
3) To understand the energy balance related to various process equipments.
4) To understand the various heats and their calculations related to chemical reactions.
5) To understand the fuels and combustion calculation, proximate and ultimate analysis.

References:

1. Narayanan K V and Lakshmikutty B, Stoichiometry and Process Calculations, Prentice Hall of India Pvt Ltd, New Delhi 2006
2. Himmelblau D.M.; Basic Principles and Calculations in Chemical Engineering, 6th Edition, Prentice Hall of India Ltd.
3. Hougen O.A. and Watson K.M.; Chemical Process Principles, Part-I (Material and Energy Balances), CBSNew Delhi

Relationship of Course Objectives to Program Outcomes

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√	√		
2	√	√	√				√		
3	√	√	√				√		
4	√	√	√				√		
5	√	√	√			√	√		

Course Coordinator
CML262

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Course information
Department : Chemical Engineering
Course Number : CML 263
Course Title : Fluid Mechanics
Revision Date : 01.09.2012
Revised by : S A Mandavgane
Compliant : Catalog
Course Type : Core
Course Credits : 06

Semester: 4th

Syllabus:

Properties of Fluid: Pressure, density, specific weight, viscosity, dynamic and kinemetic viscosity, Newton's law of viscosity and its applications.

Fluid Statics: Pascal's Law and Hydrostatic equation, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.– Forces on plane and curved surfaces

Fluid kinetics: Description of Fluid flow, Lagrangian and Eulerian approach One dimensional flow approximation, Types of fluid Flows: Steady and unsteady, Uniform and non-uniform, control volume concept, Reynolds transport theorem, Continuity equation, Velocity and acceleration of fluid particle, stream line, streak line, path line, velocity potential function,

Fluid Dynamics: Momentum theorem and its application. Euler's equation, Bernoulli's equation for incompressible fluid flow, Engineering applications of energy equation,

Pitot – static probe, Current meters,Venturimeter, Orificemeter, Rotameter, Nozzlemeter, Notches & weirs.

Flow Through Pipes: Critical Reynold's number, velocity distribution in pipes, friction factor, Moody's chart, Laminar flow through pipe, Hagen-Poiseulli's equation, Turbulent flow through pipe, Hydraulic gradient line and Total energy line. Minor head losses in pipes. Pipe Networking Transmission of power through pipe.

Flow Over Immersed Bodies: Drag and lift, Types of drag force, Drag on sphere, Cylinder and airfoil; Circulation and Lift on a cylinder and airfoil; Magnus effect

Boundary Layer Theory: Development of Boundary layer over flat plate and pipe, boundary layer thickness

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, , specific speed, efficiency and performance curves - Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps

Course Objectives of Fluid Mechanics:

1) To understand the fundamental properties, laws and their applications related to fluids.
2) To understand the fluid kinetics and fluid dynamics.
3) To understand the fluid flow through various sections.
4) To understand the flow over immersed bodies.
5) To understand the Boundary Layer Theory.
6) To understand the various types of pumps and their working principles.

References:

1. Munson BR, Young D F and Okiishi T H , ' Fundamentals of Fluid Mechnics', 5th Edition, John Wiley & Sons
2. Gupta Santosh & Gupta Vijay, 'Fluid Mechanics and its applications', New Age International Publishers.
3. Munson BR, Young D F and Okiishi T H , ' Fundamentals of Fluid Mechnics', 5th Edition, John Wiley & Sons
4. Warren McCabe, Julian Smith, Peter Harriott, Unit Operations of Chemical Engineering, McGraw Hill International Edition, 2005

Relationship of Course Objectives to Program Outcomes

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√				√		√	
2	√	√				√	√	√	
3	√	√				√	√	√	
4	√	√				√		√	
5	√	√						√	

Course Coordinator
CML262

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP264**
Course Title	**: Fluid Mechanics and Mechanical Operation Lab-I**
Course Type	**: Core**
Course Credits	**: 02**

I. Course description: The course covers the Hands on experience of working by conducting experiments on most of the basic unit operations like hydraulic classifier, sedimentation , ball mill, jaw crusher , cyclone separator , filtration equipment , sieve analysis , flow meter etc.

II. Pre-requisites: none

III. Textbooks:

1. McCabe W.L., Smith J.C. and Harriot P., Unit Operations of Chemical Engineering McGraw Hill, New York 2001. 6th Edition
2. Chattopadhyay O.P., Unit Operations of Chemical Engineering, Vol. 1 & 2, Khanna Publications, New Delhi, 1996.
3. Coulson J. M. and Richardson J.F; Chemical Engineering Vol. 1& 2 Publishers: Butter worth – Heinemann Ltd. 2001-2002.
4. Christie J. GeanKoplis Transport processes & Unit Operation Prentice hall International
5. Badger & Banchero Introduction to Chemical Enginerring Mc-Graw- Hill Education
6. G.G. Brown Unit Operation John Willey
7. Hiremath R.S & Kulkarni A.P.,. Mechanical Operations Vol I Everest Publication

IV. Objectives:

1. To understand importance of various mechanical operations used in process industry.
2. To apply principles of basic sciences and chemical engineering for designing various size reduction, size separation and conveying equipments.
3. To experience of handling different unit operations

V. Outcomes:

At the end of the laboratory course students will be able to apply the principles of unit operations through experimentation and will demonstrate the ability to understand the various equipments used in chemical and allied process industry-

VI. Expanded Course description:

(Any ten practical out of list were conducted by student)

Expt. No.	*Details*
1	***Hydraulic Classifier***
	To separate different size range of solid particles
2	***Batch Sedimentation***
	To study the batch setting & based on that design of Thickener for given under-sludge concentration
3	***Stokes law***
	To study C_D vs Nre nature of steel ball in different fluids
4	***Sieve Analyser***
	To determine the average diameter of a different size solid particle mixtxe
5	***Jaw Crusher***
	To verify laws of crushing.
6	***Ball Mill***
	To verify laws of crushing.
7	***Cyclone Separator***
	To study the separation of solid fine dust particle from air.
8	***Centrifuge***
	To study the separation of sluge by using centrifugle force
9	***Magnetic Separator***
	To find out the efficiency of magnetic separator
10	***Rotary Vaccum Drum Filter***
	To study the working of continuous Rotary Vaccum Drum Filter
11	***Orifice Meter***
	To determine discharge coefficient C_d
12	***Venturi Meter***
	To determine discharge coefficient C_d
13	***Pitot Tube***
	To determine discharge coefficient C_d & determine point velocity.

VII. Class Schedule : Three 2 hour session per week

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√	√	√	
2	√	√				√	√	√	
3	√					√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Practical performance		
Record submission		
Sliptest –I & II		
End Semester Exam		
viva		

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CMP264

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING
COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP365**
Course Title	**: Fluid Mechanics and Mechanical Operation Lab-II**
Course Type	**: Core**
Course Credits	**: 02**

I. Course description:
The course covers the Hands on experience of working by conducting experiments on most of the basic unit operations like hydraulic classifier, sedimentation , ball mill, jaw crusher , cyclone separator , filtration equipment , sieve analysis , flow meter etc.

II. Pre-requisites: Fluid Mechanics and Mechanical Operation

III. Textbooks:
1. McCabe W.L., Smith J.C. and Harriot P., Unit Operations of Chemical Engineering McGraw Hill, New York 2001. 6th Edition
2. Chattopadhyay O.P., Unit Operations of Chemical Engineering, Vol. 1 & 2, Khanna Publications, New Delhi, 1996.
3. Coulson J. M. and Richardson J.F; Chemical Engineering Vol. 1& 2 Publishers: Butter worth – Heinemann Ltd. 2001-2002.
4. Christie J. GeanKoplis Transpor processes & Unit Operation Prentice hall nternational
5. Badger & Banchero Introduction to Chemical Enginerring Mc-Graw- Hill Education
6. G.G. Brown Unit Operation John Willey
7. Hiremath R.S & Kulkarni A.P.,. Mechanical Operations Vol I Everest Publication

IV. Objectives:
1. To understand importance of various mechanical operations used in process industry.
2. To apply principles of basic sciences and chemical engineering for designing various size reduction, size separation and conveying equipments.
3. To experience of handling different unit operations

V. Outcomes: At the end of the laboratory course students will be able to apply the principles of unit operations through experimentation and will demonstrate the ability to understand the various equipments used in chemical and allied process industry-

VI. Expanded Course description:
1. Friction in Pipeline (To determine the friction coefficient factor for different size as well as different material of pipes.)
2. Flow through Notches (To determine discharge coefficient C_d through different type of Notches)
3. Vibrating Screen (To find out the Effectiveness of Triple deck Vibrating Screen)
4. Packed Bed (To Hydraulic study in packed column.)

5. **Fluidized Bed (** To study the relation between the pressure drop & the superficial velocity throughout the bed.)
6. **Pressure Drop in Fittings (**To study the losses in pressure due to different fitting in pipes)
7. **Impact of Jet on Vanes (**To study flow of fluid through Jet)
8. **Two Phase Flow (**To study the flow pattern of two phases in singe tube.)
9. **Sampling** (To study different sampling method to determine the average diameter of particle)
10. **Pressure Measurement (**Pressure measurement in pipeline)
11. **Power in Agitator (**To determine the power consumption in Agitator with Baffles & without Baffles)
12. **Plate & Frame Filter Press (**To study batch filtration in Plate & Frame Filter Press)
13. **Leaf Filter (**To find out the rate of Filtration & resistance offered by cake & filter media.)

Note :(Any ten practical out of above were conducted by student)

VII. Class Schedule

Two hour session per week per batch

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√	√	√	
2	√	√				√	√	√	
3	√					√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Practical performance & Record submission	2 hour per session	60
End Semester Exam	30min	30
viva	10min	10

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator

CMP365

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CHL261**
Course Title	**: Inorganic Chemical Technology**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CHL261 Inorganic Chemical Technology covers fundamental knowledge of all Unit operation and Unit Process required for synthesis of production process. It covers production process of various industries like CHL261Industrial gases, Industrial carbon, Marine Chemicals, Nuclear Industries, Chlor – alkali industries, Electrolytic and Electrochemical Industries, Fertilizers, Glass - Chemistry

Overall this course is highly useful for the students of Chemical Engg for industrial point of view production processes.

II. Pre-requisites: NIL

III. Textbooks

1. Dryden C.E.; Outlines of Chemical Technology: East West Press, 1973.
2. Kirk - Othmer; Encyclopedia of Chemical Technology, 4th Edition, John Willey & Sons.
3. Shreve R.N and Brink J.M; Chemical Process Industries: McGraw Hill Co.,
4. New York, 1977.
5. Soni P.L. and Kalyal; Textbook of Inorganic Chemistry, 20th Edition, S. Chand &
6. Co., New Delhi.
7. Venkateshwarulu D.; Manual of Chemical Technology: Vols I and II, IIT, Madras,
8. 1977.

IV. Objectives:

1) To understand knowledge of unit operation and processes
2) To understand the knowledge of flow/ separation pattern of material
3) To understand the design of unit operations
4) To understand the approach for mass/heat transfer & CRE
5) To understand the approach for modeling
6) To study the overall synthesis of various chemical product of importance

V. Outcomes:

Students can synthesis production process of required product.

VI. Expanded Course description:

***Industrial gases*:** CO, CO_2, H_2, O_2, N_2, SO_2, C_2H_2, Helium and Nitrogen oxide. Industrial acids: 25% & 65% oleums, Liq. Sulphur Trioxide, Liq. Sulphur dioxide

manufacture. Sulphuric acid, Nitric acid, Hydrochloric acid and Phosphoric acid. Miscealleanous Chemicals industries: Alum [ferric & Non-ferric], sugar, carbon-disulphide.

***Industrial carbon*:** Activated carbon, lamp carbon, carbon black, graphite, industrial diamond, and Inorganic pigments: Study of pigments and dyes.

Waste Energy Recovery. Co-generation of power and Application to Chemical Industry for reducing cost of production.

***Marine Chemicals*:** Salt from seawater. By-products of salt industry e.g. Bromine and Iodine.

Nuclear Industries: Nuclear Reactors, Feed materials, Uranium and Nuclear Reactors. Reprocessing of Nuclear materials, protection from radioactivity – measures.

***Chlor – alkali industries*:** Soda Ash, Bicarbonates, Miscellaneous alkalis, Chlorine, Caustic Soda, Bleaching powder, Hypochlorites and chlorites, Eletrolytic MnO_2, Aluminium metal.

***Electrolytic and Electrochemical Industries*:** Chlorates, Per-chlorates, Primary and Scecondary cells. Artificial abrasives, Calcium carbides, Silicides and Nitrides.

***Fertilisers*:** Ammonia, Nitrogenous fertilizers, Phosphatic fertilizers, Potassic fertilizers, Compound and Complex fertilizers, miscellaneous fertilizers.

Glass - Chemistry of glass making and manufacturing process, Composition of different types of glass special glass lining to vessels, Protective Refractory Linings for Chemical Plants.

VII. Class Schedule : Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√			√
2	√					√			
3	√								
4	√					√			√
5	√					√			
6	√					√	√		√

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator

CHL261

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML363**
Course Title	**: Chemical Process Equipment Design**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The course covers the methods and procedure adopted in designing process equipment. The emphasis here is on specifying the function, operation and size of the equipment and also on the choice of the material of construction and strength considerations.

II. Pre-requisites: Physical Chemistry & General Metallurgy, Mechanical Operations

III. Textbooks:

1. Process equipment dsign-vessel design by Lloyd E. Brownell and Edwin Young, John Wiley, NewYork 1963.
2. Chemical Engineering Volume 6 – Design by J.M. Coulson, J.F. Richardson and R. K. Sinnott, Pergamon press International Edition 1989.
3. Introduction to chemical equipment design – Mechanical Aspects by B.C. Bhattacharyya, CBS Publications.
4. Process Equipment Design by M.V. Joshi and V.V. Mahajani Macmillan India
5. Pressure Vessel Hand book by Eugene F. Megyesy, Pressure vessel company USA.
6. Design of machine elements by V.B. Bhandari, McGraw Hill.
7. Appropriate ISI Specifications and codes for unfired pressure vessels, viz IS: 2825, IS: 803, IS: 804,IS: 1182, IS: 4853, IS: 3658, IS: 3703, IS: 3664, IS: 4260, IS: 4072, IS4503.

