

INTERNATIONAL COURSE

Under

GLOBAL INITIATIVE OF ACADEMIC NETWORKS (GIAN)



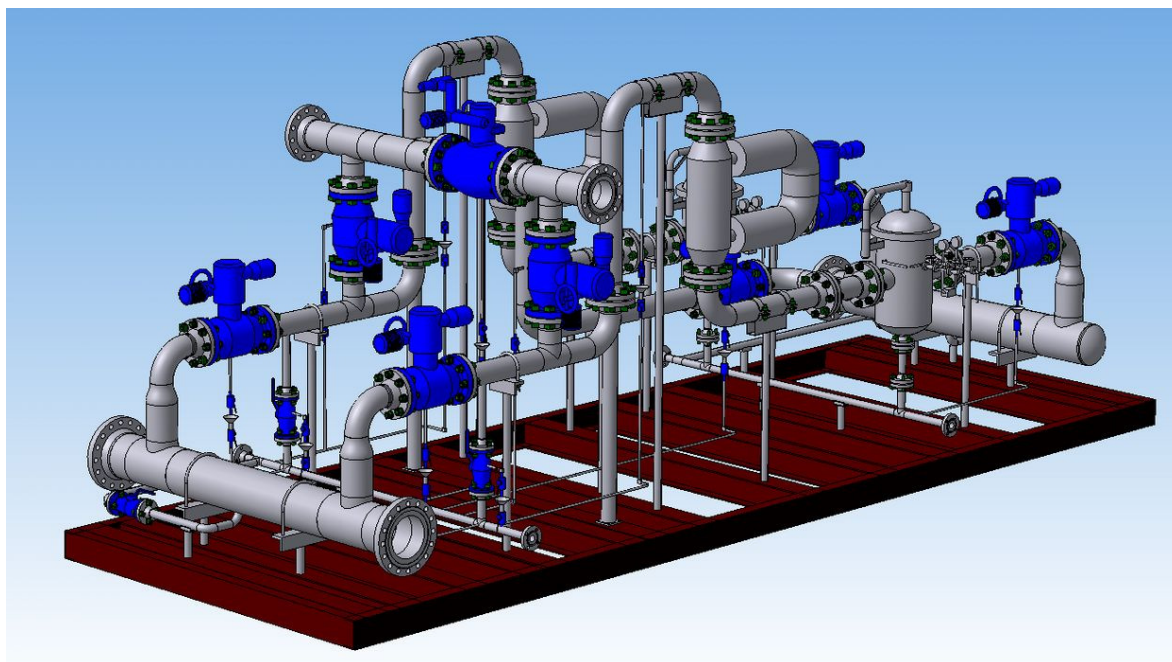
Ministry of Human Resource
Development

Advances in Pipeline Transportation of Crude Oils

June 02 to 06, 2018

Course Coordinators

Dr. Kailash Singh, Dr. Madhu Agarwal, Dr. S. Upadhyaya, Dr. R.K. Dohare



DEPARTMENT OF CHEMICAL ENGINEERING
MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY
J.L.N. Marg, Jaipur-302017, Rajasthan, India

GIAN (An Initiative of Government of India)

Union Cabinet has approved a program titled Global Initiative of Academic Networks (GIAN) in Higher Education, aimed at tapping the talent pool of scientists and entrepreneurs, internationally to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence. GIAN is envisaged to catalyze higher education institutions in the country that will initially include all IITs, IIMs, Central Universities, IISc Bangalore, IISERs, NITs and IITs. Subsequently, good State Universities where the spinoff is vast, shall also be covered. GIAN is an evolving scheme which will initially include participation of foreign faculty in Institute as Distinguished/ Adjunct/ Visiting faculty/ Professor of practice. They will delivering their expertise in short or semester-long course. In addition, other activities shall also be included in due course of time.

