Minutes of Meeting

11th Meeting
of the
Senate

Venue of the Meeting

Conference Hall, IIPE, Visakhapatnam &
Virtually through CISCO Webex

Date & Time of the Meeting

13th December, 2024 at 11:00 hrs

INDIAN INSTITUTE OF PETROLEUM AND ENERGY
VISAKHAPATNAM – 530003

भारतीय पेट्रोलियम और ऊर्जा संस्थान विशाखापत्तनम
INDIAN INSTITUTE OF PETROLEUM AND ENERGY
VISAKHAPATNAM – 530 003

MINUTES OF THE 11th MEETING OF THE SENATE OF IIPE VISAKHAPATNAM

Date & Time: 13th December, 2024 (Friday) from 11:00 hrs;

Venue: Conference Hall (Room No. 301), IIPE Campus, Visakhapatnam & virtually through CISCO Webex.

Members Present:

1.	Prof. Shalivahan, Director	Chairperson	Attended physically
2.	Prof. Arvind Kumar Mishra, Director, CSIR-CIMFR Dhanbad	Member	Attended virtually
3.	Prof. K. Srinivas Reddy, IIT Madras	Member	Attended virtually
4.	Prof. A. Seshagiri Rao, Assoc. Dean (Faculty Affairs)	Member	Attended physically
5.	Prof. Himangshu Kakati Assoc. Dean (Academic Affairs) & HoD (PE&ES)	Member	Attended physically
6.	Prof. C.V. Rao, Assoc. Dean (Students' Affairs)	Member	Attended virtually
7.	Prof. P. Aparoy, Assoc. Dean (Research & Development)	Member	Attended virtually
8.	Prof. Sivasankar P., Assoc. Dean (Planning)	Member	Attended virtually
9.	*Prof. Rajat Jain, Assoc. Dean (IRAA)*	*Member*	*Attended physically*
10.	Prof. Arun Kumar Pujari, HoD, Mechanical Engineering	Member	Attended physically
11.	Prof. Somnath Ghosh, HoD, Humanities & Sciences	Member	Attended physically
12.	Prof. R. Ramunaidu, Dept. Humanities & Sciences	Member	Attended virtually
13.	Prof. T. Hemanth Kumar, Dept. Chemical Engineering	Member	Attended physically
14.	Prof. Raka Mondal, Dept. Chemical Engineering	Member	Attended virtually
15.	Prof. Dipankar Pal, Dept. Chemical Engineering	Member	Attended virtually
16.	Shri Ram Phal Dwivedi, Registrar	Ex-officio Secretary	Attended physically

Leave of Absence

17.	Prof. K. Vijaya Kumar, Dean (Research & Development)	Member
18.	Prof. Ranjan Pramanik, Assoc. Dean (IIE)	Member
19.	Prof. P. Venkata Reddy, HoD, Chemical Engineering	Member

At the outset, the Chairman welcomed the members of the Senate. He thanked and expressed his gratitude for their valuable contributions for academic endeavours and research excellence at IIPE.

After ascertaining the quorum, the Chairman declared the meeting open. The following agenda was transacted.

Senate/11/01	**Confirmation of Minutes of the 10th Meeting of the Senate and submission of Action Taken Report.**

The Minutes of the 10th meeting of the Senate of IIPE held on 24.04.2024 were circulated to all the learned members of the Senate through email on 31.05.2024. There were no comments/ remarks received from the members either by email or on the floor. The Senate was requested to confirm the minutes of the 10th meeting.

Subsequently, the Action Taken Report (ATR) on the Minutes of the 10th meeting of the Senate was presented before the members.

Resolution: The Senate resolved to confirm the Minutes of the 10th meeting of the Senate, held on 24.04.2024 and noted the action taken report with satisfaction.

Senate/11/02	**Director's Report on the progress of various activities of the Institute.**

The Director presented the following on the progress of various activities of the Institute:

(i) Admissions:

A total of 123 students admitted in July 2024 for the academic year 2024-25 in B.Tech. Courses (Petroleum, Chemical & Mechanical Engineering). 16 students were admitted to M.Sc. in Applied Geology, 05 students in Web Based M.Tech. in Data Science & Machine Learning and 33 scholars have been admitted in Ph.D. Research Courses.

(ii) Students' strength:

A total of 455 students are pursing various courses which includes 90 research scholars, of which 34 scholars are industry-sponsored, pursuing their Ph.D.

(iii) Graduated Students:

In June, 2024, a total of 58 students were graduated, of which 32 students from B.Tech. Chemical Engineering and 26 students from B.Tech. Petroleum Engineering.

(iv) 4th Convocation:

The 4th Convocation of the Institute was held on 20.07.2024. Prof. V.V.S.S. Sarma, FNA, FNASc, Chief Scientist, CISR-NIO Regional Centre, Visakhapatnam graced the event as the Chief Guest. In the Convocation, the Institute conferred its first Ph.D. Degree on Shri Gouri Sankar Das who completed his research on the topic titled 'Advanced Nano-carbons from Waste and Biomass for Renewable Energy Technologies, Green Hydrogen Production and Fabrication of Flexible Electronics' under the guidance of Dr. Kumud M. Tripathi & Prof. Somnath Ghosh.

In addition, 58 B.Tech. students of which 26 students from Petroleum Engineering & 32 students from Chemical Engineering, were awarded the degrees.

(v) R&D Projects:

During 2024, the Institute has been sanctioned with 11 research projects, including 02 International projects, amounting to ~ Rs. 45 crores from NTPC, SERB, SPARC, ANRF, OECT, AR&DB etc.

IIPE is executing a project, in collaboration with NTPC, to develop a 1-ton-per-day plant worth Rs. 35 crores for hydrogen generation from seawater with a vision to make the Visakhapatnam as the first hydrogen city in India.

One (01) project has been sponsored by ONGC Energy Centre on Microbial EOR with estimated outlay of Rs. 45 lakhs (approx.).

The SBIF-XRD (X-ray Diffraction) Analytical Lab, a research facility was inaugurated by Shri Sanjay Prakash, Managing Director, SBI Foundation on 30th August , 2024.

(vi) Publications:

The faculty of the Institute published 44 Nos. research and review papers in reputed journals, during the year 2024.

(vii) Patents:

The faculty members filed 02 patents during the year 2024.

(viii) Placements:

The Institute has achieved 97.87% placements for the registered students during the academic year 2023-24.

(ix) Awards:

Prof. Shalivahan was conferred with Society of Exploration Geophysicists USA as South and East Asia Honorary Lecturer for Q1/Q2 2024.

(x) Seminars, Workshops, and Conferences:

(i) Indo-US Workshop on 'Hydrogen and Global Decarbonization' was organised during the period from 21st- 23rd May, 2024.

(ii) The Institute organised the SERB-DST sponsored High-End Workshop under Accelerate Vigyan Scheme, on topic titled 'Exploring Magnetotelluric Data Insights: Workshop on Data Preparation, Analysis, Processing, and 3D Inversion Strategies' during the period from 01st – 07th July, 2024.

(iii) The Institute organised High-End Workshop on 'Reservoir Simulation for CO_2 Sequestration' sponsored by SERB, DST, Govt. of India, under the Accelerate Vigyan - the Karyashala Scheme during 8th – 14th July, 2024.

(iv) The Institute jointly with the Gdańsk University of Technology, Poland, organised a workshop on "Electronic Structure Calculations and Visualisation with Molecular Nodes" during 30th July - 3rd August, 2024.

(v) The Institute organised the Industry-Academia Conclave 2024: Connecting Academia and Industry for a Sustainable World on 28th November, 2024.

(vi) A workshop on 'Corrosion Prevention and Remediation Strategies' is held during 11th – 13th December, 2024.

(vii) A workshop on 'Numerical Methods for Partial Differential Equations' is scheduled to be held from 16th - 27th December, 2024.

(viii) A workshop on 'Immersion Program on Recent Advances in Petroleum Engineering' is scheduled from 20th December 2023 – 02nd January, 2025.

(xi) Collaborations and International Projects:

Purdue University, University of Laval, CNRS France, and Oxford University.
MoUs: University of Stony Brook, University of Houston, and Ufa State Petroleum Technological University
Joint programs include a B.Tech.+ MS with the University of Houston and an MBA with IIM Visakhapatnam.

(xii) Faculty and Student Exchanges:

ETH Zurich, Oxford University, Friedrich Schiller University, and University of Norway, Purdue University, Aachen University, University of Houston, University of Stony Brook.

(xiii) NIRF Ranking:

For the first time, the Institute had participated in the NIRF ranking-2024, and was ranked in the bracket of 201 to 300. The Institute analysed the score and observed that some of the following factors which influenced the Institute's ranking are:

(i) Less number of Girl Students;
(ii) No Ph.D. Graduate in the last three years;
(iii) Space constraints led to inadequate research facilities;

The Director informed the Senate that the Institute will make all efforts to be ranked in top-100 in the next 2-3 years of time.

(xiv) The Institute has been empanelled by the Development Partnership Administrative Division of Ministry of External Affairs, GoI to conduct courses for foreign government officials/ delegates.

(xv) IIPE students Mr. Kritagya Sharma and Mr. Ujwal Narayan won the first place in the state-level RBI Quiz competition, organized to celebrate the RBI's 90th anniversary. The competition involved 83 teams and the winners received a cash prize of Rs 2 lakhs. Their success qualifies them for the upcoming South Zonal Round.

The Senate noted the same and appreciated the efforts made by the Institute.

Senate/11/03	Design approval for the M.Sc./M.Tech. Degree Certificate.

The template for the Original Degree certificate to be awarded to M.Sc. / M.Tech. programs was proposed similar to the Original Degree Certificate of the B. Tech. programs with variation in color and size for both the courses. The Senate was requested for deliberations and necessary recommendations on the same.

Resolution: After detailed deliberations, the Senate resolved to approve the similar design of the B.Tech. Original Degree Certificate for M.Sc. & M.Tech. programs and authorized the Chairman to finalize the colour and size of the certificate in coordination with the Associate Dean (Academics Affairs), before placing the same for approval of the Board.

Senate/11/04	Review of the thesis cover page design.

A cover page design for Ph.D. Thesis was presented before the Senate for necessary recommendations and approval.

Resolution: After detailed deliberations, the Senate resolved to approve the cover page design for Ph.D. Thesis as placed at **Annexure-1**.

Senate/11/05	Guidelines for fellowship/stipend disbursement for Ph.D. scholar till thesis submission.

The Senate was requested to deliberate and consider the proposal to validate the thesis submission date as the final date for stipend/fellowship disbursement for all the Institute scholars at IIPE.