IV. Objectives:

1. Provide students with basic understanding equipment design.
2. To teach students the design of pressure vessel.
3. To teach students the design of storage vessel.
4. To teach students to apply the design concepts in practical industrial design problem.

V. Outcomes:

After completion of this course the students will be able to do design of industrial pressure vessel and storage vessel.

VI. Expanded Course description:

Unit-1

Importance of chemical process equipment design, design procedure for pressure vessels subjected to internal pressure, and combined loading, closures for pressure vessels, Code and standards for pressure vessels (IS:2825:1969), materials of construction, selection of corrosion allowance and weld joint efficiency.

Unit-2
Design of pressure vessels subjected to high pressure, monoblock construction, shrink fit construction, external pressure, optimum proportions of pressure vessels, optimum sizing of vessels.

Unit-3
Design of supports, flanges, nozzles for vessels, Design of jackets (as per IS 2825), coils for pressure vessels.

Unit-4
Mechanical design of storage tanks for volatile and non-volatile liquids, roof and bottom design, optimum proportions of storage tank, storage tanks for solids and its design procedure, Design of cylindrical storage vessel as per IS:803 and rectangular tanks as per IS:804.

Unit-5
Codes and standards for heat exchangers; Baffles; Tie-rods; Tube joining methods; Design of shell and tube heat exchangers as per IS : 4503 and TEMA standards; design of single effect evaporator

Unit-6
Design of distillation column, absorption column, and reactors

VII. Class Schedule
Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Program Outcomes (PO)								
	a.	**b.**	**c.**	**d.**	**e.**	**f.**	**g.**	**h.**	**i.**
1.	√	√	√						
2.		√	√						
3.		√	√						
4.		√	√			√	√	√	√

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	55

X. **Chamber Consultation Hours**
To be announced in the class.

XI. **Notice**
Notice will be displayed on Chemical Engineering Notice Board.
Course Coordinator
CML363

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML466**
Course Title	**: Chemical Plant Design**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The course covers mainly the application of design knowledge student obtained in different design subject and practicals. It involves designing Specific unit operation in chemical industries like heat exchanger, distillation column etc. Part is subject is also given for studding the economics in chemical process industries.

II. Pre-requisites:

Physical Chemistry & General Metallurgy, Mechanical Operations, chemical process equipment design and its practicals.

III. Textbooks:

1) Process equipment dsign-vessel design by Lloyd E. Brownell and Edwin Young, John Wiley, NewYork 1963.
2) Plant Design and Economics for Chemical Engineers by Timmerhaus P., McGraw Hill Book Co, 4th Edition, 2000
3) Chemical Engineering Volume 6 – Design by J.M. Coulson, J.F. Richardson and R. K. Sinnott, Pergamon press International Edition 1989.
4) Introduction to chemical equipment design – Mechanical Aspects by B.C. Bhattacharyya, CBS Publications.
5) Process Equipment Design by M.V. Joshi and V.V. Mahajani Macmillan India
6) Pressure Vessel Hand book by Eugene F. Megyesy, Pressure vessel company USA.
7) Design of machine elements by V.B. Bhandari, McGraw Hill.
8) Appropriate ISI Specifications and codes for unfired pressure vessels, viz IS: 2825, IS: 803, IS: 804,IS: 1182, IS: 4853, IS: 3658, IS: 3703, IS: 3664, IS: 4260, IS: 4072, IS4503.

IV. Objectives:

1) To understand the basics of mechanical designing of different process equipments
2) To Apply the designing knowledge for designing different chemical unit operation equipments
3) To understand the economics related to chemical process equipment

V. Outcomes:

1) After completion of this course the students will be able to do design of different chemical process unit operation like heat exchanger, distillation column etc.
2) Student will understand the economical aspect related the chemical process plant

VI. Expanded Course description:

Introduction to various codes used in chemical industries and their application, fundamentals of process flow sheet design.

Process design calculations for heat exchange equipments such as shell and tube H.E., plate heat exchangers, single stage and multistage evaporators.
Process design calculations for mass transfer equipments such as tray towers, packed towers for distillation sieve tray design and layout, hydraulic design, packed column internals, permissible pressure drop limits, and design calculations for absorbers.
Process design calculations for dryers, crystallizers, reactors with examples.
Economic evaluation of process equipments, project cost estimation, measures of economic performance, depreciation, break even analysis, minimum cost analysis, profitability analysis.
Safety in chemical plant design, safety codes, handling of hazardous chemicals, safety factors and parameters in design of process equipments.
Pressure relieving devices, plume analysis, centrifugal pump troubleshooting, installation, regular checks, and selection criteria, risk analysis of process equipments.

VII. Class Schedule : Three classes a week each of 55 min

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√						√	
2	√	√				√		√	
3	√	√				√		√	

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours
To be announced in the class.

XI. Notice
Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML466

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP364**
Course Title	**:Chemical Engineering Design and Drawing -I**
Course Type	**: Core**
Course Credits	**: 02**

I. Course description: The course covers symbols used in Drawing, Design and Drawing of various chemical equipments and accessories like storage tank, Jacketed vessel, reaction vessel, coils, gasket, pressure vessel, supports, Agitator, etc.

II. Pre-requisites: none

III. Textbooks:

1. Joshi M.V., Mahajan V.V. Process Equipment Design MacMillan India Ltd
2. Khurmi R.S ,Gupta J.M., , A text book of machine design S.Chand &Company Ltd, New Delhi
3. Dawande S.D. Process Design of Equipments volume 1&2 Central Techno Publication, Nagpur

IV. Objectives:

1. To learn how to use and draw basic Standard equipment symbols and Standard instrumentation symbols used in chemical process industry.
2. To study how to design and draw Heads and closures, Keys and couplings, Supports for vessels- like Bracket Support, Leg Support, Skirt Support and packed absorption tower.
3. To learn how draw, Riveted joints, Welded joints and other types of joints

V. Outcomes:

At the end of course students exhibit how to use and draw basic standard equipment symbols and standard instrumentation symbols used in chemical process industry and in a competitive manner how to design and draw Heads and closures, Keys and couplings, Supports for vessels- like Bracket Support, Leg Support, Skirt Support and packed absorption tower and also demonstrate the use of drawing Pipe fittings, Riveted joints, Welded joints and Pressure relief devices.

VI. Expanded Course description:

Sheet- No	Title of Sheets
1.	**Basic Instrument symbols**
2.	**Type of joints**
3.	**Types of Heads and Storage vessel**
4.	**Types of Supports**

5.	**Types of Jackets and Coils**
6.	**Types of Flanges and its joints**
7.	**Gaskets and Flange Assembly**
8.	**Complete Assembly of Pressure vessel with Jacket**
9.	**Reaction vessel with Coils**
10	**One complete Process Flow sheet**

VII. Class Schedule

Three 2 hour session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√	√	√	
2	√	√				√		√	
3	√	√				√	√		

IX. Evaluation of students

	Component	**Duration**	**Weightage**
	Marks on drawing sheet (Total no. of sheets = 10)	2- hour per week	50
	Assignment on each sheet (Detail description of the diagram and related theory).	-	20
	Slip test -1 (after completing five sheets)	15min	10
	Slip test -2 (after completing rest five sheets)	15min	10
	Viva and end sem exam	10min	10

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator

CMP364

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP 464**
Course Title	**: Chemical Engineering Design and Drawing II**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

Drawing sheets on chemical equipments and flow sheets such as heat exchanger, distillation column, jacketed vessel, agitated vertical column, evaporator, fermentor, reactor cyclone separator, autoclave, dryer, pump, flow sheets.

II. Pre-requisites:

CML 464 Chemical Engineering Design and Drawing

III. Textbooks:

1. Joshi M.V., Mahajan V.V, Process Equipment Design, Macmillan India Ltd
2. Khurmi R.S ,Gupta J.M. A Text Book Of Machine Design, S.Chand &Company Ltd, New Delhi
3. Dawande S.D. Process Design of Equipments, Central Tecno Publication, Nagpur.

IV. Objectives:

1) To understand knowledge of unit operation and processes
2) To understand the knowledge of flow/ separation pattern of material
3) To understand the design details of unit operations for towards systematic drawing
4) To understand the approach for scaling for drawing
5) To study the overall synthesis of various chemical product of importance

V. Outcomes:

At the end of the sheets, the student will understand the basic concepts and operations of various chemical equipments and flow sheets related to chemical engineering design and drawing.

VI. Expanded Course description:

Design and drawing of chemical equipments like, Heat exchanger, distillation column, evaporator, cyclone seperator, autoclave, Dryer, Pump, etc.

Preparation of working drawing part list & assembly drawings of plant layouts and piping drawing, device drawing.

Minimum 10-12 Imperial size sheets (A-1) covering the above syllabus should be drawn out of which $1/3^{rd}$ should be drawn using computer software like AutoCAD.

VII. <u>Total Sheets to be drawn :</u> Ten

VIII. Class Schedule

Two hours per week.

IX. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1		√				√			
2		√				√			
3		√							
4		√				√			
5		√				√			

X. Evaluation of students

Component	Duration	Weightage
Internal	2 hrs per week	60
Assignments and Objective Test	-	25
Final Submission and viva	--	15

XI. Chamber Consultation Hours

To be announced in the class.

XII. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CMP 464

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML361**
Course Title	**: Mass Transfer-I**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 361 Mass Transfer-I covers the fundamentals and basic concepts of separation and purification of mass through its transfer from one phase to the other. Further, it
gives learning and understanding skills towards the problems related to separation & purification and in tern the approach to solve it by applying the concepts/principles learned in the curriculum.

II. Pre-requisites: CML262-Chemical Process Calculations

III. Textbooks:

1. Mass Transfer Operations, Treybal R.E., McGraw Hill Book Co., New York 1980, 3rd Edition
2. Chemical Engineering Vol. I, II & III, Coulson J.M. and Richardson J.F., Pergamon Press, New York 1977
3. Unit Operations of Chemical Engineering, McCabe W.L. and Smith J.C. & Harriot, McGraw Hill Book Co., New York 1980, 5th Edition
4. Principles of Mass Transfer and Separation Process, Binay K. Dutta, PHI Learning Pvt. Ltd., New Delhi, Eastern Economy Edition
5. Introduction to Chemical Engineering, Badger W.L. and Banchero J.T., Tata McGraw Hill Book Co.

IV. Objectives:

The objective of this course is to introduce the basic principles of mass transfer and how to quantify, formulate, and solve engineering problems involving different mass transfer operations like diffusion, humidification & dehumidification, drying, crystallization and adsorption. To demonstrate that how to apply mass balances and its transfer and analyze systems

V. Outcomes:

Students will comprehend to Fick's law of diffusion, the principles of diffusion, driving force, different theories of Mass Transfer and the analogies. They will understand the through details including problem solving approach and the applications of theory learnt in industrial practices regarding the mass transfer operations like diffusion, humidification & dehumidification, drying, crystallization and adsorption.

VI. Expanded Course description:

Introduction to mass transfer operations, Diffusion in gases and liquids, steady state and unsteady state operations, diffusion mass transfer, individual and overall mass transfer coefficients concept.
Theories of mass transfer, analogies and Interphase mass transfer process; simultaneous heat and mass transfer processes.
Drying: Constant rate and falling rate periods, equilibrium moisture contents, drying equipments, rotary dryers, drum dryers, vacuum dryers, Spray dryer, fluidized bed dryers, dryer calculations and dryer selection criteria.
Crystallization: Theory of Crystallization, saturation, supersaturation, nucleation and crystal growth, various equipments for crystallization, their operational and design characteristics.
Adsorption: Adsorption isotherms, adsorption agents, equipments for adsorption, pressure swing adsorption technology, adsorption phenomena
Humidification and dehumidification, equipment's operational characteristics, design procedures and selection criteria along with mass transfer calculations, Types of cooling towers, cooling tower operational characteristics.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Contribution of Courses to Program Outcomes				Program Outcomes								
Type	Credit	Course No	Course Titles	a	b	c	d	e	f	g	h	i
T	6	CML361	Mass Transfer-I									

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests, Quizes and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator

CML361

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML366**
Course Title	**: Mass Transfer-II**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 361 Mass Transfer-II covers the fundamentals and basic concepts of separation and purification of mass through its transfer from one phase to the other. Further, it
gives learning and understanding skills towards the problems related to separation & purification and in tern the approach to solve it by applying the concepts/principles learned in the curriculum.

II. Pre-requisites: CML262-Chemical Process Calculations

III. Textbooks:

1. Mass Transfer Operations, Treybal R.E., McGraw Hill Book Co., New York 1980, 3rd Edition
2. Chemical Engineering Vol. I, II & III, Coulson J.M. and Richardson J.F., Pergamon Press, New York 1977
3. Unit Operations of Chemical Engineering, McCabe W.L. and Smith J.C. & Harriot, McGraw Hill Book Co., New York 1980, 5th Edition
4. Principles of Mass Transfer and Separation Process, Binay K. Dutta, PHI Learning Pvt. Ltd., New Delhi, Eastern Economy Edition
5. Introduction to Chemical Engineering, Badger W.L. and Banchero J.T., Tata McGraw Hill Book Co.

IV. Objectives:

To provide students the basic learning and understanding skills towards the problems related to separation & purification and in turn the approach to solve it by applying the concepts/principles learned in the curriculum and to increase the student's ability to apply the principles for the design of Mass Transfer Equipments and their application in process industries.

V. Outcomes:

At the end of the course, the student will understand the Mass Transfer-II principles. The students will be able to the basic principles of Mass Transfer and to apply it for the design of Mass Transfer equipments needed in process industries.

VI. Expanded Course description:

Distillation: Vapour – liquid equilibria, Raoult's law, X-Y and H-X-Y diagrams, differential distillation and equilibrium distillation, steam distillation, azeotropic distillation, extractive distillation.

Fractionation, binary distillation, plate and packed columns for distillation, analytical and graphical methods for estimation of number of stages required in distillation column, minimum reflux ratio, optimum reflux ratio, number of stages at optimum reflux, murphree plate efficiency and overall plate efficiency, effect of feed conditions on number of plates for separation.