GIAN is envisaged to achieve the following objectives:

- a) Provide opportunity to our faculty to learn and share knowledge and teaching skills in cutting edge areas.
- b) To provide opportunity to our students to seek knowledge and experience from reputed International faculty.
- c) To create avenue for possible collaborative research with the international faculty.
- d) To increase participation and presence of international students in the academic Institutes.
- e) Opportunity for the students of different Institutes/Universities to interact and learn subjects in niche areas through collaborative learning process.
- f) Provide opportunity for the technical persons from Indian Industry to improve understandings and update their knowledge in relevant areas.
- g) To motivate the best International experts in the world to work on problems related to India.

About The Course

Petroleum crude oil is transported via tanker vessels, railcars, trucks, and through pipelines. The transportation mode selected depends largely on the amount being transported and the location of transportation. Besides the economic and technical challenges of associated with crude oil transportation, environmental impact and safety considerations play major roles in the design, approval and operation of all transportation options.

Large tanker vessels transport crude oils all around the world, on a truly global scale, from one continent to another. Railcars are a common way to move large volumes of crude oils to areas, particularly in absence of any pipelines. Trucks are used a lot like railcars, except for smaller volumes and over short distances. Pipelines are used to transport crude oil from the wells to refineries and storage facilities. Pipelines are the most cost efficient way to move large volumes of oil on land. Pipelines have several components, such as booster pumping stations, inspection areas, and other collection and delivery points along the way. Although their initial or fixed cost is high, the operating expense (including power consumption, maintenance and labour cost) is significantly lower than other transportation options. Thus, pipelines offer the most efficient mode of transporting crude oils.

This course will cover important technical and engineering considerations in the design, construction and operation of pipelines for heavy crude oils (including both naphthenic/aromatic and paraffinic/waxy types of crude oils). Of the two classes of heavy crude oils, the focus will be on the paraffinic or 'waxy' crude oil, which is also encountered in the Bombay High offshore reservoirs in the west coast of India. It will also

explore research topics for both laboratory-scale and pilot-scale investigations. In addition, the course will summarize non-technical factors that are crucial for successful pipeline projects, such as environmental and regulatory aspects, which are becoming more and more important these days that can cause expensive delays in project implementation. The course will include case studies and numerical calculations for facilitating the learning outcomes. This course is proposed to be delivered over a period of 5 days, with 12 lecture hours and 6 tutorial hours, for a total of 18 hours of classroom instruction.

Objectives

The primary objectives of the course are as follows:

- Classification of crude oils; Estimation of crude oil properties
- Pipeline transportation of heavy crude oils: hotbit, dilbit, thermal and PPD techniques; their economics
- Behaviour of paraffinic or ‘waxy’ crude oils; their unique rheological properties; pipeline re-start
- Models for solids formation and deposition
- Heat-transfer based model for solids deposition and deposit aging in pipelines
- Concepts of ‘Hot Flow’ versus ‘Cold Flow’ pipeline technologies
- Applications in heat exchanger fouling; Different tube fouling mechanisms
- Economic, safety and environmental considerations; Regulatory aspects.

Who Can Attend

- Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories.
- Students at all levels (B.Tech/MSc/M.Tech/PhD).
- Faculty from reputed academic institutions and technical institutions.

Modules Coverage

Day	Topics to be covered
Day 1	<p><u>Lecture 1:</u> Introduction; Classification of crude oils found worldwide; The need for transporting crude oils; Current state of pipeline transportation of (heavy) crude oils; Interrelation of technical and economic factors; Project planning.</p> <p><u>Lectures 2 & 3:</u> Estimation of crude oil properties; Thermodynamic phase behaviour data and modeling; Data and modeling of thermophysical properties of crude oils; Viscosity blending formulae; Measurement and prediction of crude oil rheology (viscosity) and gelling characteristics; Hydraulic considerations; Pipeline pressure drop and power requirement calculations.</p>
Day 2	<p><u>Lecture 4:</u> Behaviour of paraffinic or ‘waxy’ crude oils; their unique rheological properties; Gel strength; Challenges with pipeline re-start</p> <p><u>Lecture 5:</u> Pipeline transportation of heavy crude oils; Single-phase and multi-phase flows; Laminar versus turbulent flows; Pipeline start-up; Different approaches for viscosity reduction (hotbit, dilbit, PPD addition, etc) and their relative economics; Topics such as pipeline insulation, pipeline & facility design temperature, pipeline coating, derating of pipeline MOP due to higher design/operating temperature, limited capacity due to frictional heating effect, seasonal effects, etc.</p> <p><u>Tutorial 1 :</u> Practice problems on phase behaviour and transport property estimation; Approach to economic evaluation.</p>