Resolution: The Senate resolved to recommend that the stipend/fellowship for all Institute scholars at IIPE be disbursed until the thesis submission date or a maximum of five years, whichever is earlier, for approval of the FC/Board.

Senate/11/06	Proposal for introduction of M.Tech. in Petroleum Engineering for Foreign Nationals and sponsored candidates.

The Institute proposed to initiate M.Tech. Program in Petroleum Engineering for Nationals, Foreign Nationals and sponsored candidates. The detailed proposal along with the eligibility criteria and course structure were presented before the Senate for its recommendations.

Resolution: The proposal was deliberated in detail and the Senate resolved to recommend the M.Tech. Program in Petroleum Engineering for implementation from AY 2025-26 as per guidelines placed at **Annexure-2**, for approval of the Board.

Senate/11/07	PG course fee structure for foreign nationals.

The Senate was apprised the proposal for revision of fee structure for the PG Course for Foreign Nationals. The proposed revised fee structure was presented before the Senate for consideration and recommendations.

Resolution: After detailed deliberations, the Senate resolved to recommend the following proposed fee structure for the offline time-bound PG courses, for approval of the Board:

PG course fee structure for foreign nationals/sponsored:			
Fee (USD)	**ICCR/SAARC countries ($)**	**Non-SAARC/ Sponsored ($)**	**Frequency**
Tuition fee	1000	2000	Per semester
Registration Related	200	200	At the time of admission
Miscellaneous (includes library fee, sports fee, student medical insurance etc)	150	150	Per semester
Accommodation fee* (double occupancy)	400	400	Per semester
Total	1750	2750	Per semester

* Hostel and Mess fees depend on the accommodation provided and choice of menu.
* Mess fee will be extra as per actuals

The Senate further recommended that for the students who are unable to complete the course within the designated period, fees beyond this period to be charged proportionally based on the remaining credits required to complete the degree.

Senate/11/08	**B.Tech. admission eligibility criteria for foreign nationals.**

The Institute proposed the following B.Tech. admission eligibility criteria & other terms for foreign nationals:

(i) Inclusion of SAT alongside JEE Advanced in the admission criteria for foreign nationals *applying to the B.Tech. program at IIPE;*
(ii) Fee Refund Policy and remaining admission guidelines such as subjects at 10+2 level etc. will be as per IIPE UG admission guidelines.

Resolution: After detailed discussions, the Senate resolved to approve the qualification of JEE Advanced as the sole eligibility criteria for admission of foreign nationals into B.Tech. programs at IIPE. Fee Refund Policy and remaining admission guidelines such as subjects at 10+2 level etc. will be as per IIPE UG admission guidelines.

Senate/11/09	**Revision of syllabus for Physics and Fluid Flow Courses.**

The Institute proposed for the revision in the syllabus for Physics course and Fluid Flow Lab for B.Tech. Courses. The proposed revised courses (**Annexures 3 & 4**) were placed before the Senate for *approval.*

Resolution: After thorough deliberation, the Senate resolved to approve the proposed syllabus revisions for the Physics and Fluid Flow courses for B.Tech. programs.

Senate/11/10	**Academic malpractice guidelines.**

The Senate was apprised that during its 10th meeting held on 24.04.2024, the Senate recommended to constitute a committee to re-look into the existing guidelines for initiating the disciplinary action against students involved in unfair means during examinations.

Accordingly, the Institute constituted a Committee for the same and the recommendations of the Committee **(Annexure-5)** were placed before the Senate for its consideration and approval.

Resolution: After detailed deliberations, the Senate resolved to approve the recommendations of the Committee on academic malpractices for implementation at Institute.

Senate/11/11	New courses proposed for the Ph.D. programs.

The Institute proposed for the introduction of the following new courses for Ph.D. programs. The detailed syllabus for the proposed new courses was presented before the Senate for review and approval:

(i) Surface Chemistry and Catalysis **(Annexure-6);**
(ii) Adsorption Techniques for Gas Storage and Separation **(Annexure-7);**
(iii) Petroleum Engineering Lab;

Resolution: After thorough discussions, the Senate resolved to approve the courses proposed under Sl (i) & (ii) above for Ph.D. programs for implementation.

However, for the course of Petroleum Engineering Lab, the Senate advised to revise the course structure by incorporating the theory component.

Senate/11/12	Syllabus for new B.Tech. Course in Mathematics and Computing.

During the 10th Meeting of the Senate held on 24.04.2024, the Senate recommended the proposal to commence the B.Tech. program in Mathematics and Computing from the academic year 2025–26. Additionally, the Senate suggested for verification of the Program's credits compared to those of other existing programs as per Institute norms and for placing before the Senate in the next meeting for its recommendation.

Accordingly, the course structure for the proposed B.Tech. Course in Mathematics and Computing is placed before the Senate for its consideration and recommendations.

Resolution: After thorough deliberations, the Senate approved the proposed Course Structure of 1st and 2nd Semesters of the first year of the said Course **(Annexure-8)**, commencing from the academic year 2025–26 and further recommended that the remaining course structure/ syllabus be reorganized to align with the Institute's guidelines and to place for consideration of Senate in the next meeting.

RATIFIED AGENDA

Senate/11/13	Academic Calendar for the Web-Based M.Tech. Programs.

The Senate was apprised that the following guidelines for the Academic Calendar and Examination for the Web-based M.Tech. program in DS & ML were approved by the Chairman, Senate on the recommendations of a duly constituted Committee:

(i) All academic activities, except the examination process, will follow the same schedule as per the IIPE academic calendar.
(ii) There will be no midterm examination for this course. The final examination will be held along with regular end term examinations for 80% weightage, and internal assessment will account for 20%. The duration of the final exam will be 03 hrs. as per the existing norms. However, the instructor can extend the time as per the need.
(iii) The supplementary exams will be held as per the regular academic calendar for 80% weightage. The Grading for the same will be as per the Institute norms.

The Senate was requested to ratify the decision of the Chairman, Senate.

Resolution: The Senate resolved to ratify the decision of the Chairman, Senate.

Senate/11/14	**Shifting of Lab classes for B.Tech. Petroleum & Mechanical Engg. from Spring to Autumn Semester.**

The Senate was apprised that the Chairman Senate approved the following proposals received from the HoDs of the Petroleum Engineering & Earth Sciences and the Mechanical Engineering:

(i) Due to limited resources and inadequate infrastructure at the current temporary premises, the following labs would be conducted at the permanent campus during the academic year 2025–26 (July–December) autumn session.

Sl	Course Name	Particulars of the Lab
(i)	B.Tech in Mechanical Engineering	• Fluid System Lab (2023-27 Batch) • Workshop (2024-28 Batch)
(ii)	B.Tech in Petroleum engineering	• Enhance Oil Recovery (2022-26 Batch)

(ii) For the current batches, these labs will be shifted from the Spring Semester (January–June) of the 2024–25 academic year to the Autumn Semester (July–December) of the 2025–26 academic year.

The Senate was requested to ratify the decision of the Chairman, Senate.

Resolution: The Senate resolved to ratify the decision of the Chairman, Senate.

Senate/11/15	**Re-examination conducted for Mr. Ritesh Kumar (Roll No: 21PE10009) in the Supplementary Examination.**

The Senate was apprised that the Chairman Senate approved for appearing a re-examination for Mr. Ritesh Kumar (Roll No: 21PE10009) on medical grounds, held in July 2024.

The Senate was requested to ratify the decision of the Chairman, Senate.

Resolution: The Senate resolved to ratify the decision of the Chairman, Senate.

Senate/11/16	**Conversion from INSPIRE Fellowship to Institute Assistantship.**

It was reported that Mr. Chanakya Vishwanth Tarone, who was admitted to the Ph.D. program under the INSPIRE fellowship, was granted approval to convert his fellowship from INSPIRE to Institute Assistantship. This decision was followed by his unsuccessful evaluation at Level-2 scrutiny of the INSPIRE fellowship and based on the recommendations of the Doctoral Scrutiny Committee (DSC) members.

The same was approved by the Chairman, Senate. The Senate was requested to ratify the decision of the Chairman.

Resolution: The Senate resolved to ratify the decision of the Chairman, Senate.

Senate/11/17	**Consideration of delay in registration for the Spring Semester 2024-25 due to delayed Bank Loan Processing.**

The Senate was apprised that the Chairman Senate approved for the following students and were allowed to register late for the Spring Semester 2024-25, with a late fee of Rs. 2500/-, due to delay in their bank loan processing that extended beyond the midterm examination period:

(i) Mr. Shreyansh Gupta, 22PE10029 - B.Tech. (Petroleum Engineering)

(ii) Mr. Yogesh Puri Goswami, 22PE10049 - B.Tech. (Petroleum Engineering)

The Senate was requested to ratify the decision of the Chairman.

Resolution: The Senate resolved to ratify the decision of the Chairman, Senate.

Senate/11/18	**Fee structure of QIP Admission Category.**

The Senate was apprised that the following fee structure for Ph.D. students under the QIP admission category, aligned with the fee structure for sponsored Ph.D. candidates, was approved by the Chairman, Senate for the admissions in Spring Semester 2024-25.

S.No.	Particulars of Fees	Sponsored
A.	**One Time payment at the time of Admission (Non-Refundable) (Rs.)**	
1	Admission Fee	1,000
2	Identity Card	100
3	Placement Fee	0
4	Convocation Fee	2,000
5	Alumni Subscription	1,000
6	Migration fee	500
7	Thesis evaluation fee	10,000
	Total Amount	**14,600**
B.	**Caution Deposits Payable at the time of Admission# (Rs.)**	
Institute caution money		5,000
C.	**Semester Fee (Each Semester) Non-Refundable (Rs.)**	
1	Examination	500
2	Registration/Enrolment	400
3	Gymkhana Fee	1,000
4	Campus Services and Utility	0
5	Library Fee	200
6	Tuition Fee*	25,000
7	Institute Development Fund	10,000
8	Laboratory fee	800
	Total Amount	**37,900**
D.	**Annual Fees**	
1	Medical Insurance fee	0
2	Student Brotherhood Fund	500
3	Benevolent Fund	1,000
4	Modernization Fee	700
	Total Amount	**2,200**
Grand Total (A+B+C+D)		**59,700**

The Senate was requested to ratify the decision of the Chairman.

Resolution: The Senate resolved to ratify the decision of the Chairman, Senate. The Senate further suggested to review the fee structure in comparison with other IITs and to place in the next meeting of the Senate, for further implementation.

Senate/11/19	Electives for B.Tech. Program.

The Senate was apprised that the Institute is currently offering five open electives for B.Tech. Courses, spread across 6th to 8th Semesters. The Senate was requested to review the existing open electives and determine the two-elective basket for these five courses in Autumn and Spring Semesters.