Concept of HETP, HTU, NTU in distillation, plate and packed columns, packings for packed columns, pressure drop in plate and packed columns, bubble cap, sieve tray, valve tray plate columns.

Absorption Equilibrium relationships, two film theory, penetration theory, surface renewal rate theory, concept of driving force and mass transfer coefficient, plate column and packed columns for absorption, selection of solvent for absorption and absorbers design procedures.

Liquid – Liquid Extraction fundamentals, selection of solvent for extraction, estimation of mass transfer coefficients, triangular diagram representation, equipments for liquid – liquid extraction, plate and packed columns, spray columns, rotary disc contactors, design procedures and equipment selection criteria. Single stage, multistage operations etc.

Solid – Liquid Extraction fundamentals, Solvent selection, equilibrium relationship, triangular diagram representation, single stage, multistage concurrent and counter current operation, equipments for solid – liquid extraction, their design procedure and selection criteria.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Contribution of Courses to Program Outcomes				Program Outcomes								
Type	Credit	Course No	Course Titles	a	b	c	d	e	f	g	h	i
T	6	CML361	Mass Transfer-II									

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests, Quizes and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator

CML366

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP366**
Course Title	**: Mass Transfer Laboratory**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

Lab experiments on various equipments / instruments related to Mass Transfer Operations.

II. Pre-requisites:

None

III. Textbooks:

1. Mass Transfer Operations, Treybal R.E., McGraw Hill Book Co., New York 1980, 3rd Edition
2. Chemical Engineering Vol. I, II & III, Coulson J.M. and Richardson J.F., Pergamon Press, New York 1977
3. Unit Operations of Chemical Engineering, McCabe W.L. and Smith J.C. & Harriot, McGraw Hill Book Co., New York 1980, 5th Edition
4. Principles of Mass Transfer and Separation Process, Binay K. Dutta, PHI Learning Pvt. Ltd., New Delhi, Eastern Economy Edition
5. Introduction to Chemical Engineering, Badger W.L. and Banchero J.T., Tata McGraw Hill Book Co.

IV. Objectives:

1. To give the hand-in-hand experience of lab scale experiments on various equipments based on the theoretical understanding and its application learned in Theory Course.
2. To understand the scaling approach of understanding from Experimental to Industry applications.
3. To develop the students ability regarding analytical and data interpretation skills.
4. To develop the discipline, sincerity, perfection and dedication towards works/assignment/aim among students.
5. To make students ready to work in industrial environment providing the lab training.

V. Outcomes:

Students will gain practical knowledge of experimental methods. It is expected that students will be able to plan an appropriate approach to experiment work, adapt original plans in the light of preliminary findings, demonstrate safe working in the choice of method and apparatus, handle apparatus and substances correctly and safely,

make measurements to an appropriate degree of accuracy and precision, collect information to arrive at a final conclusion, appraise critically the experimental work, including identification of, and accounting for, anomalous results and experimental error, and suggest related improvements to methods, to write up an appropriate concise report.

VI. Expanded Course description:

List of Experiments:

1. To determine the Mass Transfer coefficient for Absorption of CO_2 in NaOH solution in packed Column.
2. Study of adsorption of acetic acid on activated charcoal [To verify adsorption isotherms].
3. To determine the number of Heat Transfer Units (HTU) & height equivalent to Theoretical plate (HETP) of Packed distillation column.
4. To study the drying characteristics curve under constant drying condition in rotary vacuum or tray dryer.
5. Diffusion (Liquid – Liquid) –To calculate the diffusion coefficient of vapour in still Air.
6. To study the characteristics of Boiling point diagram.
7. To study the characteristics Cooling Tower experiment.
8. Experiments on Differential Distillation.
9. To determine rate of distillation by Steam Distillation.
10. Performance evaluation of fluid bed dryer.
11. Study of factors affecting rate of Evaporation :-
    i) Effect of Surface Area.
    ii) Effect of Temperature.
12. Solid liquid extraction
13. Liquid – Liquid Extraction– To determine Overall efficiency for a three stage counter-current and cross current system.
14. Diffusion (Liquid–Air):- To find the diffusion coefficient of vapour instill air.
15. Experiments on Fractional Crystallization.
16. Spray Column Dryer:- To study the Design and operating Principles of Spray Dryer.
17. Plate Column Distillation :- to study the Performance of a rectification column.
18. Determination of Rate of drying, Free moisture content and bound moisture content.

Total Experiments to be conducted / designed: 8-10

VII. Class Schedule

Two hours per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√	√	√		√		√	
2	√	√	√	√		√	√	√	
3	√	√				√	√	√	
4	√	√			√	√	√	√	√
5	√	√			√			√	

IX. Evaluation of students

Component	Duration	Weightage
Internal	2 hrs per week	60
Class tests, Quizes and Assignments	-	20
Final Submission andviva	--	20

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator:
CMP 366

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML362**
Course Title	**: Heat Transfer - I**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 362 Heat transfer-I covers fundamental principles of the three basic modes of heat transmission namely conduction convection and radiation. It also covers boiling, condensation and how to identify, formulate, and solve engineering problems involving conduction, convection, radiation.

II. Pre-requisites:

Maths, Thermodynamics, Fluid Mechanics

III. Textbooks:

1. Hollman J.P.; Heat Transfer, McGraw Hill, 1993
2. Incropera F.P. Fundamentals of Heat and Mass Transfer 5th Edition Wiley India Pvt.Ltd Ltd.,2008
3. Cengel Y.A. Heat Transfer: A Practical Approach McGraw-Hill; 2 edition ,2002
4. Kern D.Q., Process Heat Transfer, Tata McGraw Hill Book Co., New Delhi, 1990.
5. Coulson J.M., Richardson J.R. Chemical Engineering, Vol. I 5th Edition, Butterworth Heinemann, New Delhi.
6. Dutta B.K. Heat Transfer; Principles and Applications PHI Pvt.Ltd New Delhi ,2006

IV. Objectives:

1. To understand the basic principles of heat transmission by conduction, convection, and radiation
2. How to identify, formulate, and solve engineering problems involving conduction, convection, and radiation
3. How to apply energy balances and rate equations to model and analyze thermal systems**.**

V. Outcomes:

Students will comprehend Fourier's law of heat conduction, Newton's law of cooling, and the Stefan-Boltzmann law of radiation heating , recognize the relationship between thermo-physical properties and heat transfer, comprehend the role and importance of boundary layers and dimensional analysis to convective heat transfer, can solve one dimensional steady-state or transient heat conduction problems, can use empirical correlations to solve forced and free convection heat transfer for internal and external flows, for condensation and boiling, can predict heat transfer by radiation from ideal and

actual surfaces and enclosures, can use appropriate analytical or numerical solution techniques to find temperature distributions and heat flows in thermal systems.

VI. Expanded Course description:

Basic modes of heat transfer, conduction, convection and radiation, Heat conduction equation at steady state, heat conduction in slabs, cylinders, spheres, heat generation inside solids, unsteady state heat conduction, Biot number, Fourier number, Heisler charts.

Types of thermal insulation, critical thickness and optimum thickness of insulation, extended surfaces, fin performance evaluation, effectiveness of fins.

Free and forced convection inside and outside the tubes as well as over the plates, individual and overall heat transfer coefficients. Heat transfer in laminar flow and turbulent flow, dimensionless numbers in heat transfer, expressions for calculating individual and overall heat transfer coefficients. Heat transfer coefficients in natural convection and its applications.

Condensation and Boiling: Condensation over flat plate, condensation inside and outside the tubes in horizontal, vertical and inclined position, film condensation, drop wise condensing. Estimation of film coefficient of heat transfer for condensing vapours turbulence in condensing film. Heat Transfer to boiling liquids, pool boiling and forced convection boiling, boiling curve and its characteristics.

Radiation heat transfer, laws of radiation, concepts of black body, gray body, green house effect, emissive power, heat flux by radiation, view factors, radiation shield, luminous and non luminous gases.

Heat Transfer fluids: Steam, organic thermic-fluids such as Downtherm and others, molten metals, molten salts, flue gases, calculation of heat transfer coefficients for the heating fluids and their selection criteria.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√				√			
2	√	√				√	√	√	
3	√	√				√	√	√	

IX. Evaluation of students

	Component	**Duration**	**Weightage**
	Session 1 Exam	1 hour	15
	Session 2 Exam	1 hour	15
	Class tests and Assignments	-	10
	End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator

CML362

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML367**
Course Title	**: Heat Transfer - II**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 367 Heat transfer-II covers the fundamental theory for the analysis of heat transfer processes occurring in heat exchangers, evaporators, jacketed vessels, boilers, furnaces and reactors, reboilers, agitated vessels with and without coils, packed and fluidized beds.

II. Pre-requisites:

Maths, Thermodynamics, Fluid Mechanics

III. Textbooks:

1. Hollman J.P.; Heat Transfer, McGraw Hill, 1993
2. Incropera F.P. Fundamentals of Heat and Mass Transfer 5th Edition Wiley India Pvt.Ltd Ltd.,2008
3. Cengel Y.A. Heat Transfer: A Practical Approach McGraw-Hill; 2 edition ,2002
4. Kern D.Q., Process Heat Transfer, Tata McGraw Hill Book Co., New Delhi, 1990.
5. Coulson J.M., Richardson J.R. Chemical Engineering, Vol. I 5th Edition, Butterworth Heinemann, New Delhi.
6. Dutta B.K. Heat Transfer; Principles and Applications PHI Pvt.Ltd New Delhi ,2006

IV. Objectives:

1. To understand the fundamental theory of heat transfer processes occurring in heat exchangers, evaporators, jacketed vessels, boilers, furnaces and reactors, reboilers, agitated vessels with and without coils, packed and fluidized beds.
2. How to identify, formulate, and solve engineering problems involving heat transfer equipments.
3. How to apply energy balances and rate equations to model and analyze thermal systems.

V. Outcomes:

Students will gain fundamentals, design approach and its application for various heat exchangers, evaporators, jacketed vessels, boilers, furnaces and reactors, reboilers, agitated vessels with and without coils, packed and fluidized beds. Students will have knowledge of different types of heat exchangers, evaporators and their suitability for particular applications, Students can estimate heat exchanger

performance given size and inlet conditions and design the geometry required to deliver a desire heat transfer rate.

VI. Expanded Course description:

Classification of heat exchangers, recuperative, regenerative and direct contact type, double pipe heat exchangers, co-current counter, current flow arrangement, overall heat transfer coefficient.

Fixed tube sheet, floated head and U–tube shell and tube heat exchangers, their design procedures, number of passes in heat exchangers, fouling of heat exchangers, baffles in heat exchangers, selection of heating and cooling media for heat exchangers, Troubleshooting of shell and tube heat exchangers, thermal stresses and vibrations in shell and tube heat exchangers.

Plate heat exchangers, design procedure, advantages over shell and tube heat exchangers, spiral plate heat exchangers, helical coil heat exchangers.

Heat Regenerators, fixed and fluidized bed, Evaporators types and their operational characteristics. Single stage and multistage evaporation system, Steam economy, boiling point rise of solution and its effect on evaporation system, rising film and falling film evaporators.

Effectiveness of heat exchanges, NTU method. Heat Transfer in jacketed vessels, boilers, furnaces and reactors, reboilers, heat transfer in agitated vessels with and without coils, Heat transfer in packed and fluidized beds.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√				√			
2	√	√				√	√	√	
3	√	√				√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CML367

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP 362**
Course Title	**: Heat Transfer (Lab)**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:
Lab experiments on various equipments related to heat transfer.

II. Pre-requisites:
CML 362 Heat Transfer – I, CML 367 Heat Transfer – II

III. Textbooks:
1. Coulson J.M., Richardson J.R. Chemical Engineering, Vol. I, Butterworth Heinemann, New Delhi.
2. Kern D.Q, Process Heat Transfer, Tata McGraw Hill Book Co., New Delhi, 1990.

IV. Objectives:
1. To give the in-hand experience of lab scale experiments on various equipments such as heat transfer through forced convection, pin fin, lagged pipe, emissivity apparatus, stefan's boltzmann apparatus, shell and tube heat exchanger, double pipe heat exchanger, open pan evaporator, single effect evaporator, heat transfer in agitated vessel system
2. To observe and note down the steady state temperatures of all equipments.
3. To determine the heat transfer rate, heat transfer coefficient, and overall heat transfer coefficient for various equipments such as shell and tube heat exchanger, double pipe heat exchanger etc.

V. Outcomes:
Students will gain practical knowledge of experimental methods. it is expected that students will be able to plan an appropriate approach to experiment work, adapt original plans in the light of preliminary findings, demonstrate safe working in the choice of method and apparatus, handle apparatus and substances correctly and safely, make measurements to an appropriate degree of accuracy and precision, collect information to arrive at a final conclusion, appraise critically the experimental work, including identification of, and accounting for, anomalous results and experimental error, and suggest related improvements to methods, to write up an appropriate concise report

VI. Expanded Course description:
1. To find surface heat transfer coefficient for a pipe flowing heat by forced Convection of air flowing through it for different air flow rate and heat flow rate
2. To study the temperature distribution along the length of a pin fin under free and forced convection heat transfer
3. To determine heat flow rates through the lagged pipe for known value of thermal conductivity of lagged material and To plot the temperature distribution across the lagged material.

4. To determine the emissivity of grey surface.
5. To find out Stefan's Boltzmann constant.
6. To determine cold water side and hot water side heat transfer coefficient, LMTD and overall heat transfer coefficient for parallel and counter flow.
7. To calculate rate of heat transfer, LMTD and overall heat transfer coefficient for parallel and counter flow.
8. To determine the evaporation coefficient and overall heat transfer coefficient of the open pan.
9. To determine the overall heat transfer coefficient of the evaporator.
10. To determine the heat transfer coefficient in agitated vessel system.

VII. Total Experiments to be conducted : Eight

VIII. Class Schedule

Two hours per week.