Day 3	<p><u>Lectures 6 & 7</u>: Models for solids formation from ‘waxy’ crude oils; Kinetics and mechanisms of solid formation; Rheological, thermal, crystallization and deposition behaviour of complex crude oil mixtures; Asphaltene precipitation and agglomeration; Effects of temperature and pressure on asphaltene particle size distributions; Crystallization considerations; Gelation versus deposition.</p> <p><u>Tutorial 2</u>: Practice problems relating to the prediction of precipitation of solids, their particle size distribution, and their deposition behaviour.</p>
Day 4	<p><u>Lecture 8 & 9</u>: Heat-transfer based model for solids deposition; Unsteady-state and steady-state modeling approaches; Estimation of the thermal resistance of deposit and foulant; Deposit aging in pipelines. heat-transfer model for solids deposition from waxy mixtures in a pipeline, Heat-transfer approach for predicting solids deposition in pipeline transportation of ‘waxy’ crude oils, etc.</p> <p><u>Tutorial 3</u>: Numerical problems relating to heat transfer considerations; numerical calculations to demonstrate the application of heat-transfer models for solids deposition.</p>
Day 5	<p><u>Lecture 10</u>: ‘Hot Flow’ versus ‘Cold Flow’ pipeline technologies; Applications in predicting deposition and fouling in heat exchangers.</p> <p><u>Lecture 11</u>: Economic, health & safety, environmental, regulatory and political challenges and constraints; Hurdles or necessary requirements for societal license to operate; Need for inherently safer pipeline design.</p> <p><u>Lecture 12</u>: Case studies involving present and/or planned pipeline projects; Technical and non-technical challenges; Course summary & review.</p>

Important Dates

Registration Opens: February 12, 2018

Registration Closes: May 21, 2018

Accommodation Requests: Before May 21, 2018

Venue: Malaviya National Institute of Technology Jaipur

About The Host Institute

The Institute was established in 1963 with the name as Malaviya Regional Engineering College, Jaipur. The campus spreads over 317 acres of lush green area in the central location of Jaipur city and is imaginatively laid-out with a picturesque landscape. On June 26, 2002 the college has given the status of National Institute of Technology by the Government of India under the aegis of Ministry of Human Resource Development, New Delhi and on 15th August, 2007 proclaimed ‘Institute of National Importance’ through act of Parliament-2007. The Institute is fully funded by Ministry of Human Resource Development (MHRD), Government of India. A large number of reputed Industrial houses in the country visit the Institute and select the final year students as Engineers/ Management Trainees and the Scientists. Malaviya National Institute of Technology is one of the premier NITs of India and has the responsibility of providing high quality education in engineering, technology and sciences to produce competent Technical and Scientific manpower. The Institute offers undergraduate and post graduate (B.Tech., B.Arch., M.Tech., M.Arch., M.Sc., MBA and PhD) programmes to about 4500 students in leading field of Engineering, Technology, Architecture, Management and Sciences. The institute is actively engaged in research, consultancy and developmental activities, besides imparting regular teaching.