Resolution: The Senate resolved to implement the proposal of grouping open elective courses into a two basket ie Autumn and Spring Semester basket from AY 2024-25 and recommended reviewing these courses for reformatting and prerequisites required to maintain a consistent number of electives. It further advised that departments should determine which electives to offer from the basket, ensuring that the same elective is not offered in multiple semesters at the same time. Additionally, the Chairman of the Senate suggested prioritizing the inclusion of energy-related courses.

Senate/11/20	Template-free Grading Lab Courses.

The Institute proposed for template-free grading for laboratory courses. The Senate was requested to deliberate on the same for its consideration.

Resolution: The Senate resolved to approve the template-free grading for laboratory courses at Institute for implementation.

Senate/11/21	Any other item with the permission of the Chair

The following agenda was transacted with permission of the Chair.

Senate/11/21 (i)	Initiation of Post-Doctoral Fellowship Program.

The proposal for initiation of Post-Doctoral Fellowship (PDF) program to support young researchers in advancing independent research in science, technology, engineering, and mathematics was placed before the Senate for recommendations and approval **(Annexure-09)**.

Resolution: After detailed deliberations, the Senate resolved to recommend the same for approval of the F.C./Board.

Senate/11/21 (ii)	Initiation of Global Internship Program.

The proposal for initiation of Global Internship Program (GIP) to provide international students pursuing BS/ MS (or equivalent) courses with an immersive eight-week research and cultural experience to initiative fosters adaptability, problem-solving skills, and intercultural awareness while allowing participants to engage in innovative research under expert faculty mentorship is placed before the Senate for recommendations and approval **(Annexure-10)**.

Resolution: After detailed deliberations, the Senate resolved to recommend the same with 25% expenditure to be borne by the concerned candidates, for approval of the F.C./Board.

Senate/11/21 (iii)	**Coursework credit concession for Ph.D. program.**

The Senate was requested to deliberate for consideration of a concession in coursework requirements for Ph.D. scholars admitted with a dual degree M.Tech. program.

Resolution: After thorough discussions, the Senate resolve to recommend that the dual degree program be considered equivalent to an M.Tech. program, with a minimum workload of 9 credits.

The meeting ended with thanks to the Chair.

(R.P. Dwivedi)
Registrar &
Secretary, Senate, IIPE

APPROVED

(Prof. Shalivahan)
Director &
Chairman, Senate, IIPE

Annexure-1

ANNEXURE-1

COVER PAGE

Title of the Thesis
(Times New Roman 16 Bold)

Name of the Student
Department of Chemical Engineering
2024
(Times New Roman 16 Bold)

BACK PAGE

Title of the Thesis (Time New Roman 12 Bold)

IIPE / 2024
(Times New Roman 12 Bold)

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Annexure-2

ANNEXURE -2

Annexure -A

VISAKHAPATNAM

विद्या प्रशस्यते लोके

COURSE STRUCTURE

for

2 Year M.Tech (Self sponsored) in Petroleum Engineering

Indian Institute of Petroleum and Energy

Visakhapatnam, Andhra Pradesh - 530003

Eligibility for M.Tech. programme in "Petroleum Engineering"

Course Objective: The course objective of a Master's in Petroleum Engineering is to provide advanced education and training in the extraction, production, and management of hydrocarbon resources.

General:

For Indian Nationals (Regular Candidates):
A 4-year B.Tech. / B.E. degree in Petroleum/ Petrochemical/ Chemical/ Electrical/ Mechanical/ Industrial and Manufacturing Engineering / Civil Engineering with a first class or minimum 60% marks or 6.0 CPI (55% marks or CPI for SC/ST students) in the qualifying exam and with a valid GATE score.

For Sponsored candidates:
A 4-year B.Tech. / B.E. degree in Petroleum/ Petrochemical/ Chemical/ Electrical/ Mechanical/ Industrial and Manufacturing Engineering / Civil Engineering or Msc. in Geology/Geophysics with a first class or minimum 60% marks or 6.0 CPI (55% marks or CPI for SC/ST students) in the qualifying exam/degree.

The candidate shall submit a no-objection certificate from the **sponsoring organization/industry** in prescribed format at the time of interview.

For Foreign Nationals: Bachelor's degree in Engineering /Technology or a Master's degree in appropriate Sciences with a good academic record along with SOP, letters of reference and work experience as the case may be. For international students with UG degree from India a valid GATE score /online interview is also required. The Department/ School/ Centre may put additional requirements for admission.

***Total No. of Seats**: 20*

Distributions of different category: 50 to 75% for Foreign Nationals
25 to 75% For Indian Sponsored
25 to 75% For Regular Category

This is general range which can be followed. However, in case of vacant seat (s) in any category, same can be filled up by other category.

Selection Procedure: Candidates meeting eligibility criteria are required to appear in the Interview conducted by the department.

Fee Structure:

1. At par with fee structure approved for foreign nationals.
2. The fee structure approved for foreign nationals from SAARC countries will be followed for **sponsored candidates** from India/Indian Organizations.

SEMESTER – I						
Sl. No	**Code**	**Course Name**	**L**	**T**	**P**	**Credit**
1		Petroleum Geology	3	0	0	3
2		Applied Reservoir Engineering	3	0	0	3
3		Applied Hydrocarbon Production Engineering	3	0	0	3
4		Drilling Technology	3	0	0	3
5		Formation Evaluation	3	0	0	3
6		Petroleum Engineering Lab	0	0	3	2
7		Seminar	0	0	0	2
Total						**19**

SEMESTER - II						
Sl. No	**Code**	**Course Name**	**L**	**T**	**P**	**Credit**
1		Applied Reservoir Simulation	3	0	0	3
2		Elective I	3	0	0	3
3		Elective-II	3	0	0	3
4		Elective – III	3	0	0	3
5		Elective - IV	3	0	0	3
6		Modelling and Simulation Lab	0	0	3	2
7		Viva Voce/Summer Internship	0	0	0	2
Total			**15**	**2**	**6**	**19**

SEMESTER - III						
Sl. No	**Code**	**Course Name**	**L**	**T**	**P**	**Credit**
1		Thesis -1	0	0	0	18

SEMESTER - IV						
Sl. No	**Faculty**	**Course Name**	**L**	**T**	**P**	**Credit**
1		Thesis - 2	0	0	0	20
CUMULATIVE TOTAL						**76**

ELECTIVES						
Sl. No	**Code**	**Course Name**	**L**	**T**	**P**	**Credit**
1		Carbon Capture Storage and Utilization	3	0	0	3
2		Flow Assurance	3	0	0	3
3		Data Science	3	0	0	3
4		Big Data Management	3	0	0	3
5		Artificial Intelligence and Machine Learning	3	0	0	3
6		HPHT Drilling and Completion Fluids	3	0	0	3
7		Alternate Energy Resources	3	0	0	3
8		Hydrogen Energy	3	0	0	3
9		Environmental Engineering	3	0	0	3
10		Applied Gas Engineering	3	0	0	3
11		Applied Well Stimulation Techniques	3	0	0	3
12		Applied Numerical Modelling	3	0	0	3

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Annexure-3

ANNEXURE-3

Physics (Comparison of old & new syllabus)						
Course Type	Course Code	Name of Course	L	T	P	Credit
	IC1203	Physics	3	1	0	4

Syllabus modification proposed by:	Prof. Santosh Kumar Senapati	**Scheme of evaluation**	
Designation	Assistant Professor	Mid Semester	30 marks
Year/Semester	1st year/ II	End Semester	50 marks
UG/PG/PhD	UG	Internal Assessment (Assignment/Test + Attendance)	20 marks
Branch	Common course for 1st year B.Tech students	Total	100 marks

Objectives:

1. This course is prepared to understand the basic principles and fundamentals of Physics for macroscopic, microscopic, and systems of particles.
2. The first part of the course is devoted to the understanding of different systems, coordinates, and reference frames.
3. The second part of the syllabus is devoted to thermal physics based on the connection of microscopic motion to macroscopic observation and basic concepts of heat transfer.
4. The third part of the syllabus is devoted to vibration and wave theory and basic concepts of modern physics.

Learning Outcomes:

- Students will analyze and apply the principles of coordinate systems, including transformations between different frames of reference, to understand motion in physical systems.
- Students will apply Lagrangian and Hamiltonian formulations to model and solve problems involving dynamic systems with constraints and multiple degrees of freedom.
- Students will examine fluid behavior, flow regimes, and heat transfer mechanisms, incorporating thermoelectric effects to solve practical engineering problems.
- Students will interpret and apply concepts of vibrations, wave phenomena, and electromagnetic waves, including Poynting's theorem and interference, to practical scenarios.
- Students will apply modern physics principles, such as wave-particle duality, uncertainty, and laser technology, to address challenges in energy and photonics.

S.No	Topics to be Covered (New Syllabus)	**Remark**
1.	Co-ordinate systems, Cartesian, plane polar, cylindrical and spherical polar coordinate systems, frame of reference, Inertial and non- Inertial frames, moving frames, Rotating frames, ***Transformation of frames***, Constraints and degrees of freedom, Lagrange's and Hamilton's formulations.	**Proposal to include:** *Transformation of frames in the new syllabus.*

(Total pages 03)

2.	Kinetic theory of gases: distribution of molecular velocities, ***ideal and real gases. Fluid as a continuum, Knudsen number and flow regimes for gases, fluid properties, interfacial phenomena, Young-Laplace equation, Continuity equation, Torricelli's law,*** Modes of Heat transfer: Conduction, Convection, and radiation. Fourier's law, Thermal conductivity and its measurement, Wiedemann-Franz law, Newton's law of cooling, ***Concept of free and forced convection,*** Thermal radiation: black body and its properties, classical distributions, fundamental laws of radiation. ***Concept of see beck effect, Peltier effect and Thomson effect.***	***Proposal to include new topics:*** *real and ideal gases, fluid, concept of forced and natural convection, See beck effect, Peltier, effect, and Thomson effect.*
3	Overview of vibration: Free, and forced vibrations, undamped and damped vibrations, Waves: Longitudinal and transverse waves, wave equation, phase velocity, wave packet and group velocity, Interference of waves, concept of Electromagnetic waves, Poynting's theorem, Modern physics: particle and waves, photons. ***Compton effect***, deBroglie hypothesis, uncertainty principle, ***nuclear energy, principle of Laser***.	***Proposal to include new topics:*** Compton effect, nuclear energy, principle of Laser. ***Proposal to exclude*** wave optics from the current syllabus as the students have already covered this topic in the 12th level.