IX. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√	√			√			
2	√	√	√			√	√	√	
3	√	√	√		√	√	√	√	

X. Evaluation of students

Component	Duration	Weightage
Internal	2 hrs per week	40
Assignments and Objective Test	-	30
Final Submission and viva	--	30

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator

CMP362

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML 371**
Course Title	**: Process Modelling and Simulation**
Course Type	**: Core**
Course Credits	**:06**

I. Course description:

The core subject CHL 371 Process Modelling and Simulation covers fundamental Laws, principles and uses as well as formulation of mathematical model. It also covers various mathematical models related to chemical engineering systems. The subject covers practical knowledge of simulation examples of core chemical engineering systems formulated by FORTRAN

II. Pre-requisites:

Process Modelling and Simulation: Maths, Thermodynamics, Heat Transfer, Mass Transfer, CRE, Fluid Mechanics

III. Textbooks

1. Mickley H. S., Sherwood T. S., Reed C. E., Application of Mathematical Modeling in Chemical Engineering ,Tata-McGraw-Hill, New Delhi, 2002.
2. Jensen V.G., Jeffrey's G.V., Mathematical Methods in Chemical Engineering", 2nd Ed. Academic Press, London, 1978.
3. Lubyen W. L., Process Modeling, Simulation and Control for Chemical Engineers, McGraw-Hill,New York, 1989.
4. A. Kayode Coker, Modelling of Chemical Kinetics and Reactor Design, Gulf professional publication
5. Incropera F.P. Fundamentals of Heat and Mass Transfer 5th Edition Wiley India Pvt.Ltd Ltd., 2008

IV. Objectives:

1) To understand knowledge of fundamental principles and basic laws of modeling
2) To understand the approach for mass/heat transfer & CRE
3) To apply the knowledge of differential equations
4) To understand the approach for modeling
5) Formulation of mathematical model for various chemical Engg. system

V. Outcomes:

Students are able to model every Chemical Engg. System given to them. Moreover they could make program of the model equation to get output results, and analyzed the performance of the system

VI. Expanded Course description:

INTRODUCTION TO PROCESS MODELING AND SIMULATION

MATHEMATICAL MODELING OF CHEMICAL ENGINEERING SYSTEM
Principle of formulations, Mathematical consistency of model, Continuity equations, Component
continuity equations, Energy equations, Equations of motion, Transport equations, Equilibrium,
Chemical Kinetics with examples.
MODELING OF CHEMICAL KINETICS AND REACTOR DESIGN
Modeling for different reaction scheme
Introduction to Reactor Design Fundamentals
for Ideal Systems
Introduction
A General Approach
Ideal Isothermal Reactors
Numerical Methods for Reactor Systems Design
Reversible Series Reactions
The Semibatch Reactor
Continuous Flow Stirred Tank Reactor (CFSTR)
Multi-Stage Continuous Flow Stirred Tank Reactor
Equal Size CFSTR In Series
APPLICATIONS IN CHEMICAL ENGINEERING SYSTEMS
Series of isothermal, constant_holdup CSTR'S,CSTR'S with variable Holdups, two heated tanks,Gas-Phase pressurized CSTS,NONISOTHERMAL CSTS, single component vaporizer,Multicomponent flash Drum,Batch Reactor, Reactor with mass Transfer, idial binary distillation column, multicomponent Nonidial distillation column, batch distillation with holdup
TREATMENT OF EXPERIMENTAL RESULTS
Solve above developed modeling equations using polymath/matlab/c++

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√	√		
2	√					√	√		
3	√					√	√		
4	√					√	√		
5	√					√	√		

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours
To be announced in the class.

XI. Notice
Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CML 371

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP 371**
Course Title	**: Process Modelling and Simulation**
Course Type	**: Core**
Course Credits	**: 06**

Course description:
Lab experiments on various chemical engineering process
Pre-requisites:
Theory course of Process Modeling and Simulation

Textbooks:

1. Mickley H. S., Sherwood T. S., Reed C. E., Application of Mathematical Modeling in Chemical Engineering ,Tata-McGraw-Hill, New Delhi, 2002.
2. Jensen V.G., Jeffrey's G.V., Mathematical Methods in Chemical Engineering", 2nd Ed. Academic Press, London, 1978.
3. Lubyen W. L., Process Modeling, Simulation and Control for Chemical Engineers, McGraw-Hill,New York, 1989.
4. A. Kayode Coker, Modelling of Chemical Kinetics and Reactor Design, Gulf professional publication
5. Incropera F.P. Fundamentals of Heat and Mass Transfer 5th Edition Wiley India Pvt.Ltd Ltd., 2008

Objectives:

1) To understand knowledge of fundamental principles and basic laws of modeling
2) To understand the approach for mass/heat transfer & CRE
3) To apply the knowledge of differential equations
4) To understand the approach for modeling
5) Formulation of mathematical model for various chemical Engg. system

Outcomes:
Out put data are created for each program and graphs are plotted to analyze the system

Expanded Course description:

1. The following experiments have to be conducted using any one software Polymath/C / C++/ Fortran Depending on availability on machine (Any six out of 14 listed below).

1. Gravity Flow tank.
2. Three CSTR's in series – open loop.
3. Three CSTR's in series – closed loop.
4. Non-isothermal CSTR.
1. Complex reaction scheme (Batch Reactor)
2. Second order complex batch reactor
3. Series parallel reaction scheme
4. Semi-batch reactor model
5. Complex reaction model

6. Parallel second order reaction scheme
7. Reversible and irreversible 1st order reactions
8. 2nd order series reactions
9. Complex set of series parallel reactions

Total Experiments to be conducted : **Nine**

Class Schedule
Two hours per week.

Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√		√			√			
2	√		√			√			
3	√		√			√			
4	√		√			√			
5	√		√			√			

Evaluation of students

Component	Duration	Weightage
Internal	2 hrs per week	40
Assignments and Objective Test	-	30
Final Submission and viva	--	30

Chamber Consultation Hours
To be announced in the class.

Notice
Notice will be displayed on Notice Board near to Chamber.
Course Coordinator
CMP 371

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML 368**
Course Title	**: Chemical Reaction Engineering-I**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:
Intensive coverage of reaction kinetics, temperature pressure effects on reaction. Various reactor types, their performances and how they affect conversion for a given reaction are stressed in this course.

II. Pre-requisites: None

III. Textbooks:
1. Chemical Reaction Engineering, Octave Levenspiel, John Wiley & Sons, Singapore, 3rd edition, 1998.
2. Elements of Chemical Reaction Engineering, Fogler H.S., Prentice-Hall, NJ, 4th edition, 2006.
3. Chemical Reactor Analysis, G. F. Froment and K. B. Bischoff, John Wiley & Sons, Singapore, 2nd edition, 1990.
4. Chemical Engineering Kinetics, Smith J. M., McGraw Hill, N Y, 3rd edition, 1981.

IV. Objectives:
1. Provide students with a basic understanding of reaction engineering, type of reactions, reaction kinetics.
2. Enhance their knowledge on types of reactors, working of reactors and different types of arrangements of reactors
3. Improve the student's ability in deciding type of reactor and their arrangement relating with a given conversion keeping economy in point of view

V. Outcomes:
At the end of the course, the student will understand the reaction kinetics, type and sequential arrangement of the reactors to be used, reaction mechanism and reaction path of a given chemical reaction

VI. Expanded Course description:

1. Introduction to Chemical Reaction Engineering:
   What is chemical reaction engineering?, Role of Chemical Reaction Engineering in Process Industry, Classification of reaction based on various terms, Reaction rate, Chemical kinetics, Variables affecting rate of reaction, Speed of reactions, Problems.
2. Kinetics of Homogeneous Reactions:
   Concentration dependent term and temperature dependent terms of rate equation, Single and multiple reactions, Elementary and non-elementary reactions, Molecularity and order of reaction, Rate constant, Representation of reaction rate, Kinetic models,

Temperature dependency from Arrhenius' law, thermodynamics, various theories, Activation energy, Problems.

3. Interpretation of Batch Reactor Data:
   Constant volume batch reactor, Variable volume batch reactor, Integral method and differential method of analysis of kinetic data, other methods of analysis of kinetic data, Temperature and reaction rate, Problems.
4. Introduction To Reactor Design:
   Types of reactors, PFR, CSTR etc., Material & energy balances single ideal reactor, Space-time and space-velocity, Holding time, Introduction of non-ideal flow, Problems
   Ideal Reactors for a Single Reaction:
   Ideal Batch Reactor, Steady State Mixed Flow Reactor, Steady State Plug Flow Reactor, Problems
5. Design for Single Reactions:
   Size comparison of single reactors, General graphical comparison, Multiple reactor system, Recycle reactor, Autocatalytic reactions, Problems.
6. Design for Parallel Reactions:
   Introduction to design of parallel reactions, Qualitative and Quantitative discussion on product distribution, Contacting patterns, Reactor Size and arrangement, Selectivity, Yield, Problems.
7. Potpourri of Multiple Reactions:
   Reversible first order reaction, First order followed by zero order reaction, Zero order followed by first order reaction, Successive reversible reactions of different orders, reversible reactions, Irreversible series-parallel reactions, Graphical representation, Denbigh reactions and their special cases, Problems.
8. Temperature and Pressure Effects:
   Single and multiple reactions, Heats of reaction from thermodynamics, Equilibrium constant, Temperature, Graphical design procedure, Optimum Temperature Progression, Heat Effects, Adiabatic and non-adiabatic operations, Problems.

VII. Class Schedule

Three 55 minutes session per week

VIII. Relationship of Course Objectives to Program Outcomes:

Course objectives	Program outcomes								
	a	b	c	d	e	f	g	h	i
1	✓					✓		✓	
2	✓					✓		✓	
3	✓	✓				✓		✓	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML 368

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML462**
Course Title	**: Chemical Reaction Engineering - II**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 462 Chemical Reaction Engineering – II covers the application of CML 368 Chemical Reaction Engineering – I in understanding Flow Pattern and Non-ideal behavior; heterogeneous catalytic, fluid – fluid, fluid – particles reactions and reactors.

II. Pre-requisites:

CML 368 Chemical Reaction Engineering – I

III. Textbooks:

1. Chemical Reaction Engineering, Octave Levenspiel, John Wiley & Sons, Singapore, 1998 3rd Edition
2. Elements of Chemical Reaction Engineering, Fogler H.S., Prentice-Hall, NJ, 2006, 4th Edition
3. Chemical Engineering Kinetics, Smith J. M., McGraw Hill, N Y, 1981, 3rd Edition

IV. Objectives:

1. Provide students with a basic understanding of Flow Pattern, Non-ideal behavior; heterogeneous catalytic systems, fluid – fluid systems, fluid – particles systems.
2. Provide the kinetics and design concepts for these systems.
3. Increase the student's ability to apply these principles for the design of reactors and application in process industries.

V. Outcomes:

At the end of the course, the student will understand the Chemical Reaction Engineering - II principles. The students will be able to apply these principles for the design of reactors and application in process industries.

VI. Expanded Course description:

Unit I (4 hrs)

Overview of Chemical Reaction Engineering: Summary of Chemical Reaction Engineering-I, Choosing the right kind of reactor, Problems.

Unit II (8 hrs)

Flow Pattern, Contacting, and Non-Ideal Flow: Non ideal flow in reactors, RTD of fluid in reactors, Age distribution, F curve, C curve and E curve, Compartment model, Dispersion model, Tank in Series model, Problems.

Unit III (8 hrs)

Introduction to Heterogeneous Reactions: Examples of heterogeneous reactions, contacting pattern and flow modeling, Problems.
Solid Catalysed Reactions: Introduction and Spectrum of kinetic regimes, Surface kinetics and rate equation, pore diffusion, porous catalyst, Heat effects, Performance Equation, Experimental methods and rate equation, Controlling Resistance, Product distribution in multiple reactions, Problems.
Unit IV (4 hrs)
Introduction to Catalyst and Catalytic Reactors: Typical Catalysts, Catalyst Characterizations, Catalyst Deactivation and Regeneration, Packed bed reactor, Fixed Bed, Fluid Bed, Trickle bed, Slurry Reactors etc., Problems.
Unit V (6 hrs)
Kinetics and Design of Fluid- Fluid Reactions: The rate equation, Kinetic regimes for mass transfer and reaction, Fast reaction, Intermediate reaction, Slow Reactions, Factors to select the contactor, Straight mass transfer, Various cases of mass transfer with chemical reaction, reaction kinetics, Problems.
Unit VI (6 hrs)
Kinetics and Design of Fluid- Particle Reactions: Various models for fluid-solid reactions, Shrinking core model, Rate of reaction, Reaction/Mass transfer Control, Rate controlling steps, plug flow and mixed flow of solids, Problems.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√		√					√	
2	√	√	√			√		√	
3	√	√	√			√	√	√	

IX. Evaluation of students

	Component	**Duration**	**Weightage**
	Session 1 Exam	1 hour	15
	Session 2 Exam	1 hour	15
	Class tests, Quizes and Assignments	-	10
	End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator
CML 462

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP 462**
Course Title	**: Chemical Reaction Engineering (Lab)**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:
This course mainly deals with the understanding the basic fundamental principles of chemical reaction engineering by performing different experiments

II. Pre-requisites:
Chemical reaction engineering I, Chemical Reaction Engineering II

III. Textbooks:
1) Chemical Reaction Engineering, Octave Levenspiel, John Wiley & Sons, Singapore, 1998 3rd Edition
2) Elements of Chemical Reaction Engineering, Fogler H.S., Prentice-Hall, NJ, 2006, 4th Edition
3) Chemical Engineering Kinetics, Smith J. M., McGraw Hill, N Y, 1981, 3rd Edition

IV. Objectives:
1) To understand the basic principle of chemical reaction engineering

V. Outcomes:
1) Students will understand the basic of chemical engineering and its practical application.

VI. Expanded Course description:
1) Three CSTRS Connected in Series
Aim: Study the kinetics of reaction for all the combination for given three CSTR in series
2) PFR & CSTR in Series
Aim: Study the kinetics of reaction for all the combination for given PFR and CSTR in series
3) Isothermal Continuously Stirred Tank Reactor
Aim: To Study the performance of isothermal continuous stirred tank reactor for the reaction ethyl acetate and NaOH
4) Isothermal Plug Flow Reactor
Aim: To Study the performance of isothermal continuous stirred tank reactor for the reaction ethyl acetate and NaOH
5) R.T.D. Studies in Plug Flow Reactor
Aim: To plot the F-Curve and C- Curve for given Plug Flow Reactor
6) Semi Bath Reactor
Aim: To determine overall order of Reactions for bimolecular reactions
7) R.T.D. Studies in Series & Parallel CSTR
Aim: To plot the F-Curve and C- Curve for given Plug Flow Reactor
8) Adiabatic Batch Reactor

Aim: To study the kinetics of reaction adiabatically
9) Isothermal Batch Receiver
Aim: To find the Arrhenius constant
10) R.T.D. Studies in Packed Bed Reactor
Aim: To plot the F-Curve and C- Curve for given packed bed reactor
11) Condensation Polymerization Reactor
Aim: To study the polymerization reaction in given condensation polymerization reactor
12) Fluidized Bed Reactor
Aim: To study the performance of fluidized bed reactor.