About The Host Department

The Department of Chemical Engineering was commenced in the year 1988 with 30 undergraduate students in the B.Tech. Chemical Engineering programme and has been doing its best to bring about excellence in academics achieved in the last 29 years. The PG Programmes of M.Tech. in Chemical Engineering and Ph.D. was started in year 2006 and 2004 respectively. The current sanctioned intake of the B.Tech. Chemical Engineering Program and M.Tech Chemical Engineering Program is 100 and 31, respectively for Full time Courses. The Department is well equipped with good undergraduate and research laboratories. The Department aims to provide students with a balance of intellectual and practical expertise that enables them to serve the worldwide chemical industry as well as the societal needs. The programmes offered by the department are accredited by NBA and has educational objectives that are consistent with the vision and mission of the department. The curriculum has been designed to meet the programme goals and objectives that lay more stress on learning under the guidance of a vibrant and highly qualified faculty.

GIAN Portal Registration

Step-1: One Time Web Portal Registration

Create login and password at <http://www.gian.iitkgp.ac.in/GREGN/index> login and complete the Registration Form and pay Rs. 500/- (non-refundable, GIAN Portal Registration Fee) through online payment gateway. After payment, select this course from the listed GIAN courses.

Download "pdf file" of the application form and forward to the course coordinator by email:ksingh.chem@mnit.ac.in.

Step 2: Institute Registration

The registration form for this course can be found along with this brochure. The soft copy of brochure can be download from the institute website www.mnit.ac.in (GIAN portal). Participants are requested to fill the registration form and send to the course coordinator along with course registration fee. The registration fee details are listed below:

Course Registration Fee (exclusive of GIAN Portal Registration Fee)

Students (UG, PG, and PhD)	Rs. 1000
Academicians	Rs. 2500
Industry and Research	Rs.3000
Participants from Abroad	US \$ 100

The above fee includes all instructional materials, computer use for tutorials and lab, free Internet facility, refreshments between sessions and working lunch. The accommodation will be provided to the outstation participants on payment basis subject to availability.

Mode of Payment

Participants are requested to send a Demand Draft in favor of **“REGISTRAR, MNIT Jaipur”** payable at Jaipur with a print out of the filled in Registration form, by **Courier/ Speed Post/ Registered Post** before 25th May 2018 to: **Dr. Kailash Singh, Associate Professor, Department of Chemical Engineering, J.L.N. Marg, MNIT, Jaipur-302017, Rajasthan, India**. Please label the envelop, "GIAN: Sustainable Fuels and Chemical Production using Novel Catalysts". Please email a scanned copy of the DD and the signed registration form by the deadline to Dr. Kailash Singh at ksingh.chem@mnit.ac.in

How To Reach Jaipur

Jaipur is well connected by Air, Rail and Road with all the major cities in India. It is about 280 kms from New Delhi. It has direct flights from New Delhi (45 min), Mumbai (1.5 hrs), Hyderabad (1.45 hrs), Chennai (2.15 hrs), Bangalore (2.00 hrs) and Kolkata (2.2 hrs). The Institute is prominently located on JLN Marg and is 3 km from the Airport. It is 10 km from the main Railway Station and Bus Stand.

Local Accommodation

Accommodation at the Institute Guest houses will be available on payment basis. The details regarding boarding and lodging are as follows:

Rates:

Guest House 1 (Limited capacity): (Single occupancy, double-bedded a/c room): Rs. 900/- per day.

Guest House 2: (Single occupancy, double-bedded a/c room): Rs. 700/- per day.

Aurobindo Boys Hostel: (Single occupancy, double-bedded non a/c room): Rs. 100/- per day.

Gargi Girls Hostel: (Dormitory): Rs. 100/- per day There are many good fair price lodging facilities available nearby the campus.

TA/DA will not be paid to any participant.

Places To Visit

Jaipur is famous for its hospitality, culture, gems and jewelry, blue pottery, hand printed organic textiles and magnificent forts and palaces. Most prominent places to visit are Hawa Mahal, Jantar Mantar, City Palace, Albert Hall Museum, Amber Fort–Heritage Palace, Nahargarh fort, Jaigarh fort, Jal Mahal, Kanak Varindavan Garden, Govind Dev Ji temple and many more. You may also visit Agra for a day to visit one of the wonders Taj Mahal and Fetehpur Sikari. 150 km distance from Jaipur to Pushkar and Ajmeer.