Text Books:

1. Classical Mechanics, H Goldstein, Reading Mass Adison-Wesley Press, Inc.
2. Physics for Scientists and Engineers Raymond A. Serway and John W. Jewett.
3. Concepts of Modern Physics, A. Beiser.
4. Introduction to Electrodynamics, Griffiths D.J. (2012) PHI Learning Pvt. Ltd. 4.2
5. Concepts in Thermal Physics, Blundell S.J., Blundell K.M., Sanjuán M.A., Oxford University Press, 2011.

References:

1. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow, Tata McGraw-Hill.
2. Classical Dynamics, D T Greenwood, Prentice Hall of India, Pvt. Ltd., New Delhi.
3. Physics: Principles with Applications Douglas C. Giancoli.
4. Introduction to special relativity, Robert Resnick.
5. Introduction to Electricity & Magnetism Liao, Dourmashkin, and Belcher.
6. Introduction to Electromagnetics, Griffith D.J. PHI Learning, 4th edition.

Justification:

- Transformation of frames: Essential for analyzing motion and forces in different reference frames.
- Real and ideal gases: Foundation for understanding thermodynamics and gas behavior in various processes.
- Fluid dynamics: Key for understanding fluid behavior and its impact on natural and industrial processes, including heat transfer.
- Seebeck, Peltier, and Thomson effects: Crucial for understanding thermoelectric phenomena and energy conversion.
- Compton effect: Provides insights into quantum mechanics with applications in material science and medical imaging.
- Nuclear energy: Essential for understanding energy generation and nuclear reactions. Principle of Laser: Important for communication, precision measurement, and medical technologies.
- Proposed for removal of 'wave optics' as it is generally covered in the 12th-grade curriculum, ensuring that students already have a solid understanding of the topic. This change allows the syllabus to focus on more advanced concepts and emerging areas in physics, eliminating redundancy and providing a more targeted learning experience.

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Annexure-4

Fluid Mechanics Laboratory						
Course Type	Course Code	Name of Course	L	T	P	Credit
CORE	ME2103	Fluid Mechanics Laboratory *(Earlier Fluid Flow Lab)*	0	0	3	2
Syllabus modification proposed by:		Prof. Santosh Kumar Senapati				
Designation		Assistant Professor				
Year/Semester		2nd year/ III				
UG/PG/PhD		UG				
Branch		Mechanical Engineering				

Objectives:

- Equip students with the ability to measure and analyze fluid properties such as viscosity and pressure, and understand fundamental fluid mechanics concepts like metacentric height and Bernoulli's principle.
- Develop experimental skills by determining flow velocity, discharge coefficients of venturi and orifice meters, and calibrating rotameters.
- Enable students to evaluate major and minor losses in pipe systems, study laminar-turbulent transition, and visualize flow patterns in two-phase flow systems.
- Introduce numerical simulation techniques for analyzing basic fluid flow phenomena and enhance understanding of drag force measurements for various objects.

Learning Outcomes:

- Students will learn to apply fundamental fluid mechanics principles to measure and analyze properties like viscosity, pressure, flow velocity, and discharge coefficients, gaining practical insights into fluid behaviour in real-world systems.
- Students will develop skills to evaluate and optimize fluid systems by investigating energy losses, flow transitions, and drag forces, while also exploring advanced techniques such as flow visualization and numerical simulation.
- Students will have a broad understanding of various measuring equipment such as venturi meter, orifice meter, rotameter, PIV, pitot static tube etc.

S.No	Topics to be Covered	Syllabus compared with
1.	***Measurement of fluid properties: viscosity, pressure etc.***	IIT Guwahati IIT Kanpur
2.	***Determination of Metacentric height of a floating body.***	
3.	Bernoulli's equation applied to a convergent-divergent passage.	
4.	Experiment to determine the flow velocity, and ***study the free and forced vortices.***	
5.	To determine the discharge coefficients of venture meter and orifice meter, and calibration of rotameter.	
6.	Determination of major and minor losses in pipe using pipe friction apparatus and pipe fitting apparatus.	
7	***Studying laminar-turbulent transition flow in a tube usingReynolds apparatus.***	
8	To visualize the flow pattern and determine the pressure drop in two-phase flow.	
9	***Measurement of drag force for various objects.***	
10	***Introduction to numerical simulations for basic fluid flowphenomena.***	

Justification for Revision:

*The changes have been highlighted in **bold** and *italics*.

The inclusion of these experiments in the "Fluid Flow Lab," renamed as the "Fluid Mechanics Lab," is crucial for addressing the core technical aspects of fluid mechanics within the field of Mechanical Engineering. Measuring viscosity and pressure is fundamental for understanding fluid properties, which are critical in applications like lubrication and hydraulic systems. Determining the metacentric height is essential for analyzing stability in marine and offshore engineering. The study of free and forced vortices deepens comprehension of rotational flows encountered in turbines, pumps, and aircraft propulsion systems.

Examining laminar-turbulent transition using Reynolds apparatus provides hands-on experience with flow regimes that govern pipe flow design and energy efficiency. Drag force measurement equips students with insights into aerodynamic and hydrodynamic forces vital for vehicle and ship design. Introducing numerical simulations familiarizes students with computational methods, an indispensable tool in modern fluid mechanics for optimizing designs and solving complex flow problems. Renaming the lab to "Fluid Mechanics Lab" reflects this technical breadth and aligns its purpose with Mechanical Engineering principles.

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Annexure-5

Academic Malpractice Guidelines

- Acts of academic malpractices by students during examination are dealt by **Students disciplinary committee (SDC).**

Guidelines for invigilators:

- Upon discovery of an act of indiscipline by a student during an exam, the invigilator should confiscate relevant material like chits, phones, answer papers, etc.
- A fresh answer book should be issued to the student and the student should be allowed to resume writing the exam.
- A detailed note should be prepared as above and submitted to the Associate Dean Academic.The report should contain the following:
    - The roll number and name of the student
    - The course number
    - A report containing a description of the act
    - A description of the evidence collected along with the material evidence to the extentpossible.

Guidelines for the SDC:

- On receipt of a complaint, the SDC considers the evidence put forward. The Associate Dean of Academic will call a meeting. A meeting is then convened to decide onthe disciplinary action.
- The Dean/ Associate Dean (Academic) will finally forward the decision of the SDC to the Director for approval. Once approved by the Director, the report is sent to the Academic Office for implementation. A letter is also issued to the student regarding the implementation of the report with copies to the concerned instructor, the parents of the student, and the Head of the student's department.
- The Dean/ Associate Dean (Academic)'s office maintains all documents related to reported cases of academic malpractices.

ANNEXURE-5

Punishment/ Penalty for Unfair Means

Sl No	Nature of Offence	Action to be Taken		
		Mid semester	End semester	Supplementary semester
1	**Communicating with other students during exams**			
	a) If a student is found verbally communicating with another student during the examination, in the absence of any other evidence except a signed note from the invigilator.	Loss of One Grade	Loss of One Grade	Loss of One Grade
	b) If students doesn't follow the instruction of the instructor even after awarding one grade less and keep on communicating with other.	Take the answer book and sent him/ her out from the examination hall.	Take the answer book and sent him/ her out from the examination hall.	Take the answer book and sent him/ her out from the examination hall.
	c) If a student is found passing chits/supplements/ calculator/ other unauthorised material to other students or exchange question paper.	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded
2	**Carrying unauthorised material during exams**			
	a) If a mobile phone is found in the possession of a student after the exam has begun or found in washroom	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded
	b) If a student is found carrying unauthorised material like electronic gadgets, using prohibited facilities like the internet etc., or is found with scribblings on one's body. Detection of such material with the student is enough to attract the penalty.	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded
3	If found guilty of swallowing or destroying any note or paper found with him/her, refused to be searched.	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded

4	If someone tries to tear the answer book, additional booklets etc. and/or instigate/disturb others in the Examination hall to support his cause.	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded
5	If someone taken away the answer book from the examination hall either by mistake or deliberately	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded
6	**Communicating with others in washroom during exams**			
	If a student who is found using a mobile phone, chits, books and other unauthorised material during toilet breaks, while the exam is in progress	Answer booklet will be cancelled.	"F" Grade will be awarded. May be allowed to sit in supplementary exam.	"F" Grade will be awarded
7	If found misbehaving/ arguing/ other serious misconduct with Invigilators/ staff	"F" Grade will be awarded for all the subjects and declared Fail in that semester.		
8	**Repeat Offences during the entire period of her/his academic program**			
	If found violates more than one time	"F" Grade will be awarded for all the subjects and declared Fail in that semester.		
	If found violates more than two times	The student may be rusticated for a period of one year.		
9	Cases not covered by these regulations	To be dealt with by SDC in an appropriate manner.		

Remarks:

a) If as student is found violating any of the above, disciplinary action will be taken as mentioned and the decision of the same will be communicated to the parents of the student by the Academic section.

b) If a student is found violating any of the above, he/ she will NOT be eligible for any fee waiver/scholarship/fellowship, etc.

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Annexure-6

SEMESTER -

ANNEXURE-6

Course Type	Course Code	Name of Course	L	T	P	Credit
		Surface Chemistry and Catalysis	3	0	0	3

Course Objective
To familiarize the students with fundamentals and advance topics in Surface Chemistry and Catalysis
Learning Outcomes
At the end of the course, the student will be able to: 1. The basic concept of surface chemistry 2. Preparation and properties Micelles and colloids 3. The principles of heterogeneous and homogeneous catalysts. 4. Applications

Unit No.	Topics to be Covered	Learning Outcome	Content compared with Which University
1	Introduction to surface chemistry, Surface tension, Adsorption isotherms, BET	1	IIT Madras, CTUAP
2	Micelles and Colloids Surface active agents, classification, CMC, thermodynamics of micelle formation, micro emulsions and applications, Introduction, preparation and properties of colloids	2	
3	Introduction to catalysis, homogeneous and heterogeneous, enzymatic, phase transfer catalysis. Preparation and characterization of catalysts, evaluation of activity and selectivity of catalysts.	3	
4	Applications in various reactions such as cracking, alkylation, hydrogenation, dehydrogenation, oxidation, reduction, enantioselective, Zeigler-Natta, C-H activation reactions	4	
	Total Classes	36 h	

References:

1. Introduction to surface chemistry and catalysis by Gabor A. Somorjai (John Wiley & Sons)
2. Physical Chemistry of macromolecules by C. Tanford
3. Physical Chemistry of Surfaces by A. W. Adamson
4. Physical Chemistry by P. W. Atkins

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Annexure-7

ANNEXURE - 7

Course Details

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective	XXXX	Adsorption Techniques for Gas Storage and Gas Separation	3	0	0	3

Course Objective

This course provides comprehensive knowledge of adsorption techniques for gas storage and separation, focusing on their industrial applications, commercial adsorbent materials, the chemical process of adsorption systems and modelling and simulation.