VII. Total Experiments to be conducted : Any eight out of above list

VIII. Lab Schedule: Two hours per week.

IX. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1			√			√	√		

X. Evaluation of students

Component	**Duration**	**Weightage**
Internal	2 hrs per week	40
Assignments and Objective Test	-	30
Final Submission and viva	--	30

XI. Chamber Consultation Hours
To be announced in the class.

XII. Notice
Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CMP 462

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML 461**
Course Title	**: Transport Phenomena**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

This course mainly deals with application of knowledge gain by students in fluid mechanics, heat transfer and mass transfer. This subject also covers the topic which shows the similarity between fluid mechanics, heat transfer and mass transfer

II. Pre-requisites: Fluid mechanics, Heat Transfer and Mass Transfer

III. Textbooks:

1) R.B. Bird, W. Stewart and E.N Lightfoot, Transport Phenomena, John Wiley & Sons, 2nd Edition, 2006
2) C.O. Bennet and J.E. Myres, Momentum, Heat & Mass Transfer, McGraw Hills, 3rd Edition, 1994
3) R. Brodkey and H. C. Hershey, Transport Phenomena – A Unified Approach, volume 1, McGraw Hill Book Co., 2nd Edition, 1988
4) C.J. Geankoplis, Transport Processes and Separation Process Principles, Prentics Hall India Ltd., 4th edition, 2003
5) G.S. Laddha and T.E. Degaleesan, Transport Phenomena in Liquid Extraction, Tata McGraw Hill Book Co., 1st edition, 1978

IV. Objectives:

1) To understand the theoretical similarities between heat, mass and momentum transfer
2) To understand the shell balance approach for momentum transfer
3) To understand the shell balance approach for heat transfer
4) To understand the shell balance approach for mass transfer
5) Application for differential equation for shell balance modeling

V. Outcomes:

1) Student will understand the analogical correlation between heat, mass and momentum transfer. Using this information they can solve the problem in any area (e.g. momentum transfer) using corresponding logical data in other area (like head and mass transfer).
2) Velocity profile equation derived for given case can be used to estimate various important properties in momentum transfer.
3) Temperature profile equation derived for given case can be used to estimate various important properties in heat transfer.
4) Concentration profile equation derived for given case can be used to estimate various important properties in mass transfer.
5) Student can develop model equations for important properties in the area of momentum, heat and mass transfer.

VI. Expanded Course description:

Definition of transport properties, their measurement and estimation, velocity distribution in laminar and turbulent flow, shell momentum balances, flow of non-Newtonian fluids, development of boundary layer, flow over flat plates, and velocity profiles.
Similarity between heat, momentum and mass transport and mass transport and various analogies. Application of heat, momentum and mass transport concepts to various to various disciplines of engineering and technology.
One-dimensional equation of motion and continuity, Euler and Navier–stokes equation, dimensional analysis of equation change.
Shell balance approach for developing equations for momentum, heat and mass transport, Temperature distribution in solids and fluids in laminar flow, development of thermal boundary layer.
Concentration distribution in solids and in fluids in laminar flow, equations of change for multi component systems.

VII. Class Schedule : 3 Classes a week each of 55 minutes

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√		√	
2	√	√				√	√	√	
3	√	√				√	√	√	
4	√	√				√		√	
5	√	√						√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	20
End Semester Exam	3 hours	50

X. Chamber Consultation Hours
To be announce in the class

XI. Notice
To be announce in the class

Course Coordinator
CML461

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML463**
Course Title	**: Process Control and Instrumentation**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject "Process Control and Instrumentation" provides introduction to process control and in depth discussion on process modelling. The methods of analysis used in the control area are so different from the previous experiences of students that the materials comes to be regarded as a sequence of special mathematics techniques, rather than the integrated design approach to a class of real and practically significant industrial problems.

II. Pre-requisites: Mathematics

III. Textbooks:

1. "Process system Analysis & Control", Donald R. Coughanowr and Kappel, Mc Graw Hill Book Company.
2. T. Marlin, "Process Control", McGraw Hill, 1995.
3. W.L.Luyben, "Process Modelling Simulation and Control for Chemical Engineers", McGraw Hill, 1990.
4. G.Stephanopoulos, "Chemical Process Control: An Introduction to Theory and Practice", Prentice-Hall, New Jersey, 1984.
5. R.P.Vyas, "An Introduction to Process dynamics & control, Central publication, Nagpur, 2001

IV. Objectives:

1. To obtain theoretical and empirical mathematical models of different processes**.**
2. To introduce some of the basic principles and problems involved in process control.
3. To introduce analytical tools and design methodologies to tackle process control problems.
4. To design simple and effective control systems.

V. Outcomes:

1. Students will able to analyze the dynamic behavior of processes and develop good understanding of their behavior in different situations.
2. Students will able to design different types of controllers and tuning techniques.
3. Students will able to apply control schemes in chemical process Industries.
4. Student will exposed to various schemes like Multi input and multi output, complex control system, and application of control valves.

VI. Expanded Course description:

Importance, aims and objectives of process control, introduction to system dynamics, concept of dynamic response, first order, second order interacting and non interacting systems, concepts of transfer function, time constant, process gain, overshoot, decay ratio, dead time.
Introduction to set point, disturbance, closed loop and open loop control, feedback and feed forward configurations, dynamics of feedback control system.
Types of controllers, P, PI and PID controllers, controller gain, stability analysis, Routh stability criteria.
Design of controllers using open loop response, Zigeler – Nichols controller settings, Bode and Nyquist stability criteria.
Control valve and choice of controller settings. Basic design of pneumatic controllers, electric / electronic controllers, discontinuous control modes – two position, classical and modern control actions.
Process instruments used for measurement of pressure, temperature, liquid level, flow rate and compositions, pressure gauge, strain gauge, McLeod gauge, vacuum measurement, transducers, transmitters, digital signal processing.
Introduction to set point, error, accuracy, sensitivity, Application of control systems to chemical process equipments such as chemical reactors, heat exchangers, distillation columns, boilers etc.

VII. Class Schedule

Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√		√	
2	√							√	
3	√					√		√	
4	√					√		√	

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	55

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML463

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML 374**
Course Title	**: Optimization Technique**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:
This course mainly deals with basics of different optimization techniques and its application for various engineering purpose.

II. Pre-requisites: Numerical methods, Basic Math's

III. Textbooks:
1) Edgar, T.F., D.M. Himmelblau, and L.S. Lasdon, Optimization of Chemical Processes, 2nd Edition, McGraw-Hill International Edition, Singapore, 2001.
2) Rao, S.S., Engineering Optimization Theory and Practice, 4th Edition, A Wiley Inetrscience Publication, Canada, 2009.
3) Reklaitis, G.V., A. Ravindran, and K.M. Ragsdell, Engineering Optimization: Methods and Applications, 2nd Edition, John Wiley, New York, 2006.
4) Fletcher R., Practical method of optimization, 2nd Edition, John Wiley, New York, 2000.
5) Chong E.K.P. and Zal S. H., An Introduction to optimization, 2nd Edition, John Wiley, New York, 2001.
6) Nocedal J. and Wright S.J. Numerical Optimization, 2nd Edition, Springer,2000.
7) G. Mitsuo and C. Runwei, Genetic Algorithms and Engineering Optimization, John Wiley, New York, 2000.

IV. Objectives:
1) To understand the basics of optimization techniques, and problem formulation for optimization
2) To understand the single variable and multivariable optimization techniques and their application
3) To understand the linear programming application for optimization
4) To understand the advance optimization technique like genetic algorithm

V. Outcomes:
1) Student will understand necessary and sufficient condition for optimization and will be able to formulate the optimization problem.
2) Student will be able to solve different optimization problem and their application to the case studies like heat exchanger, evaporator etc

VI. Expanded Course description:
Nature and organization of optimization problems: what optimization is all about, Why optimize, scope and hierarchy of optimization, examples of applications of optimization, the essential features of optimization problems, general procedure for solving optimization

problems, obstacles to optimization. Classification of models, how to build a model, fitting functions to empirical data, the method of least squares, factorial experimental designs, fitting a model to data subject to constraints.

Basic concepts of optimization: Continuity of functions, unimodal versus Multimodel functions. Convex and Concave functions, Convex region, Necessary and sufficient conditions for an extremum of an unconstrained function, interpretation of the objective function in terms of its quadratic approximation.

Optimization of unconstrained functions: one-dimensional search:

Numerical methods for optimizing a function of one variable, scanning and bracketing procedures, Newton's, Quasi-Newton's and Secant methods of uni-dimensional search, region elimination methods, polynomial approximation methods, how the one- dimensional search is applied in a multi-dimensional problem, evaluation of uni-dimensional search methods.

Unconstrained multivariable optimization:

Direct methods, random search, grid search, uni-variate search, simplex method, conjugate search directions, Powell's method, indirect methods- first order, gradient method, conjugate method, indirect method- second order: Newton's method forcing the Hessain matrix to be positive definite, movement in the search direction, termination, summary of Newton's method, relation between conjugate gradient methods and Quasi-Newton method.

Linear programming and applications:

Basic concepts in linear programming, Degenerate LP's – graphical solution, natural occurrence of linear constraints, the simplex method of solving linear programming problems, standard LP form, obtaining a first feasible solution, the revised simplex method, sensitivity analysis, duality in linear programming, the Karmarkar algorithm, LP applications.

Optimization of Unit operations-1 recovery of waste heat, shell & tube heat exchangers, evaporator design, liquid liquid extraction process, optimal design of staged distillation column.

Optimization of Unit operations-2 Optimal pipe diameter, optimal residence time for maximum yield in an ideal isothermal batch reactor, chemostat, optimization of thermal cracker using liner programming.

Genetic Algorithms: (Qualitative treatment) Working principles, differences between GAs and traditional methods, similarities between GAs and traditional methods, GAs for constrained optimization, other GA operators, real coded GAs, Advanced Gas

VII. Class Schedule : 3 Classes a week each of 55 minutes

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√			√
2	√								√
3	√								√
4	√								√

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	20

End Semester Exam	3 hours	50

X. Chamber Consultation Hours

To be announce in the class

XI. Notice

To be announce in the class

Course Coordinator
CML374

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML 481**
Course Title	**: Instrumental Analytical Techniques**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

This course mainly deals with basics and application of various analytical equipments like, gas chromatography, liquid chromatography, gas chromatography mass spectroscopy, liquid chromatography mass spectroscopy, UV visible Spectrophotometer and infra red spectrophotometer etc.

II. Pre-requisites:

Basic courses in Fluid mechanics, Heat Transfer and Mass Transfer

III. Textbooks:

1) Harris, D.C., *Quantitative Chemical Analysis,* 7th Edition, W.H.Freeman and company, New York 2006.
2) Bruno, T.J, and Svoronos, P. D. N., *Handbook of Basic Tables for Chemical Analysis*, 2nd Edition, CRC Press, New York 2003.
3) McNair, H. M. and Miller, J. M., *Basic Gas Chromatography*, 1st Edition, John Willy and Sons, Inc, Singapore, 1998.
4) Palvia D. L., Lampman G. M., Kriz G. S. and Vyvyan J. R., *Introduction to Spectroscopy*, 4th Edition, Brooks/Cole, Belmont USA, 2009.
5) Snyder L. R, and Krikland J. J., *Introduction to Modern Liquid Chromatography*, 2nd Edition, A Wiley Inetrscience Publication, New York, 1979.

IV. Objectives:

1) To understand the fundamental analytical chemistry for instrumentation
2) To understand the basic processes used in Instrumental Analytical Techniques
3) To understand the basic working principle of some important analytical instruments like GC, GCMS, LC, LCMS, FTIT, UV-Vis etc

V. Outcomes:

Student will understand basic fundamental and operating principle for different analytical instruments like GC, GCMS, LC, LCMS, FTIT, UV-Vis etc.

VI. Expanded Course description:

An introduction to analytical chemistry: choice of analytical methodology, sampling, sample preparation, chemical analysis, tools for quantitative chemical analysis, quality assurance. Extraction methods such as liquid-liquid extraction, solid phase extraction, super-critical fluid extraction and accelerated solvent extraction. Cleanup and fractionation methods. Introduction to Chromatography, high-pressure liquid chromatography (HPLC), gas chromatography (GC) and other chromatographic methods. Detector types with focus on mass spectrometry and hyphenated techniques such as GC-MS and LC-MS.

Introduction to spectroscopic methods (UV-VIS, IR, X-ray, atomic absorption spectroscopy (AAS) and inductive coupled plasma mass spectrometry).
Introduction to data processing, errors in chemical analyses, statistical analyses (including chemometrics) and data presentation. Method development, evaluation, validation and QA/QC measures. Uncertainty analysis.

VII. Class Schedule : Three class a week, each of 55 minutes

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1		√	√						
2		√	√						√
3		√	√						√

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	20
End Semester Exam	3 hours	50

X. Chamber Consultation Hours
To be announce in the class

XI. Notice
To be announce in the class

Course Coordinator
CML481

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML474**
Course Title	**: Plant Utility**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:
The course covers the major utilities required for process plants such as water and its treatment, properties of steam and boiler performance, different refrigerants and refrigeration cycle , air compressor and psychometric properties. It also involves the basic calculations for evaluating the performance of steam generation, refrigeration, compressor and cooling tower.