Brief Profile of Resource Person



Prof. Anil K. Mehrotra has been a faculty member, since 1981, in the Department of Chemical and Petroleum Engineering in the Schulich School of Engineering at the University of Calgary. He received a BE (Hons) degree in chemical engineering from Birla Institute of Technology & Science (1972; BITS, Pilani, India; with Gold Medal), an MEng degree in environmental engineering from Asian Institute of Technology (1975; AIT, Bangkok, Thailand), and a PhD degree in chemical engineering from the University of Calgary (1980). His experience includes positions held in private sector (2 years) and academic/research (36 years).

Dr. Mehrotra is a skilled administrator, team-builder, and well-respected research leader with strong interests in energy and environmental engineering. Dr. Mehrotra has held several senior-level administrative positions, including Interim Dean, in the Schulich School of Engineering and the Department of Chemical and Petroleum Engineering. During 2002–16, he served as the (founding) Director of the Centre for Environmental Engineering Research and Education (CEERE) in the Schulich School of Engineering. During 2012–16, Dr. Mehrotra also served as the Academic Director of an interdisciplinary post-graduate program, called Sustainable Energy Development (SEDV). With an integrated course offering by especially qualified faculty members from the schools of engineering and business as well as the faculties of law and environmental design, the SEDV Program incorporates development, assessment, planning, implementation, coordination and leadership in the area of sustainable energy development.

Dr. Mehrotra has published over 160 refereed papers in international journals. His research interests include transport and thermo-physical properties of heavy crude oils, wax deposition in pipelines, and energy and environmental engineering. His research expertise is in several areas of considerable industrial relevance, including non-isothermal crystallization, rheology and solids deposition in pipelines from paraffinic mixtures and 'waxy' crude oils; Transport and thermodynamic properties of heavy hydrocarbon and bitumen mixtures; soil remediation and bio-filtration for methane (greenhouse gas) emission control; and mathematical modeling of processes involving fluid dynamics, heat transfer, phase transformation and reaction kinetics.

Dr. Mehrotra has received numerous awards and recognitions for his teaching excellence (from the Schulich School of Engineering, the Engineering Students' Society, the University of Calgary Students' Union, and APEGA) and service contributions, including two Summit Awards from the Association of Professional Engineers and Geoscientists of Alberta (APEGA). For over 17 years, he served on the Board of Examiners of APEGA. He is a registered professional engineer in Alberta. He is a fellow of Chemical Institute of Canada (FCIC), Engineers Canada (FEC), and Geoscientists Canada (FGC). Dr. Mehrotra continues to provide expert advice and consulting services to chemical and petroleum engineering companies in Canada and internationally.

Presently, Dr. Mehrotra is the Secretary–Treasurer, and a member of the Executive Council, of the Shastri Indo-Canadian Institute (SICI), which is a binational organization, with over 100 member institutions of higher education, for promoting understanding between India and Canada through academic activities and student/faculty exchanges. It receives funding from MHRD of the Government of India and the Federal Government of Canada.

Course Coordinators



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GIAN Local Coordinator



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Jaipur-302017



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2nd June – 6th June, 2018

Under

Global Initiative of Academic Networks (GIAN)
Ministry of Human Resource Development
Govt. of India

REGISTRATION FORM

Name (In Block Letters):

Designation:.....

Qualification:

Institution:

Address:

.....

Email address:

Mobile No:

Payment by DD in favor of “REGISTRAR, MNIT JAIPUR” payable at Jaipur.

Details of Demand Draft:

DD No: **Bank Name:**..... **Date:** **Amount Rs:**

.....
Signature of the Candidate

Speed Post
Dr. Kailash Singh
Associate Professor
Department of Chemical Engineering,
J.L.N. Marg, MNIT, Jaipur-302017,
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