Learning Outcomes

At the end of the course, students will be able to:

1. Understand the fundamentals of adsorption and its applications in gas storage and separation.
2. Develop and analyse adsorption-based systems using transport modelling approaches.
3. Contribute to advancements in adsorbent materials for industrial applications.

Course Structure

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome	Content Compared with Which University
1	**Introduction to Adsorption**: Principles of adsorption, physisorption vs. chemisorption, adsorption equilibrium and kinetics, types of adsorbents (activated carbons, zeolites, MOFs).	3	Basics of adsorption and adsorbent classification	Technical University of Denmark (DTU)
2	**Adsorption Isotherms and Thermodynamics**: Langmuir, Freundlich, BET isotherms, thermodynamic parameters, and experimental techniques for isotherm determination.	5	Understand the thermodynamics and modeling of adsorption systems.	Technical University of Munich (TUM)
3	**Gas Storage Using Adsorption**: Adsorbents for hydrogen, methane, and CO_2 storage; factors influencing adsorption capacity, selectivity, and regeneration.	6	Gain knowledge of adsorption applications in gas storage.	ETH Zurich

4	**Adsorption for Gas Separation**: Mechanisms of selective adsorption; applications in CO_2 capture, air separation, and hydrogen purification; adsorption cycle processes (PSA, TSA, VSA).	8	Learn adsorption-based gas separation techniques.	University of Alberta
5	**Design and Modelling of Adsorption Systems**: Adsorption bed design principles, mass transfer zones, breakthrough curves, simulation tools (Aspen Adsorption, MATLAB).	6	Acquire skills in designing and modelling adsorption systems.	-
6	**Advanced Adsorbent Materials**: Synthesis and characterization of MOFs, COFs, and nanoporous carbons; industrial applications of advanced adsorbents.	4	Understand the advancements in adsorbent materials.	-
7	**Case Studies**: Simulation of adsorption processes using ASPEN	4	Get hands-on experience with simulation tools for adsorption.	-

Total Classes: 36

Textbooks

1. Rouquerol, Jean, et al. *Adsorption by Powders and Porous Solids: Principles, Methodology, and Applications*. 2nd Edition, Academic Press, 2014.
2. Do, Duong D. *Adsorption Analysis: Equilibria and Kinetics*. Imperial College Press, 1998.
3. Ruthven, Douglas M. *Principles of Adsorption and Adsorption Processes*. Wiley, 1984.

References

1. Bansal, Rajinder P., and Meenakshi Goyal. *Activated Carbon Adsorption*. CRC Press, 2005.
2. Zhao, Dan, et al., eds. *Metal-Organic Frameworks for Gas Storage*. Springer, 2017.
3. Yang, Ralph T. *Gas Separation by Adsorption Processes*. Butterworth-Heinemann, 1987.

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Annexure-8

ANNEXURE-8

COURSE STRUCTURE and SYLLABUS

for

4 Year B. Tech. in Mathematics & Computing

Indian Institute of Petroleum and Energy

Visakhapatnam, Andhra Pradesh – 530003

(Total Pages. 29)

SEMESTER - I							
Sl. No	**Code**	**Course Name**	**Course type**	**L**	**T**	**P**	**Credit**
1	IC1101	Calculus	IC	3	1	0	4
2	IC1102	General Chemistry	IC	3	1	0	4
3	IC1103	Engineering Mechanics	IC	3	1	0	4
4	IC1104	Introduction to Materials	IC	3	0	0	3
5	IC1105	Engineering Graphics	IC	1	0	3	3
6	IC1106	English for Communication	IC+HSS	1	0	2	2
7	IC1107	Electrical Technology	IC (Modular)	2	0	0	2
8	IC1108	Basic Electronics		2	0	0	2
9	IC1109	Chemistry Lab	IC	0	0	3	3
10		EAA I		0	0	0	P/F
Total				**18**	**3**	**8**	**27**

SEMESTER - II							
Sl. No	**Code**	**Course Name**	**Course type**	**L**	**T**	**P**	**Credit**
1	IC1201	Linear Algebra & Differential Equations	IC	3	1	0	4
2	IC1202	Strength of Materials	IC	3	1	0	4
3	IC1203	Physics	IC	3	1	0	4
4	IC1204	Programming and Data structures	IC	3	0	3	5
5	IC1205	Earth Energy & Environment	IC (Modular)	2	0	0	2
6	IC1206	Fundamentals of Biological Systems		2	0	0	2
7	IC1207	Electrical & Electronics Lab	IC	0	0	3	2
8	IC1208	Workshop	IC	0	0	3	2
9		EAA II		0	0	0	P/F
Total				**16**	**3**	**9**	**25**

1st Semester

Engineering Mathematics - I (Calculus)						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1101	Engineering Mathematics – I (Calculus)	3	1	0	4

Objectives:

1. To introduce the notions of limits, continuity, differentiation and integration of real-valued functions of single variable and multivariable and the integration of vector-valued functions on curves and surfaces.
2. To learn the polynomial approximation of n-times differentiable functions and consequently to understand the behavior of the functions.

Learning Outcomes:

At the end of the course, the student will be able to:

1. Analyze the properties such as continuity, differentiability, and Integration of single and multi-variable functions.
2. Evaluate the maxima and minima of a function by various methods such as Lagrange's multiplier method.
3. Understand polynomial approximation of a single and multivariable function by Taylor series.
4. Know the convergent properties of sequence, series and Beta and Gamma functions.
5. Evaluate the area, volume, surface area, double and triple integrals.
6. Know the connection between single, double, and triple integrals by Green's, Gauss, and Stoke's theorem.

S.No	Topics to be Covered	Learning Outcome
1.	**Functions of single variable:** Sequences in real numbers, limits and continuity of real-valued functions on intervals, extreme values of functions in interval, Intermediate value property and differentiation, Mean Value Theorems, Indeterminate forms, Taylor's formula, convergence of series, root test, ratio test, Cauchy condensation test, alternating series, Leibnitz's test, absolute and conditional convergence, power series, radius of convergence, Taylor series.	The student will be able to, analyze the properties such as continuity, differen- tiability, maxima, minima, polynomial approximation, the convergence of sequence and series, and integration of single-variable functions
2.	Riemann integration, Riemann integrable functions, Mean value theorems of Integrals, Improper integrals, Beta and Gamma functions and their convergence, comparison test, absolute convergence.	The student will be able to, evaluate and study the convergent properties of definite integrals and indefinite integrals such as Beta and Gamma functions.

3.	**Functions of several variables:** Continuity, partial derivatives, directional derivatives and gradient, differentiability, chain rule, tangent plane and normal line, Euler's theorem on ho- mogeneous functions, Taylor's theorem, extreme values, Lagrange multipliers.	The student will be able to, analyze the properties such as continuity, differentiability, maxima, minima, polynomial approximation and Integration of multivariable functions.
4.	Double and triple integrals, volume and area, change of variables, surface area, surface in- tegrals, line integrals, Green's theorem, vector fields, divergence and curl of a vector field, Stoke's theorem, Divergence theorem.	The student will be able to, evaluate the area, volume, sur- face area, double and triple in- tegrals, relations among lines, surface and volume integrals

Text Books:

1. G. B. Thomas Jr, M. D. Weir, and J. R. Hass, Calculus, Pearson Education (2009).
2. Hughes-Hallett et al., Calculus - Single and Multivariable (3rd Edition), John-Wiley and Sons (2003).
3. James Stewart, Calculus, Thomson (2003).
4. N. Piskunov, Differential and Integral Calculus Vol.1-2, Mir publishers, (1974).
5. Tom M. Apostol, Calculus Vol. 1-2, Wiley, (2007).

References:

1. S.R. Ghorpade, B.V.Limaye, A course in Calculus and Real Analysis, Springer (2017)
2. S.R. Ghorpade, B.V.Limaye, A course in Multivariable Calculus and Analysis, Springer (2017)

General Chemistry						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1102	General Chemistry	3	1	0	4

Objectives:

1. This course is designed to provide good foundation on the fundamental concepts of Physi- cal and Inorganic chemistry, viz: Thermodynamics, Chemical Equilibrium, Kinetics, Physical properties of matter, Electrochemistry, Basic spectroscopy, Alkane-alkene chemistry.

Learning Outcomes:

At the end of the course completion, the student will be able to:

1. Identify directionality and/or the tendency of physical/chemical change through thermody- namic properties/laws.
2. Identify the directionality of chemical equilibrium after perturbation in the system.
3. Identify and determine the rate constant and related properties of a chemical reaction.
4. Utilize the basic spectroscopic concept to identify basic organic/inorganic molecules.
5. Measure and determine EMF of a cell and thereby solubility product (in water) of sparingly soluble salt.
6. Understand and improvise the concept of primary and secondary battery.
7. Utilize the concept of hydrocarbon chemistry in the synthesis and characterization of Alkane/Alkene/Alkyne.

S.No	Topics to be Covered	Learning Outcome
1.	Concept of entropy, Chemical potential, Equilib- rium conditions for closed systems, Phase and re- action equilibria, Maxwell relations, Real gas and real solution. Electrochemical Systems: Electro- chemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and pH, corrosion.	Identification of direction- ality and/or the tendency of physical/chemical change through thermodynamic prop- erties/laws.
2.	Reversible, consecutive and parallel reactions, Steady state approximation, Chain reactions, Photochemical kinetics.	Identification and determina- tion of rate constant and re- lated properties of a chemical reaction.
3.	Alkane, Alkene, Alkyne: structure, stereochem- istry, physical and chemical properties, chemical reactivity, separation.	Utilization of the concept of hy- drocarbon chemistry in the syn- thesis and characterization of Alkane/Alkene/Alkyne.
4.	Basic concepts of spectroscopy, Selection rule, De- termination of molecular structure.	Utilization of the basic spectro- scopic concept to identify basic organic/inorganic molecules

Text Books:

1. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company).
2. ATKINS' Physical Chemistry by Peter Atkins, Julio de Paula (Oxford press).
3. Organic Chemistry (Volume 1) by I. L. Finar (Richard Clay and Company Ltd.)

References:

1. Physical Chemistry by Robert J. Silbey, RobertA. Alberty, Moungi G.Bawendi (John Wiley&Sons, Inc.).
2. Principle of Physical Chemistry by Puri, Sharma, Pathania (Vishal Publication)

Engineering Mechanics						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1103	Engineering Mechanics	3	1	0	4

Objectives:

1. To provide students fundamental understanding of various principles of statics and Dynamics and to expand this knowledge into the vast area of "rigid body Mechanics".
2. To enhance students' ability to design by requiring the solution of open-ended problems.
3. To prepare the students for higher level courses such as courses in Mechanics of Solids, Fluid Mechanics and other Design and Structural Analysis subject.