II. Pre-requisites: none

III. Textbooks:
1. Chattopadhya Boiler operations Tata McGraw Hill, New Delhi
2. Yadav R. Thermodynamics & Heat Engines Central Publishing House
3. Lyle O. Efficient Use of Steam Prentice Hall 1963
4. Mahesh Rathore Thermal Engineering McGraw Hill,

IV. Objectives:
1. State the principles involved during water treatment, generation of steam and its uses, refrigeration cycles.
2. Describe the different equipments used to run the process plant with different utilities.
3. Acquire the knowledge for selection of different utilities.
4. Understand basic calculation involved in steam generation, psychometric operation and refrigeration

V. Outcomes:
At the end of the course student will be able to describe the different utilities used to run the process plant. Acquire the knowledge for selection of different utilities. Understand basic calculation involved in steam generation, psychometric operation, cooling tower and refrigeration.

VI. Expanded Course description:

1. *Importance of utilities :*
Sources of water, hard and soft water , Requisites of industrial water and its uses, Methods of water treatment, Chemical softening, Demineralization, Resins used for water softening, Reverse osmosis and membrane separation, Effects of impure boiler feed water & its treatments., Scale & sludge formation, Corrosion, Priming & foaming, Caustic embrittlement.

2. Refrigeration:

Refrigeration cycles 04, Different methods of refrigeration used in industry, Vapour compression, Vapour absorption: Lithium bromide (eco-Friendly)‘ Different refrigerants‘ Monochlorodifluoro methane (R-22)‘ Chlorofluorocarbons (CFC-Free) ‘ Secondary refrigerants: Brines’ Simple calculation of C.O.P. Refrigerating effects.

3. *Steam and steam generation:*
Properties of steam, Problems based on enthalpy calculation for wet, steam, dry saturated steam, superheated steam,, Types of steam generator / boilers: water tube & fire tube, Solid fuel fired boiler. , waste gas fired boiler., Waste heat boiler., Fluidized bed boiler., Scaling, trouble shooting, preparing boiler for inspection, Steam traps, boiler mountings and accessories , Boiler Act.

4. *Psychrometry:*
Properties of Air-water vapors. Use of humidity chart , Equipment used for humidification, dehumidification ,Evaporative cooling, spray ponds, cooling towers .

5. *Air:*
Use of Compressed air, process air and instrument air, Process of getting instrument air.

6. *Non steam heating system:*
Thermic fluid heater, Down therm heater , Temperature range , Principle, construction & working.(3-Hr)

VII. Class Schedule : Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√					√	√	√	
2	√	√				√		√	
3	√	√				√	√		
4	√					√	√		

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours
To be announced in the class.

XI. Notice
Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML474

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML468**
Course Title	**: Mineral and Ore Processing**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

The course covers the fundamentals of mineral processing , aspects of sampling, particle characterization, comminution and classification, physical processes of mineral concentration involving dense media and gravity separation, magnetic and electrostatic separation and ore sorting techniques, Froth flotation technique etc.

II. Pre-requisites: Mechanical Operations

III. Textbooks:

1. Elements of Mineral Dressing Author Gaudin A.M.;, Publisher New York Edition2nd Edition
2. Mineral Processing Author Pryor E.J; Publisher Kluwar Academic Publishers Edition3rd Edition
3. Elements of Mineralogy Author Rutley F. Publisher Thomas Murray & Co., London
4. A Text Book of Ore Dressing, Author Robert H. & Locke, Richards C.E; Publisher McGraw Hill Co.

IV. Objectives:

1. The objective of this course is to understand the fundamentals of minerals processing
2. To give the basic principles of different unit operation used in mineral dressing
3. To identify various processes and equipment used in mineral processing.

V. Outcomes:

At the completion of the course students will be able to understand the different steps used for the processing of various minerals.

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VI. Expanded Course description:

1.Mineralogy:

Studies of important metallic and non metallic minerals, their characteristics, origin etc. application of non metallic minerals. Sea as a source of minerals. Status of mineral beneficiation industry in India. Study of some representative beneficiation practices with flow sheets. Sampling methodology and equipments.

2.Comminution:
Primary, secondary and special crushers and their performances. Cylindrical and cylindro-conical ball mills, Rod mills, Tube / Pot mills and their performances, capacities, reduction ratios etc. Dry and Wet Grinding. Open and closed circuit grinding. Work Index calculations. Interlocking and liberation of minerals.

3.Screening:
Sizing and Classification: Standard screening tests and graphical representations of the results.Particle size distribution, Sorting, Sizingand Pneumatic classifiers and their performances.Thickeners, Hydrocyclones etc.Theory and practice of sedimentation and filtration.Working of Rotary vacuum filters.

4.Gravity Concentration Techniques:
Principles of Jigging, Tabling and Heavy Media Separation. Processes with equipments used, important controlling factors in operation and application.Beneficiation practice for arsenopyrite containing scheelite.

5.Froth Flotation:
Natural and Artificial Floatability of minerals. Frothers, Collectors, Depressants, Activators / Deactivators, PH Modifiers, etc. Flotation machines.Study of representative sulphide and non sulphide minerals and non metallic ores.Multistage flotation and Column Flotation.

6.Electrostatic and Magnetic Separation:
Principles of Electrostatic and Magnetic Separation (Dry and Wet type). Separation units used in practices and examples in the industries.Calculation of Recovery and ratio of concentration and Mass balance calculations in ore dressing. Industrial set up of Ore Dressing plant.

VII. Class Schedule
Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√						√	√	
2	√						√	√	
3	√	√				√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours
To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator

CML468

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML621**
Course Title	**: Nano Technology**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

This course provides new technology and platform for students to learn and apply knowledge of nanotechnology to develop new and improved quality product.
This enables students to learn concepts like CNT's, Nanofluids, Polymer Nanocomposites, Synthesis of various Nanomaterials and it's applications in various fields as per their requirement

II. Pre-requisites:

No pre-requisites

III. Textbooks

1. Gipzjpmg Cap, Ying Wang, Nanostructures and Nanomaterials(synthesis properties and applications, 2nd Edition, USA 2011
2. Jurgen Schulte, Nanotechnology (strategies, industry trends and applications, Willey ,1st Edition, England 2005
3. S.Reich, C.Thomsen, J.Maultzsch, *Carben Nanotubes (Basic concept and physical property, Wiley-VCH,1st Edition, 2004, Weinheim*

IV. Objectives:

1) To understand knowledge of new technology
2) To understand the knowledge of Engg/Technology along with science
3) To understand the synthesis rout of Nano particles
4) To understand the applications in various Engg/Tech towards development of new product
5) To understand the approach for modeling for synthesis rout

V. Outcomes:

Synthesis of various nanoparticles are performed and their themal property using analytical equipments are done

VI. Expanded Course description:

Introduction to Nanotechnology,
Physical chemistry of solid surfaces: Electrostatic stabilization, steric stabilization
Synthesis of Nanomaterials: Matrix mediated growth technique, sol-gel method, Chemical precipitation method etc,
Application in Chemical Technology: Polymer Nanocomposites-Synthesis, characterization, mechanical, thermal properties etc

Application in Carbon nano tubes: Synthesis, characterization, SWNT,MWCNT, different models used for CNT, method of synthesis-Arc discharge method, lasor ablation method, CVD method etc
Application in drug delivery,
Application in nanofluids: Synthesis of various kind of nanofluids, application in Thermal conductivity, heat transfer coefficient, heat exchanger applications, study of dimensionless analogy, etc
Study of Characterization of nanoparticles techniques: XRD, TEM,SEM,AFM,DSC, TGA,DMA, Rheometer etc

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√				√		√	√
2	√	√				√	√	√	
3	√	√							
4	√					√		√	√
5	√					√			

Course Objectives

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CML621

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML374**
Course Title	**: Petroleum Refinery Engineering**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

A brief review of the basic principles and existing techniques of petroleum refinery such as exploration of crude oil, characterization and fractionation into usable petroleum products. Recent advancements in secondary processes on the above areas to meet the revised standard and specification of the petroleum products. This course will end up with understanding of the fundamentals of refinery and present and future requirements of the refinery/oil sector.

II. Pre-requisites:

CML 361, CML366

III. Textbooks:

1. Modern Petroleum Refining Processes, Bhaskara Rao B.K., Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi., Edition 3rd
2. Petroleum Refining Engineering, Nelson W.L.., Tata McGraw Hill Publication Co. Ltd. (1985), 4th Edition.
3. Petroleum Refining Technology and Economics, Gary J.H. & Handwerk G.E., Marcel Dekker, Inc., New York, 3rd Edition
4. Petroleum Refining Manual, Noel H.M., Publisher Reinhdd Pub. Corp., New York.
5. Modern Petroleum Technology, Hobson G.D. & Rohl W., Applied Science Publication, 4th Edition.

IV. Objectives:

1. To develop the fundamentals of refining of petroleum crude oil and its fractionation in different useful petroleum products.
2. The student will be aware to the product quality, related environmental concern and the standards by applying the different primary, secondary and advanced refinery processes.
3. The student will be aware to problems and remedies in petroleum sector.
4. To develop the skill and knowledge for upgradation of petroleum refineries as per present and future demand.
5. To develop the responsibility of technological inputs related to energy and environmental demand.

V. Outcomes:

At the end of the course, the student will understand the fundamentals and advances in refinery sector. Students will gain detailed knowledge of exploration of crude oil, its fractionation into different useful petroleum products, their quality, related

environmental concerns and the standard by the recent and updated technology. The students will be able to visualize the scenario of refinery in India and abroad and can work in refineries and R&D sector of the related area.

VI. Expanded Course description:

Unit I (6 hrs) : Fundamental principles of origin and occurrence of petroleum crude and its exploration, Composition of petroleum, classification and physical properties, Characterization of crude oil and petroleum products, status of petroleum refining in India, future refining trends.

Unit II (6 hrs): Crude oil Distillation Process, Pretreatment of crude, atmospheric and vacuum distillation process

Unit III (6 hrs) : Secondary conversion processes: Thermal and catalytic cracking, Catalytic reforming, Pyrolysis

Unit IV (6 hrs): Heavy Residue Upgradation Technologies: Hydrocracking, Hydrotreating, visbreaking and coking, alkylation, Isomerisation, dehydrogenation processes, polymerization.

Unit V (6 hrs): Lubricating oil, grease and Bitumen: Dewaxing and deoiling, deasphalting, lube hydrofinishing, bitumen air blowing, Sweetening and Desulphurization, Hydrodesulphurisation of petroleum products.

Unit VI (6 hrs): Energy conservation in petroleum refineries. New Trends in petroleum refinery operations, Biorefinery concept.

VII. Class Schedule : Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√	√				√	√	
2	√	√	√		√	√	√	√	√
3	√	√	√	√	√	√	√	√	√
4	√	√	√	√	√	√		√	
5					√	√	√	√	√

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests, Quizes and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator

CML374

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML473**
Course Title	**: Safety and Risk Analysis**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

A brief review of the existing standards of safety in chemical process industries and the analysis of event. Hazard identification, different analytical techniques of analysis of hazards regarding Fire and Explosion and Chemical hazards in process industries. This course will terminate with much understanding of the different aspects of safety and hazards and their analytical valuation for prevention and standards for future.

II. Pre-requisites:

None

III. Textbooks:

1. Chemical Process Safety: Fundamentals with Applications, Daniel A. Crowl and Joseph F. Louvar, Prentice Hall International Series, 2nd Edition
2. Safe and Efficient Plant Operation and Maintenance, Greene R., McGraw Hill Book Co., New York.
3. Safety Management and Practices for Hazardous Units, Dekkar Marcel, McGraw Hill Book Co., New York, 1995
4. Safety and Good House Keeping, Saxena, National Productivity Council, New Delhi (1976), 3rd Edition.
5. Safety in Process Plant Design, Wells G.L., George Godwin Ltd., (1980).

IV. Objectives:

1. To give knowledge of process plant safety, hazardous chemicals, fire and explosion hazards and different methods of hazard identification and its analysis in qualitative and quantitative scales.
2. The students will introduce to personnel safety and case study problems.
3. To develop the social, ethical and environmental responsibility among the students.
4. To develop the safety concepts among the students with detailed understanding of technical knowledge.
5. To develop the responsibility and ability for precautions and remedial actions for any untoward event.

V. Outcomes:

At the end of the course, the student Students will gain knowledge of safety standards to be maintained at process industries and handling of problems related to safety, different methods of hazard identification and their analysis.

VI. Expanded Course description:

Introduction to process plant safety, handling of hazardous chemicals, Lower flammability limit (LFL), UFL, LEL, UEL, TLV, electrostatic hazards, Hazard code and explosive limit, TWA, Ceiling level, Safety in handling of gases, liquids and solids
Flammable liquid hazards, fire and explosion index, fire ball hazards, oil spillage hazards, Bleveuvce, pool fires, jet fires, radiation hazards.
Explosion, emergency and disasters in chemical process plants, onsite and offsite emergency plan, Fire detectors, smoke detectors.
Safely audit of chemical process plants, HAZOP studies, fault tree and event tree analysis.
Resources for combating fires, dry chemical powders, fire fighting foam, fixed and portable fire extinguishers, FMEA.
Risk analysis of chemical processes, risk management, risk identification, personnel training, risk to environment.
OSHA standards, importance of plant layout in safety, importance of site selection, personnel safety, role of human error in losses. Case studies of fires, explosions, disasters in chemical process plants.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√	√	√			√	√	
2	√	√	√	√	√	√	√	√	√
3					√	√	√		√
4	√	√	√					√	
5	√	√	√	√	√	√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests, Quizes and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours :

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator
CML473

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML471**
Course Title	**: Biotechnology & Biochemical Engineering**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:
A consideration of the engineering and scientific basis for using cells or their components in engineered systems. Central topics addressed include kinetics and reactor design for enzyme and cellular systems; fundamentals, techniques, and bioseparations. Additional lectures will provide an introduction to metabolic modeling as well as special topics. The course is designed to be accessible to students with engineering backgrounds.

II. Pre-requisites: Mass Transfer, Chemical Reaction Engineering

III. Textbooks:

1. Biochemical Engineering fundamentals By Bailey ollis
2. Bioprocess Engineering:-Basic concept by Shuler & Kargi (PHI)
3. Biochemical Engineering:-principles & concepts by Syed Tanveer Ahmed Inamdar(PHI)
4. Introduction to Biochemical Engineering by D.G.Rao

IV. Objectives:
1. To introduce the essential concepts of bioprocessing to traditional chemical engineers.
2. To make the student aware about advances in Biotechnology.
3. The Program encourages students to work in the field of biotechnology.

V. Outcomes:
Student will gain an ability to apply knowledge of mathematics, bioscience, and engineering. Students will learn to apply the principles of biology, engineering science, along with problem solving skills and critical thinking to a broad spectrum of problems in biotechnology.

VI. Expanded Course description:
Types of micro organisms, structure and function of microbial cells, batch and continuous culture, microbial growth kinetics, enzymes from cells, their function and immobilized kinetics, kinetics of microbial growth.

Enzyme technology and kinetics, enzyme catalysis, enzyme applications in industries and medicines, metabolism and bioenergetics, photosynthesis, synthesis and regulation of bimolecular, fundamentals of microgenetics, role of DNA and RNA.
Reactions catalyzed by enzymes, types of reactors such as CFSTR, Plug flow.
Introduction to Bioreactor design, scale up of bioreactions and bioreactors, volumetric mass transfer rate of oxygen from air bubbles, respiratory model for mycellial pallet, mechanical mixing, aeration, power consumption, heat transfer in bio reactor.

Sterilization techniques, media and air sterilization, death rate of micro organisms.
Introduction to fermentor design, design of fermentors with modified organisms.
Bioreactor modeling and simulation. Design for bioproducts, applications in biochemical and biomedical engineering.
Downstream processing in biochemical industries: such as separation processes for bulk chemicals unit operations such as Ultra filtration, Aqueous two phase extraction.

VII. Class Schedule

Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1							√		√
2							√		√
3							√		√

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	55

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML471

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML380**
Course Title	**: Industrial Waste Treatment**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:
Our objective is to discuss engineering aspects of industrial Pollution Control Technologies. The emphasis in this course will be the control of gaseous ,liquid and solid pollutants.

II. Pre-requisites: None

III. Textbooks:
1. Industrial Waste Treatment,Nemerow N.L,Butterworth-Heinemann,1st
2. Pollution Control in Process Industries,S. P. Mahajan,Tata McGraw Hill ,1st
3. Industrial Waste Treatment Handbook,Frank Woodard,Butterworth-Heinemann, 1st
4. Environmntal pollution control engineering,C.S.Rao,New Age International, 2nd
5. Industrial Pollution Prevention Handbook, Freeman H. M.,McGraw Hill,1st

IV. Objectives:
1. To understand the effect of air, water and solid pollutant on public health and on environment.
2. To study the different methods of sampling.
3. To describe the different control strategies to protect the ecosystem from adverse effect of pollutants.
4. To identify waste management practices and technologies adapted by different industries.

V. Outcomes:
1. Student will gain the knowledge of adverse effect of different pollutants on public health and on ecosystem.
2. Students will learn the different methods of collection and measurement of air pollutant.
3. Students will learn different methods to control the different pollutants.
4. Students will gain the knowledge of conventional methods as well as new methods to control the pollution.

VI. Expanded Course description:

Nature and characteristics of industrial wastes; Sources and types of wastes: solid, liquid, and gaseous wastes; Pre-treatment of Industrial wastes, unit operations and unit processes. Sampling Techniques.

Methods for Treating industrial waste gases or air discharges- physical method, chemical method, combined method, biological method.

Solid and Hazardous wastes: definitions, concepts. Incineration, recycling, composting, landfill, On-Site Monitoring and Analysis of Industrial Pollutants.

Waste water treatment-physical, chemical and biological method.

Recent trends in Industrial waste treatment. Application of Biotechnology for Industrial Waste Treatment.

Case Studies:- Example (Treatment of Pharmaceutical Wastes, Treatment Refinery Wastes, Treatment of Textile Wastes, Treatment of Pulp and Paper Mill Wastes, Treatment of Dairy Processing Wastewaters, Treatment of Pesticide Industry Wastes, Food Waste Treatment, Treatment of Rubber Industry Wastes, Treatment of Tannery Industry Wastes and Radioactive waste etc.).

VII. Class Schedule

Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√	√			√		√	
2	√	√		√					√
3	√	√						√	
4	√	√				√		√	

IX. Evaluation of students

Component	**Duration**	**Weightage**
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	55

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator

CML380

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML467**
Course Title	**: Materials in Chemical Industries**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

The course covers the fundamentals of different kinds of materials used in chemical industries, their physical and chemical interactions under various service conditions, testing and maintenance.

II. Pre-requisites: None

III. Textbooks:

1. Introduction to material science, James F. Shacketford, McMillan publishing company, New York ISBN 1990.
2. Properties of Engg. Materials, Jestrazebaski D.Z., Toppers. Co. Ltd. 3rd edition.

IV. Objectives:

1. To provide basic knowledge and application of different type of materials.
2. To study short-term and long-term mechanical behavior of materials.
3. To understand the science behind the failure of materials.
4. To provide knowledge on different heat treatment techniques.
5. To understand the types of corrosion and methods to prevent it.

V. Outcomes:

Students shall have a solid knowledge basis in physical and chemical properties of different types of materials.
They shall understand the development of science and technology of materials in chemical industry from time to time.

VI. Expanded Course description:

Introduction : Introduction to materials and their principle properties, Simple stresses and strains, Concept of stress, strain, shear stress, shear strain, Hook's law, Elastic limit, stress-strain curve for mild steel and elastomeric materials, factor of safety, Poisson's ratio, Strain energy

Basic principles in their selection for fabrication and erection of chemical plant: Testing of materials, destructive and non-destructive tests, structure of atom and chemical bonds, crystal structures and their influence on material properties, Deformation and slip processes. Special diffusion process : Aluminizing, Electroplating-hard chrome & nickel plating - Hard dip coating, Cladding - Physical and chemical vapour deposition - Metal spraying , Plastics and rubber coating ,Conversion coating , Coating of tools ,TiC, TiN, Alumina and diamond coating of tools ,Selection of coating of tools , Selection of coating for wear and corrosion resistance.

Metals and their alloys: Iron–carbon diagram, Ferrous and nonferrous alloys, Fe-C diagram, mild steel, special steels, stainless steels, brasses, aluminium alloys and titanium alloys, high and low temperature material, insulation, refractories. Selection of the steel, Heat treatment of steel, Proper design for proper heat treatment , Critical temperature and heating - Annealing- Spheroidzing- normalizing , hardening -Isothermal transformations , TTT diagram - tempering - austempering - martempering and ausforming. Heat treatment of corrosion - resistance steels. Hardenability and its testing, hard material alloys, Types of structure and their specific volume. Effect of temperature on mechanical properties various methods of improving the strength for service conditions. Effect of alloying elements on properties of steel. Alloys of copper, aluminium, magnesium, nickel and zinc, compositions and their uses.

Corrosion and its control: Different types of corrosion: chemical, biochemical, and electrochemical; Internal and external factors affecting corrosion of chemical equipments. Corrosion factors, inhibition, prevention, control and testing, Corrosion behaviour of metals and alloys. Forming processes and corrosion. Fracture in Ductile and Brittle materials, creep, mechanisms of creep and methods to reduce creeping in materials, creep rate and relations. Fatigue-mechanism- methods to improve fatigue resistance in materials. Composite materials, types, stress-strain relations in composite materials, applications.

Polymers, natural & synthetic: Selection of polymeric materials for equipment linings, fiber reinforced plastic, application of special polymers like Nylon 66, Teflon in engineering. Elastomers and plastomers, molecular structure and properties of polymers.

Ceramic and glasses: Crystalline and non-crystalline ceramics, silicates, refractories, clays, cements, glass vitreous silica, and borosilicate, Ceramic

VII. Class Schedule

Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course objectives	Program outcomes								
	a	b	c	d	e	f	g	h	i
1						✓		✓	
2						✓		✓	
3						✓		✓	
4						✓		✓	
5					✓	✓	✓	✓	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator

CML467

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML620**
Course Title	**: Membrane Technology**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 620 Membrane Technology covers concept, design and application of various membrane separation processes such as microfiltration, reverse osmosis, ultrafiltration, nanofiltration, dialysis and electrodialysis, pervaporation, liquid membrane permeation, gas permeation

II. Pre-requisites:

Heat Transfer-I, Fluid Mechanics

III. Textbooks:

1. Geankoplis, Transport Processes And Separation Process principles, Prentice-Hall of India Private Ltd , New Delhi.
2. Richardson J.F., Harker J.H., Chemical Engineering, Vol. II, Butterworth Heinemann, New Delhi.2006.
3. Nath K., Membrane Separation Process, Prentice-Hall of India Private Ltd , New Delhi 2008

IV. Objectives:

1. To introduce the concept of various membrane separation processes such as microfiltration, reverse osmosis, ultrafiltration, nanofiltration, dialysis and electrodialysis, pervaporation, liquid membrane permeation, gas permeation
2. To design of various membrane separation processes such as microfiltration, reverse osmosis, ultrafiltration, nanofiltration, dialysis and electrodialysis, pervaporation etc.
3. To introduce application of various membrane separation processes such as microfiltration, reverse osmosis, ultrafiltration, nanofiltration etc.

V. Outcomes:

Students will gain fundamentals, design approach and its application for various membrane separation processes such as microfiltration, reverse osmosis, ultrafiltration, nanofiltration, dialysis and electrodialysis, pervaporation, liquid membrane permeation, gas permeation

VI. Expanded Course description:

Principles, characteristic, and classification of membrane separation processes; Membrane materials, structures, and preparation techniques; Membrane modules; Plant configurations.

Membrane characterization: Pore size and pore distribution; Bubble point test; Challenge test; Factors affecting retentivity, concentration polarization, gel polarization, fouling, cleaning and regeneration of membranes.

Mechanisms of separation: Porous membranes, dense membranes, and liquid membranes.
Membrane separation models: Irreversible thermodynamics; Capillary flow theory; Solution
diffusion model; Viscous flow models; Models for separation of gas (vapour) mixtures;

Science and technology of microfiltration, reverse osmosis, ultrafiltration, nanofiltration, dialysis and electrodialysis, pervaporation, liquid membrane permeation, gas permeation.
Membrane reactors: Polymeric, ceramic, metal and bio-membrane

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√				√			
2	√	√				√	√	√	
3					√	√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CML620

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML475**
Course Title	**: New and Renewable Energy Engg.**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

The core subject CML 475 Heat transfer-I covers concept of various forms of renewable energy, to outline division aspects and utilization of renewable energy sources for both domestics and industrial applications, to analyze the environmental and cost economics of using renewable energy sources compared to fossil fuels.

II. Pre-requisites:

Thermodynamics, Heat Transfer-I

III. Textbooks:

1. Rai G.D, Solar Energy Utilization , Khanna Publishers, Delhi.
2. Rai G.D, Non-Conventional Energy Sources, Khanna Publishers, Delhi.
3. Twiddle J., Weir T., Renewable Energy Resources, Cambridge University Press, 1986.
4. Veziroglu, N., Alternative Energy Sources, Volume 5 & 6, McGraw-Hill, 1978

IV. Objectives:

1. To understand concept of various forms of renewable energy.
2. To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications.
3. To analyze the environmental and cost economics of using renewable energy sources compared to fossil fuels.

V. Outcomes:

At the end of the course the student will have knowledge about various renewable energy sources, be able to choose the appropriate renewable energy as an alternate for conventional power in any application.

VI. Expanded Course description:

Introduction : Energy scene of supply and demand in India and the world, Energy consumption in various sectors, potential of non-conventional energy resources, energy needs and energy supply, sources, contribution of non-conventional energy.

Solar Energy: Solar radiation and its measurement, characteristics and estimation, limitations in the applications of Solar Energy, Collectors: flat plate and concentrating types, their comparative study; design and material selection, efficiency, selective paints and surfaces. Solar water heater, applications of Solar Energy for heating, drying, water desalination, solar concentrators, photovoltaic power generation using silicon cells. Thermal storages, Solar ponds, solar pumps, Solar power, Solar cookers

etc. Direct conversion of solar energy to electricity and its various uses, materials, limitations and costs.

Bio- Fuels: Photosynthesis and generation of bio-gas, digesters and their design, selection of material; feed to digester, pyrolytic gasification, production of hydrogen, algae production and their uses.

Wind Energy: Principle of energy from wind, availability, site selection, different types of wind turbines, design criteria and material selection, economics.

Geo-Thermal Energy: Geo-technical wells and other resources dry rock and hot aquifer analysis, harnessing geothermal energy resources

Tidal Energy: Its meaning, causes of tides and their energy potential, enhancement of tides, limitations, different methods of using tidal power. Principles of ocean thermal energy conversion (OTEC) analysis and sizing of heat exchangers for OTEC.

Ocean Thermal Energy: Principle of utilization and its limitations, description of few systems.

Other Non-conventional Energy Sources, fluidized bed combustion, heat from waste and other sources.

Energy Conservation: Principles of energy conservation. Familiarization with the different energy conservation appliances and practices, improved cooking stoves, benefits of improved cooking stoves over the traditional cooking stoves. Scope of energy conservation in the domestic, commercial and agricultural sector.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√	√				√			
2	√	√			√	√	√	√	
3	√	√				√	√	√	

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	15
Class tests and Assignments	-	10
End Semester Exam	3 hours	60

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber.

Course Coordinator
CML475

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML333**
Course Title	**: Polymer Processing**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:
Basics on different types of polymers, structure-property relationship, different processing techniques for polymers, their rheology, testing for various properties, management of polymer wastes and its recycling are stressed in this course.

II. Pre-requisites: None

III. Textbooks:
1. Gruenwald G, Plastics - How Structure Determines Properties, Hanser Publishers, 1993
2. Baird D. G. and Collias D. I., Polymer Processing Principles and Design, Butterworth-Heinemann, 1995
3. Vishu Shah, Hand Book of Plastics Testing Technology, John Wiley & Sons Inc., New York, 2nd edition, 1998.
4. J.S.Anand, K.Ramamurthy, K.Palanivelu, How to identify Plastics by Simple Methods, CIPET, Chennai, 2nd edition.
5. Anthony L. Andrady (Ed.), Plastics and the Environment, Wiley Interscience, New York.

IV. Objectives:
1. To understand the basics on polymers and methodologies to improve the properties of polymeric materials.
2. Provide students with a basic understanding of polymer processing techniques and rheological behavior.
3. Increase the student's ability to identify plastics by simple tests.
4. To understand standard testing methods for evaluation of different properties.
5. To enhance knowledge on importance of plastic waste management and recycling techniques.