Learning Outcomes:

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

1. Use scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Apply fundamental concepts of statics to analyse stability of any structure.
3. Use principle of Kinematics and kinetics of particles to the analysis of simple, practical. problems.
4. Apply basic knowledge of mathematics and physics to solve real-world problems (LO4)

S.No	Topics to be Covered	Learning Outcome
1.	Introduction to Engineering Mechanics	Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
	Introduction to force system	
	Problems on Resolution of Forces	
	Review of Vectors	
	Problems on Vectors	
	Moment of force about a point and about an axis	
	Problem on Moment	
	Couple moment	
	Reduction of force system with a force and couple	
	Problems	
	Free body diagram	Apply fundamental concepts of statics to analyse stability of any structure.
	Equilibrium and its equation	
	Problems in two and three dimensions	
	Sample problems for practice	
	Trusses Introduction	
	Sample problems for practice	

2.	Laws of Coulomb friction, problems involving large and small contact surfaces	Learn about application of friction in designing screws, belt, Bearing.
	Square threaded screws	
	Belt friction	
	Friction in Bearing, Rolling resistance	
3.	Properties of area Introduction	Apply basic knowledge of mathematics and physics to find center of gravity and MOI of objects
	Moment of inertia and product of inertia	
	Polar moment of inertia and related problems	
	Principal moment of inertia	
	Sample problems for practice	
4.	Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables	Use the principle of Kinematics and kinetics of particles to the analysis of simple, practical problems.
	Central force motion	

Text Books:

1. Vector Mechanics for Engineers: Statics and Dynamics, 12th Edition By Ferdinand Beer and E. Johnston and David Mazurek and Phillip Cornwell and Brian Self.
2. Engineering mechanics. Volume 1, Statics : SI version, James L Meriam; L Glenn Kraige; Jeff N Bolton.
3. Engineering mechanics: statics and dynamics, Author:R C Hibbeler, Publisher:Upper Saddle River, NJ : Pearson Prentice Hall, ©2010.

References:

1. Engineering mechanics. Dynamics, Author:Irving Herman Shames; Ian Cole Publisher:Prentice Hall International, ©1998.

Introduction to Materials						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1104	Introduction to Materials	3	0	0	3

Objectives:

To familiarize the students with fundamentals of materials science such as crystallography, principles of alloy formation, plastic deformation, mechanical properties, various types of heat treatment processes, isothermal transformation and continuous cooling transformation diagrams. Further to introduce Ceramic, Composite and Polymeric Materials.

Learning Outcomes:

At the end of the course, the student will be able to:

1. LO1: Understand classification of materials and crystal structures.
2. LO2: Understand imperfections and defects and mechanical properties of materials.
3. LO3: Understand phase rule and phase diagrams of engineering materials.
4. LO4: Understand various types of ceramics and composite.
5. LO5: Understand different types of polymers, characterization techniques.

S.No	Topics to be Covered	Learning Outcome
1.	Introduction, Classifications of materials, Atomic Structure & Interatomic Bonding, The Structure of Crystalline Solids, Imperfections (Defects) in Solids.	L01
2.	Mechanical Properties of Metals, Dislocations & Strengthening Mechanisms, Failure.	L02
3.	Phase Diagrams, Development of Microstructure and Control of Mechanical Properties in Metals, Applications of Metal Alloys.	L03
4.	Structures and Properties of Ceramics and Applications.	L04
5.	Polymer Structures, Characteristics, Applications of Polymers and Composites.	L05

Text Books:

1. W. D. Callister, Jr: Materials Science and Engineering- An Introduction, John Wiley and Sons, N.Y,
2. Callister W D, Materials Science and Engineering, 2nd Edition, Wiley India (P) Ltd. (2014).

References:

1. J. F. Shackelford: Introduction to Materials Science for Engineers, Mc-Millan Publishing Co., N.Y. 1992
2. Askeland D R, The Science and Engineering of Materials, 5th Edition, Thomson (2005).
3. Avner S H, Introduction to Physical Metallurgy, 2nd Edition, McGraw Hill Education (2017).
4. Kodgire V D, Material Science and Metallurgy for Engineers, 31st Edition, Everest Publishing House (2011).
5. Raghavan V, Materials Science and engineering - A first Course, 6th Edition, Prentice Hall India Learning (P) Ltd. (2015).

Engineering Graphics						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1105	Engineering Graphics	1	0	3	3

Objectives:

1. Enables students to learn the concepts of drawing as graphic communication, their role in engineering design.
2. Make familiar with different drawing equipment, technical standards, and procedures for the construction of different views.
3. Equipped with the skill that enables them to convert pictorial to orthogonal representations.
4. To enable the student to learn about computer graphics using solid-works tool.

Learning Outcomes:

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

1. Use EG as a tool of communication between engineers.
2. To represent design data as per the BIS standards.
3. To visualize and represent the object in orthographic and isometric view.
4. To draw various engineering application devices using computer graphics techniques.

S.No	Topics to be Covered	Learning Outcome
1.	Engineering Drawing Introduction	Students will get to know about the uses of drawing and its importance.
2.	Projection of point	Students will get to know about the orthographic projection of points, lines, planes, and solids
3.	projection of line	
4.	Projection of planes	
5.	Projection of solid	
6.	Engineering Curve	Students will get to know about various profile generation
7.	Introduction to solid works	Students will get to know about modelling using solid works.
8.	Section of Solids	Students will get to know about generation of solids and its sections
9.	Isometric projection	Students will get to know about various views such as isometric, diametric and trimetric.
10.	EStudents will get to know about various views such as isometric, diametric and trimetric.	Students will get to draw various engineering application devices using computer graphics technique

Text Books:

1. Bhatt, N.D., Engineering Drawing,

References:

1. Shah, M.B. and Rana, B.C., 2009. Engineering Drawing. Pearson Education India.

English for Communication						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1106	English for Communication	1	0	2	2

Objectives:

1. This course has been designed to provide a foundation in effective communication in English.
2. The focus of the course is to improve the language proficiency of the students by emphasizing on the LSRW (Listening, Speaking, Reading, and Writing) skills.

Learning Outcomes:

At the end of the course, the student will be able to:

1. Use the English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in formal and informal contexts.

S.No	Topics to be Covered	Learning Outcome
1.	**English Grammar** A Revisiting Articles; Prepositions Modal verbs; Subject-verb agreement; Tense; Types of sentences Phrases and Clauses. **Exercises** On articles, prepositions (fill in the blanks) Correction of sentences (error analysis) Joining of sentences & Parsing of sentences On modal verbs.	To help students to refresh and revise the grammar
2.	**Importance of vocabulary building & Lexi- cal aspects** Word- Form- Meaning Synonyms & Antonyms Word formation Idioms and phrases/ Phrasal verbs Collocations Words as metaphors and images. **Exercises:** Exercises on word formation & Word games: Hangman; building words with cards; memory game, etc. Reading of Maya Angelou's **"Caged Bird"** Robert Frost's **"After Apple-picking"**.	To help students to refresh and revise the grammar
3.	**Pronunciation/ Phonetics** Articulation of sounds (consonants & vowels) Syllable and conso- nant cluster Stress and Intonation Indian English pronunciation Received Pronunciation. **Exercises:** practice sessions on pronunciation (fricatives) Reading of Charles Dickens's Oliver Twist (Chapter 2: **Please Sir, I want more. . .)**; Julian Barnes's The Sense of an Ending (**Introduction**); Emma Donoghue's **"The Tale of the Rose"**.	To help the students to improve their pronunciation

4.	**Developing Listening Skills** Types of listen- ing: active, passive, interpretive & critical Role of listening in communication. **Exercises:** Martin Luther King, Jr.'s I have a Dream. . . & Michelle Obama's New Hamp- shire Speech on Women Empowerment Snippets from movie: Troy (to re-narrate the Greek myth) &Games like Chinese whisper etc.	To develop students' listening comprehension skills
5.	**Reading Comprehension (literary texts)** Types of reading: close reading, reading between the lines, skimming & scanning Summarising & paraphrasing analysis and interpretation textual reading contextual reading (underpinning ideas on history/politics/economic condition/ knowl- edge/power structure etc. **Exercises:** Reading of short stories: - Ruskin Bond's **'Time Stops at Shamli'** - Mahasweta Devi's **Bitter Soil & Imaginary Maps** William Somerset Maugham's **"The Luncheon"**.	To develop students' reading comprehension of literary texts
6.	**Reading non-literary texts** Difference be- tween scientific and literary discourses Objective vs. subjective; Fact vs fiction Brevity in expres- sion& Linearity in discourse. **Exercises:** Cuttings from The Hindu's Science and Technology section Samples from science textbooks and journals.	To develop students' reading comprehension of non -literary and general texts
7.	**Oral Communication** Communication, the two way process Channels of communication Impor- tance of listening in verbal discourses Importance of intonation in verbal discourses Sensitivity/ Aptness of words in articulating one's thought; Barriers to Communication. **Exercises:** On oral communication in the form of role plays; situational conversations for negoti- ation, persuasion, assertion etc. Making a Sales Presentation.	To develop students' speaking skills
8.	**Oral Presentation** India and the World with Shashi Tharoor, Conversations with History (youtube uploaded by univ of California, 2015). **Exercises:** Individual/ team presentations, im- promptu presentations, chalk - talks, etc.	To develop students' oral pre- sentation skills
9.	**Group Discussions** The Argumentation and Debate Process Body language. **Exercises:** GDs/ reporting of group activities.	To develop students' discussion skills
10.	**Developing Writing Skills** Different elements of the writing process (pre - writing, drafting, re- vising and editing) Types of writing (expository, descriptive & persuasive) Preparing an outline Sentence structure/ clusters, coherence & Sense of paragraph Use of Linking devices; grammati- cal device. **Exercises:** On paragraph writing Preparing an outline Summarizing a text Paraphrasing a text **Assignments:** letter Writing & Writing SoPs.	To develop students' Written Communication skills

11.	**Punctuation** Capitalization; apostrophe; colon; semi-colon; comma; hyphen; parentheses; Dash; Ellipses; quotation marks & inverted commas. **Exercises:** Short passages to punctuate Quizzes.	To help students develop their skills to use punctuation marks effectively
12.	**Rhetorical Functions in Academic Writing** Intro: For whom one is writing and the purpose for which one is writing to Argue, Inform, Per- suade, Explain, Convince etc. Laboratory Re- ports, Book Reviews, Research Proposals, etc. Description; reporting; narration; comparison & contrast; explanation. **Exercises:** On description, reporting, narra- tion, comparison and contrast, explanation As- signments: to prepare and present oral and visual laboratory reports.	To develop students' academic writing skills
13.	**Writing & Rhetoric** Writing about sports; food; fashion; film (in the form of review). **Exercises:** Related exercises on Writing: sports/ food/ fashion/ film review.	To develop students' writing skills for different purposes

Suggested reading:

1. Bailey, Stephen. Academic Writing: A Handbook for International Students. Routledge. 2011.
2. Doron, L. & Soffos,C. Teaching for Deep Comprehension. Portland, 2005.
3. Frey, N. & Fisher, D. Rigorous Reading: Five Access Points for Comprehending Complex Texts. Thousand Oaks, CA: Corwin. 2013.
4. Garner, Bryan A. Modern English Usage. OUP, 2016.
5. Gerson S J & Gerson S M (2002). Technical Writing, 3/e Pearson Education Asia.
6. Green, David. Contemporary English Grammar–Structures and Composition. MacMillan India. 2014.
7. Huckin T. N. & Olesan. Technical Writing and Professional Communication, McGraw-Hill, Inc.
8. Kortepeter, Paul. Writing & Rhetoric Series
9. Laminack, L. & Wadsworth, R. Learning under the influence of Language and Literature: Making the Most of Read-alouds Across the Day. Portsmouth, NH: Heinemann. 2006.
10. Lebauer, R. S. Learn to listen, listen to learn: Academic listening and note-taking. (2nd edn.). White Plains: NY: Pearson Education. 2000.
11. Lewis, Norman. Word Power Made Easy. Penguin India. 2015 (Print)
12. Pease, Allen & Barbara Pease. The Definitive Book of Body Language. Read Books, 2004.
13. Rost, M. Introducing Listening. London: Penguin books. 1994.
14. Solomon, Philip Sunil. Word Power: Vocabulary Builder. Oxford University Press. 2017 (Print)
15. Trimble, Louis. English for Science and Technology: A Discourse Approach. CUP. 1985.

Electrical Technology						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1107	Electrical Technology	2	0	0	2

Objectives:

1. To develop knowledge on electrical circuits analysis methods, understanding/calculation of various parameters in single phase and three phases alternating current (AC) circuits/distribution network.

Learning Outcomes:

1. Analysis of Direct Current (DC) circuits, Alternating Current circuits (both Single phase and Three phase) under steady state and calculate various parameters (like voltage, current, power etc).

S.No	Topics to be Covered	Learning Outcome
1.	**Electrical Technology** • DC Networks: Ohms Law, Voltage and Current Laws, Nodal and Mesh analysis Kirchhoff's laws, node voltage and mesh current methods, Superposition principle, Thevenin's, Norton's theorems. • Single phase AC Circuits: Single phase EMF generation, average and effective val- ues of sinusoids, solution of R, L, C series circuits, the j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series – parallel circuits. • Three phase AC Circuits: Three phase EMF generation, delta and Y – connections, line and phase quantities, solution of three phase circuits, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits.	The student will be able to, analyze the properties such as continuity, differen- tiability, maxima, minima, polynomial approximation, the convergence of sequence and series, and integration of single-variable functions.

Text Books:

1. "Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly.
2. "Electronic Circuits, Analysis and Design" by Donald A. Neamen.

References:

1. "Electronic Devices and Circuits; An Introduction" by Allen Mottershead (Goodyear Publishing).
2. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N. O. Sadiku.
3. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky.
4. "Digital Logic and Computer Design" by Morris Mano.

Basic Electronics						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1108	Basic Electronics	2	0	0	2

Objectives:

1. To develop knowledge on basic Operational amplifier circuits, semiconductor devices, digital logic gates and their application aspects in some electronic circuits.

Learning Outcomes:

1. Understanding operation/functioning of basic electronic devices (diode, bipolar junction transistor, operational amplifier) and their application in some electronic circuits.
2. Knowledge on Boolean function implementation using logic gates and their application in digital logic circuits.

S.No	Topics to be Covered	Learning Outcome
1.	**Basic Electronics** • Operational amplifier: Differential mode of operation, common mode rejection, typical op-amp specifications, inverting amplifier, non-inverting amplifier, integrator, differentiator, summing amplifier etc., concept of active filters; • Semiconductor devices: Diode, half wave and full wave rectification, filtering, regulation with zener diode, BJT, structure and principle of operation; Small-Signal Model of BJT and BJT Amplifier. • Digital electronics: Review of Boolean algebra and signed number representa- tion schemes in binary, implementation of Boolean functions using various logic gates, concept of combinatorial and sequential circuits, registers and counters from functional viewpoint.	Understanding operation/functioning of basic electronic devices (diode, bipolar junction transistor, operational amplifier) and their application in some elec- tronic circuits. Knowledge on Boolean function implemen- tation using logic gates and their application in digital logic circuits.

Text Books:

1. "Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly.
2. "Electronic Circuits, Analysis and Design" by Donald A. Neamen.

References:

1. "Electronic Devices and Circuits; An Introduction" by Allen Mottershead (Goodyear Publishing).
2. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N. O. Sadiku.
3. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky.
4. "Digital Logic and Computer Design" by Morris Mano.

Chemistry Lab						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1109	Chemistry Lab	0	0	3	3

Objectives:

1. This course is designed to provide the foundation on the lab experience of Physical Chemistry concepts.

Learning Outcomes:

At the end of the course, the student will be able to:

1. Experience in measuring several physical quantities.
2. Learn how conductivity measurements help in the determination of the end-points of titrations.
3. Measure various kinetic parameters of the chemical reactions.
4. Perform volumetric titrations for quantitative analysis.

S.No	Topics to be Covered	Learning Outcome
1.	Measurement of surface tension, CMC of a sur- factant	Surface tension measurement with stalagmometer
2.	Molecular weight of a polymer by viscometric method	Viscosity measurement with Ostwald viscometer
3.	Conductometric titration	Strength of an acid can be de- termined using conductometer
4.	pH-metric titration	Determination of strength/pKa of a weak acid
5.	Acid-Base Volumetric titration	Determination of strength of a given acid.
6.	Redox titration	Determination of amount of Fe(II) in Mohr's salt.
7.	Determination of vander-Waals gas constant by using the P-V data.	Plotting using Excel package.
8.	Kinetics of Ester hydrolysis	Determination of rate constant.
9.	Phase diagram of a Binary system (Phenol-water)	Determination of critical solu- tion temperature from phase di- agram
10.	Determination of heat of a solution	Application of the concepts of specific heat and temperature change in the determination of heat of solution of a water- soluble salt
11.	Determination of concentration and molar extinc- tion coefficient using UV-Visible spectroscopy	Handling of UV-Visible spec- troscopy, validation of Lambert Beer's Law.
12.	Identification of functional groups of a given poly- mer by FTIR spectroscopy	Handling of FTIR spectroscopy and characteristic vibrational frequency identification

Text Books:

1. Advanced Physical Chemistry Experiments by Dr. J. N. Gurtu and Amit Gurtu
2. Laboratory manual for instructions.

2nd Semester

Engineering Mathematics - II						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1201	Engineering Mathematics – II	3	1	0	4

Objectives:

1. To introduce the fundamental concepts such as vector spaces, subspaces, basis, linear transformations and their matrix representation of linear algebra. To study various methods to find the solution of a system of equations and the consistency conditions of it. To study the conditions for a square matrix to be similar to a diagonal matrix.
2. To expose students to understand the ordinary differential equations and their solvability in a variety of applications, behavior of complex valued functions and its singularities.

Learning Outcomes:

At the end of the course, the student will be able to:

1. Generate the new vector spaces from existing ones and find the basis for a vector space.
2. Understand the relationship between linear transformations and matrices.
3. Solve the linear system of equations by using various methods and understand their consistency conditions.
4. Understanding the variety of techniques to solve the ordinary differential equations arises in engineering applications.
5. Analyze the properties like continuity, differentiability and analyticity of complex functions. Evaluate the complex integrals, analytic functions and to classify the singularities of complex-valued functions.

S.No	Topics to be Covered	Learning Outcome
1.	**Linear Algebra:** Algebra of matrices, Vector spaces, subspaces, linear dependence of vectors, basis and dimensions, linear transforms, matrix representation of a linear transform, rank-nullity theorem, rank and inverse of a matrix, solution of algebraic equations-consistency conditions, Gaussian elimination and Gauss-Jordon methods, Hermitian, skew Hermitian and unitary matrices, eigenvalues and eigenvectors, Cayley-Hamilton theorem, diagonalizability, bilinear forms.	The student will be able to: Understand the relationship between linear transformations and matrices. Generate the new vector spaces from existing ones and find the basis for a vector space. Solve the lin- ear system of equations by us- ing various methods and understand their consistent conditions.

2.	**Differential equations:** First order differen- tial equations: Exact Equations, integrating fac- tors, Reducible to exact differential equations, lin- ear and Bernoulli's form, Orthogonal trajecto- ries, Lipschitz condition, Picard's theorem, Ex- amples of non-uniqueness. Homogeneous and non-homogeneous second order ODE's with con- stant coefficients, Characteristic equation, Linear dependence and Independence, Existence of solutions, Wronskian, method of variation of parameters, general linear differential equations with constant coefficients, Method of undetermined coefficients, Cauchy-Euler equations, System of differential equations.	The student will be able to, understanding the variety of techniques to solve the ordinary differential equations arises in engineering applications.
3.	**Complex Variables:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, independence of path, existence of indefinite integral, Cauchy's integral formula, derivatives of analytic functions, Taylor s series, Laurent s series, Zeros and singularities, Residue theorem, evaluation of real integrals.	The student will be able to: Analyze the properties like continuity, differentiability, and analyticity of complex functions. Evaluate the complex integrals, analytic functions, and to classify the singularities of complex valued functions.

Text Books:

1. K. Hoffman and R. Kunze, Linear Algebra, Pearson publisher
2. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
3. S.L. Ross, Differential Equations, Third Edition, Wiley-India (2004).
4. R. V. Churchill, J. W. Brown, Complex Variables and Applications, Mc-GrawHill, (1990).

References:

1. G. Strang, Linear Algebra and its applications.
2. S. Ponnusamy, H. Silverman, Complex Variables with Applications, Birkhauser, (2006).

Strength of Materials						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1202	Strength of Materials	3	1	0	4

Objectives:

1. To understand fundamental concepts of stress and strain under various types of loading conditions.
2. To understand various concepts tension, compression, shear, bending and torsion.
3. To learn about location of maximum stress and strain under loading and calculate shear force, bending moment and deflection of beams.