V. Outcomes:
At the end of the course, the students would able to explain the polymer processing techniques and have knowledge to opt a particular technique for production of specific products. The students will learn effective ways of handling polymer wastes (without having any environment issues).

VI. Expanded Course description:

1. Introduction:
Comparison of thermoplastics and thermoset plastics; Thermoset plastics - Types of resins, Interpenetrating Polymer Networks (IPN); Thermoplastics- Types of aliphatic and aromatic thermo plastics, copolymers, Blends and alloys; Liquid crystal plastics; cellular plastics; oriented plastic materials.

2. Processing:
Basics of process design, Classification & general aspects ofprocesses - molding& forming operations, Post die processing; Decoration of plastics - Printing, Vacuum Metalizing, In-mold decoration.Additives & Compounding - Different types of additives**,** Batch mixers, continuous mixers, Dispersive and distributive mixing, Characterization of mixed state.

Fundamentals on Viscous & Viscoelastic behavior of polymer melt, Rheological measurements and Polymer processability. Non isothermal aspects - Temperature effect on rheological properties, Crystallization, Morphology & Orientation, plastic memory, Molecular weight effects on processing and properties.

3. Properties & Testing of plastics:
Basic concepts of testing,National & International standards, Test specimen preparation, Pre conditioning & Test atmosphere.

Identification of plastics by simple test - Visual examination, Density, Melting point, Solubility test, Flame test, Chemical tests.

Effect of shape & structure on material properties, Long - term & short - term mechanical properties, crazing, Permeability & barrier properties, Environmental-stress cracking, Melt flow index, Heat deflection temperature, Vicat softening temperature, Glass transition temperature, thermal conductivity, Co-efficient of thermal expansion, Shrinkage, Thermal stability, Flammability.

4.Waste management & Recycling:
Plastics waste and the associated problems, Integrated waste management - source reduction, recycling & sustainability correlation, energy recovering process. Environmental issues, policies and legislation in India.

VII. Class Schedule
Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course objectives	Program outcomes								
	a	B	c	d	e	f	g	h	i
1						✓		✓	
2	✓	✓				✓		✓	
3			✓			✓		✓	
4			✓			✓		✓	
5		✓			✓	✓	✓	✓	✓

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	20
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	50

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML333

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML491**
Course Title	**: Project Planning and Management**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:
Intensive coverage of management in a wide range of project applications from concept through operations. Planning, scheduling, controlling, economic analysis, quality control and customer satisfaction are stressed in this course".

II. Pre-requisites: None

III. Textbooks:
1. Mantel, Samuel, Meredith and others, Project Management: Core Text Book, Wiley India Pvt. Ltd., 1st Edition, 2006.
2. S. Choudhary, Project Management, McGraw Hill India.

IV. Objectives:
Provide students with a basic understanding of project management principles and practices.
Increase the student's ability to function effectively on a project team.
Increase the student's ability to function effectively as a project manager.
Improve the student's ability to communicate effectively both orally and in writing.

V. Outcomes:
At the end of the course, the student will understand the project management principles.
The students will be able to communicate effectively both orally and in writing.

VI. Expanded Course description:

1. The World of Project Management:
Project Management, Project Management vs General Management, Life cycles of projects, Project selection methods, Case studies, Examples.

2. The Manager, The Organization and The Team:
PM's role, PM's responsibilities to the project, Selection of project manager, Project management as a Profession, Fitting projects into the parent organization, Project team, Case studies.

3. Planning the Project:
The contents of a project plan, Planning process, Work breakdown structure, Multidisciplinary teams, Case studies.

4. Budgeting the Project:

Methods of budgeting, Cost Estimating, Improving cost estimates, Budget uncertainity and risk management, Case studies.

5. Scheduling the Project:
PERT and CPM networks, Project uncertainity and risk management, Simulation, Gnatt chart, Extensions to PERT and CPM, Case studies.

6. Allocating Resources to the Project:
Expediting a project, Resource loading, Resource leveling, Allocating scarce resources to projects

VII. Class Schedule
Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Contribution of Courses to Program Outcomes				Program Outcomes								
Type	Credit	Course No	Course Titles	a	b	c	d	e	f	g	h	i
T	6	CML491	Project Planning and Management									

IX. Evaluation of students

	Component	Duration	Weightage
	Session 1 Exam	1 hour	15
	Session 2 Exam	1 hour	20
	Class tests and Assignments	-	10
	End Semester Exam	3 hours	55

X. Chamber Consultation Hours
To be announced in the class.

XI. Notice
Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML491

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML480**
Course Title	**: CFD for Chemical Engineers**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

The course covers the fundamentals of Computational Fluid Dynamics (CFD). The CFD techniques that can be applied for solving practical problems in fluid flow / heat transfer is discussed. Illustration on application of CFD in solving industrial problem is discussed.

II. Pre-requisites: Numerical methods, Fluid mechanics

III. Textbooks:

1. H. K. Versteeg and W. Malalasekera, An introduction to CFD, Longman Scientific and Technical, 1st edition, 1995.
2. S. V. Patankar,Numerical heat transfer and fluid flow, Mc Graw-Hill Book Company, 1st Edition, 1980.
3. P. S. Ghoshdastidar, Computer simulation of flow and heat transfer, Tata McGraw-Hill Publishing, 1st edition, 1998.
4. K. Muralidhar and T. Sundararajan, Computational Fluid Flow and Heat Transfer, Narosa Publications, 2nd Edition, 2003.
5. Anderson. J., Computational Fluid Dynamics: The Basics with Applications, Mc-Graw Hill, 1995.

IV. Objectives:

To introduce students to applied computational fluid dynamics (CFD) and to teach them how to solve a fluid flow problem using different numerical techniques available for CFD.

V. Outcomes:

At the end of the course, the student will have understood the principles of computational fluid dynamics, the various numerical techniques available and be in a position to intelligently use this CFD techniques for simulation of practical problems in fluid flow / heat transfer.

VI. Expanded Course description:

Introduction

History, Comparison of the three basic approaches for engineering problems in solving by analytical, experimental and computational methods, Beam advance in computational techniques, Softwares available for CFD.

Problem Formulation

Formulation of problem, Physical and mathematical classification of problems, Types of governing differential equations.

Discretisation
Truncation and Round-off error; Explicit and Implicit approaches; Basic of finite difference method, Finite element method, Finite volume method and Spectral method, Treatment of boundary conditions.

Numerical Solution of Heat Conduction Problems
Steady-state problems, One dimensional heat conduction transfer through a pin-fin, Two dimensional conduction through a plate unsteady state problem, One dimensional transient heat conduction, Explicit and implicit methods, Assessing accuracy and stability of numerical methods.

Numerical Solution of Fluid Flow Problems
Types of fluid flow and their governing equation, Viscous incompressible flows calculation of flow field using the stream function-vorticity method, Calculation of boundary layer over a flat plate, Numerical algorithm for solving complete Navier-Stokes equation-MAC method SIMPLE algorithm, Introduction to standard κ-ε model for turbulent incompressible flow, Project problem.

Introduction of Commercial CFD Packages

VII. Class Schedule
Three 55 minutes session per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Contribution of Courses to Program Outcomes				Program Outcomes								
Type	Credit	Course No	Course Titles	a	b	c	d	e	f	g	h	i
T	6	CML480	CFD for Chemical Engineers	■	■					■		■

IX. Evaluation of students

Component	Duration	Weightage
Session 1 Exam	1 hour	15
Session 2 Exam	1 hour	20
Class tests and Assignments	-	10
End Semester Exam	3 hours	55

X. **Chamber Consultation Hours**
To be announced in the class.

XI. **Notice**
Notice will be displayed on Chemical Engineering Notice Board.

Course Coordinator
CML480

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CML472**
Course Title	**: Advance Separation Process**
Course Type	**: Elective**
Course Credits	**: 06**

I. Course description:

A brief review of the existing separation technologies such as adsorption-based separation, membrane separation, cryogenic separation, multi-component distillation, and biotechnology based separation. Recent advancements on the above areas and new separation processes such supercritical extraction, hybrid systems, reactive separation etc. will be covered. This course will terminate with several design projects on real life problems.

II. Pre-requisites:

None

III. Textbooks:

1. Separation Process Principles, Seader J. D., Henley E. J., Wiley, 2001, 2nd Edition
2. Chemical Engineering Vol. 2, Richardson J. F., Harker J. H., Elsevier, 2002, 5th Edition.
3. Natural Extract using Supercritical CO_2, Mukhopadhyay M., CRC Press, 2000, 1st Edition.
4. Membrane Separation Processes, Nath K., Prentice Hall of India, 2008, 1st Edition.
5. Bio-separations: Principles and Techniques, Sivasankar B., Prentice Hall of India, 2005, 1st Edition.

IV. Objectives:

1. Continuous research and development activities across the world have enhanced the scope of chemical engineering application in the field of separation technology. This course gives the basic overview of the existing technologies such as adsorption, membrane separation, cryogenic separation and biotechnological separation.
2. It also covers upcoming topics such as reactive distillation, supercritical fluid extraction etc.
3. Another interesting feature of this course is that it gives the students a perspective of the application of these technologies via projects related to recent research topics.

V. Outcomes:

At the end of the course, the student will understand the advances in conventional and new separation processes. The students will be able to apply these principles for the separation of various components by considering their advantages and disadvantages for application and design.

VI. Expanded Course description:

Course content: Unit I + Any four Units from Unit II to Unit VIII

Unit I (4 hrs)

Overview of Separation Processes:Introduction / Revision of various Conventional Separation Processes and their applications, advantages, and disadvantages, Need of advance Separation processes, types, Problems.

Unit II (8 hrs)

Reactive Separations: Introduction, Concept of reactive separations, types of reactive separations, reactive distillation, membrane based reactive separations, reactive extraction, reactive adsorption, reactive absorption, reactive crystallization, applications, design aspects, scope for future, Problems.

Unit III (8 hrs)

Hybrid Separations: Introduction, Concept of hybrid separations, types of hybrid separations, networking or combination of various separation processes, applications, design aspects, scope for future, Problems.

Unit IV (8 hrs)

Membrane Separations: Introduction, type of membrane separations, membrane, membrane materials, ultrafiltration, microfiltration, nanofiltration, reverse osmosis, pervaporation, type of membrane modules, membrane fouling, concentration polarization, various mathematical models for membrane processes, application, design considerations, Problems.

Unit V (8 hrs)

Supercritical Fluid Extraction: Introduction, Concept of super critical extraction, factors affecting supercritical extraction, properties of supercritical fluid, applications, design considerations, Problems.

Unit VI (8 hrs)

Multi-component Distillation: Introduction, need of multi-component distillation, methods of multi-component distillation, design methods of multi-components distillation Problems.

Unit VII (8 hrs)

Chromatographic Separation: Introduction, Principles, Classifications, High performance liquid chromatography, ion exchange chromatography, affinity chromatography, reversed phase chromatography, gas chromatography, application, Problems.

Unit VIII (8 hrs)

Bio-separation Processes: Introduction, overview of bioseparations, cell disruption, filtration, centrifugation, adsorption, extraction, membrane separation, precipitation, chromatographic separation, Applications, Problems.

Unit VIII (8 hrs)

Electro-kinetic Separation: Introduction, Various methods, Electrophoresis, Capillary electrophoresis, Isoelectric focusing, Esotachophoresis, Electro-floatation, Applications, Problem.

VII. Class Schedule

Three lectures of 60 minutes each per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1	√		√					√	
2	√	√	√			√		√	
3	√	√	√			√	√	√	

IX. Evaluation of students

	Component	**Duration**	**Weightage**
	Session 1 Exam	1 hour	15
	Session 2 Exam	1 hour	15
	Class tests, Quizes and Assignments	-	20
	End Semester Exam	3 hours	50

X. Chamber Consultation Hours

To be announced in the class.

XI. Notice

Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator:
CML472

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF CHEMICAL ENGINEERING

COURSE OUTLINE

Department	**: Chemical Engineering**
Course No.	**: CMP472**
Course Title	**: Separation Process**
Course Type	**: Core**
Course Credits	**: 06**

I. Course description:

Lab experiments on various equipments / instruments related to separation process.

II. Pre-requisites:

None

III. Textbooks:

1) Separation Process Principles, Seader J. D., Henley E. J., Wiley, 2001, 2nd Edition
2) Chemical Engineering Vol. 2, Richardson J. F., Harker J. H., Elsevier, 2002, 5th Edition.
3) Natural Extract using Supercritical CO_2, Mukhopadhyay M., CRC Press, 2000, 1st Edition.
4) Membrane Separation Processes, Nath K., Prentice Hall of India, 2008, 1st Edition.
5) Bio-separations: Principles and Techniques, Sivasankar B., Prentice Hall of India, 2005, 1st Edition.

IV. Objectives:

1. To give the exposure of various equipments
2. Handing the instruments related to separation process.
3. Designing the experiments

V. Outcomes:

At the end of the course, the student will understand the basic concepts and operations of various lab equipments / instruments related to separation process.

VI. Expanded Course description:

Study of Membrane Bioreactor
Study of Pervaporation (1)
Study of pervaporation (2)
Study of fermentor : Ethanol production
Study of fermentor: Carboxylic acid production
Study of Reactive Extraction (1)
Study of Reactive Extraction (2)
Study of Supercritical Extraction (Design)
Study of Multi-component Distillation (Design)
Study of hybrid separation (Design)

Study of Membrane Filtration (Design)
Total Experiments to be conducted / designed: **Eight**
Any six from first eight + Any two from remaining

VII. Class Schedule
Two hours per week.

VIII. Relationship of Course Objectives to Program Outcomes:

Course Objectives	Programme outcomes								
	a	b	c	d	e	f	g	h	i
1			√					√	
2		√	√			√		√	
3	√	√	√			√	√	√	

IX. Evaluation of students

	Component	**Duration**	**Weightage**
	Internal	2 hrs per week	60
	Class tests, Quizes and Assignments	-	20
	Final Submission andviva	--	20

X. Chamber Consultation Hours
To be announced in the class.

XI. Notice
Notice will be displayed on Notice Board near to Chamber and Chemical Engineering Notice Board.

Course Coordinator
CMP472