Learning Outcomes:

At the end of the course, the student will be able to:

1. Understand concept of stress and strain.
2. Predict deformation under axial loading, compressive loading, bending, shear and torsion Understand and solve statically determinate and indeterminate problems on members subjected to torsion.
3. Understand the concept of principal stresses and Mohr's circle, stress estimation in pressure vessels.
4. Understand the failure loads for columns for various end conditions

S.No	Topics to be Covered	Learning Outcome
1.	External vs. Internal loadings, Axial loading vs. transverse loading – Theory + Problems Normal stress and Shear Stress– Theory + Prob- lems Bearing stress – Theory + Problems Stresses in axially loaded members– Theory + Problems Normal strain, Hooke's law Stress-strain diagram and strain energy concept Poisson's ratio– Theory + Problems Generalized Hooke's law– Theory + Problems Homogeneous and Composite members under axial loading– Theory + Problems	Students will get to know the concept of stress and strain
2.	Shear stress, strain and angle of twist concept in solid and hollow circular shaft subjected to torque– Theory + Problems	Learn to predict deformation under axial loading, compressive loading, bending, shear and torsion Understand and solve statically determinate and indeterminate problems on members subjected to torsion.
	Shear stress, strain and angle of twist concept in circular composite shaft subjected to torque – Theory + Problems	
	Shear stress, strain and angle of twist in both ends fixed circular shaft subjected to torque – Theory + Problems	
	Shear stress, strain and angle of twist geared circular shaft subjected to torque – Theory + Problems	

3.	Concept of bending, neutral axis, pure flexural stress derivation, radius of curvature estimation	Students will learn to draw shear force and bending moment diagram for beams
	Stresses in homogeneous beam subjected to pure bending – Theory + Problems	
	Stresses in composite beam subjected to pure bending– Theory + Problems	
	Concept of shear force, Bending moment and shear force diagram for beams subjected to various loads– Theory + Problems	
4.	General state of stress	Understand the concept of principal stresses and Mohr's circle, stress estimation in pressure vessels
	Stress estimation in members subjected to eccentric loading (axial + bending) – Theory + Problems	
	Stress estimation in members subjected to loading (axial + torsion) – Theory + Problems	
	Stress estimation in members subjected to loading (axial + torsion + bending) – Theory + Problems	
5.	Principal stress and strain	
	Estimation of principal stress, maximum shear stress from Mohr's circle– Theory + Problems	
	Stresses in pressure vessels – cylindrical and spherical – Theory + Problems	
6.	Buckling of slender column – Theory + Problems	Understand the failure loads for columns for various end conditions
	Euler's buckling load for different end conditions – Theory + Problems	

Text Books:

1. Mechanics of Materials by Beer Johnson et al. McGraw-Hill Education; 7th edition.

References:

1. Elements of Strength of Material by Timoshenko and Young (East West Press).
2. Mechanics of Materials by R.C. Hibbler. Pearson; 10th edition (5 January 2016).

Physics						
Course Type	Course Code	Name of Course	L	T	P	Credit
	IC1203	Physics	3	1	0	4

Objectives:

1. This course is prepared to understand the basic principles and fundamentals of Physics for macroscopic, microscopic, and systems of particles.
2. The 1st part of the course is devoted to the understanding of different systems, coordinates, and reference frames.
3. The second part of the syllabus is devoted to thermal physics based on the connection of microscopic motion to macroscopic observation and basic concepts of heat transfer.
4. The concept of electromagnetic waves -particle duality and electromagnetic theory forms the basis for conceptualizing the signal communication techniques and also forms the basis of electric signal theory.

Learning Outcomes:

1. This course is designed in such a way that the students learn the fundamentals of Classical Physics, which will build the base for the study of Engineering and Technology. Upon com- pletion of this course, the students will be able to have a basic understanding of the motion of a system of particles, the statistical behavior of molecules, and their correlation with gross properties such as temperature, heat conduction, and convections, Radiation.
2. The course will also help students in understanding wave motion, and the propagation characteristics of electromagnetic waves in a vacuum as well as in materials systems.

S.No	Topics to be Covered	Learning Outcome
1.	Co-ordinate systems, plane polar, cylindrical and spherical polar coordinate systems, frame of reference, rotational frame, Coriolis forces. The motion of a system of particles, Conservation laws, Constraints and degrees of freedom, Generalized coordinates, Lagrange's and Hamilton's formulations.	
2.	Concepts of distribution of molecular velocities; distribution laws and statistics-MB, FD and BE; mean free path; Transport phenomena – viscosity, diffusion; thermal conductivity, measurement of thermal conductivity; the periodic and aperiodic flow of heat, Wiedemann-Franz law. Heat radiation, black body and black body radiation, Planck's distribution law and its application to classical distribution (Rayleigh-Jeans and Wiens) and total radiation (Stefan-Boltzmann) laws, Basic concept of conduction, and convection.	

3.	Overview of vibrations with emphasis on damped and forced oscillations, resonance, coupled oscillations, and normal modes. Wave Motion: longitudinal and transverse waves, wave equa- tion, plane waves, phase velocity, superposition wave packets and group velocity, two and three-dimensional waves, polarization. Electromag- netic Waves: Maxwell's equations, wave equation, plane electromagnetic waves, energy-momentum, Poynting's theorem, electromagnetic boundary conditions, reflection and refraction, interference, Young's experiment, interferometers, diffraction, Fraunhofer diffraction (single slit), dispersion, radiation. Wave Mechanics: failure of classical physics, qualitative review of relevant experiments, de Broglie waves, uncertainty principle, wave function and Schrodinger equation.	

Text Books:

1. Classical Mechanics, H Goldstein, Reading Mass Adison-Wesley Press, Inc.
2. Physics for Scientists and Engineers Raymond A. Serway and John W. Jewett.
3. Concepts of Modern Physics, A. Beiser .
4. Introduction to Electrodynamics, Griffiths D.J. (2012) PHI Learning Pvt. Ltd. 4.2

References:

1. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow, Tata McGraw-Hill.
2. Classical Dynamics, D T Greenwood, Prentice Hall of India, Pvt. Ltd., New Delhi.
3. Physics: Principles with Applications Douglas C. Giancoli .
4. Introduction to special relativity, Robert Resnick.
5. Introduction to Electricity & Magnetism Liao, Dourmashkin, and Belcher.
6. Introduction to Electromagnetics, Griffith D.J. PHI Learning, 4th edition.

Programming and Data Structure						
Course Type	Course Code	Name of Course	L	T	P	Credit
	IC1204	Programming and Data Structure	3	0	3	5

Objectives:

Introduce students to digital computers, basics of programming, different constructs in C-programming language. Introduce fundamental data structures: arrays, linked list, stack, queue, trees and graphs and standard algorithms (Sorting and Searching).

Learning Outcomes:

At the end of the course, the student will be able to improve his/her problem-solving skills and will be able to use: C-Programming constructs, standard data structures, and sorting and searching algorithms.

S.No	Topics to be Covered	Learning Outcome
1.	Introduction to digital computers; Introduction to programming variables, assignments; expressions; input/output; Conditionals and branching; Iteration; Functions; Recursion; Arrays.	Able to use the basic C-constructs like conditional statements, loops, functions, and arrays.
2.	Introduction to pointers; Character strings; Structures; Introduction to data-procedure encapsulation; Dynamic allocation.	Able to use advanced C-constructs like Structures, pointers, dynamic allocation
3.	Time and space requirements; Searching and sorting algorithms.	Able to understand search and sorting methods and their complexity
4.	Introduction to data structures Linked structures. stacks and queues, Trees and Graphs.	Able to select and use right data structures for a given problem.

Text Books:

1. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein (MIT Press).
2. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.

References:

1. Schaum's Outline of Programming with C, Byron Gottfried, Tata McGraw-Hill.
2. Data Structures, Schaum's Outline Series, Seymour Lipschutz, Tata McGraw-Hill.
3. Fundamentals of Data Strcutures in C , Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, W. H. Freemn and Company.
4. Classic Data Structures, Debasis. Samanta, Prentice Hall of India.

Earth Energy and Environment						
Course Type	Course Code	Name of Course	L	T	P	Credit
	IC1205	Earth Energy and Environment	2	0	0	2

Objectives:

1. This course aims to train students to understand environmental issues, policies and regulations.
2. It imparts understanding on the linkages between the human-environment-economy.

Learning Outcomes:

1. Students will understand the major environmental problems and it will create awareness on their role as an individual.
2. Students will understand the role of conservation of natural resources and biodiversity to achieve sustainable development.

S.No	Topics to be Covered	Learning Outcome
Unit 1.	• Introduction • Geological Timescale and Geological Processes • Global Environmental crisis • UN conferences on Environment and Sustainable Development • Sustainable Development Goals	• Students will be acquainted with the Environmental crisis and the importance of its management. • Sustainable energy goals will be introduced.
Unit 2.	• Ecosystems: Basic concepts • Cycles in Ecosystem • Changes in various Ecosystems • Renewable natural resources • Non-renewable natural resources	• Anthropogenic and natural changes in ecosystem, non-renewable and natural resources will be discussed.
Unit 3.	• Greenhouse gases and climate change • Species extinction • Human population growth and resource usage. • Water and Soil Pollution • Air pollution • Solid Waste Management	• The role of various pollutants and greenhouse gases in breaking down the ecological harmony will be discussed.

Unit 4.	• Environmental Policies • UNFCC, Kyoto Protocol and Paris Agreement • Human-environment relationship • DPSIR model • Biodiversity • Biodiversity conservation • MINAS Standards • Changes in fuel quality specification	• The relationship of human-environment, the importance of biodiversity conservation will be discussed.

Text Books:

1. Environmental Studies: From Crisis to Cure, R. Rajagopalan, OUP India, 3rd Edition.
2. Textbook of Environmental Studies for Undergraduate Courses of all branches of higher education By Erach Bharucha.

References:

1. Environmental Science: A Study of Interrelationships, 12th Edition, Eldon D. Enger and Bradley F. Smith, McGraw-Hill.

Fundamentals of Biological Systems						
Course Type	Course Code	Name of Course	L	T	P	Credit
	IC1206	Fundamentals of Biological Systems	2	0	0	2

Objectives:

1. This course aims to provide thorough understanding of the basic concepts in biochemistry, cell and molecular biology.
2. It imparts understanding of the structure and functional roles of biological macromolecules.

Learning Outcomes:

1. Students will understand how the biological processes are interconnected and regulated.
2. It will introduce all the fundamentals and prepare students for advanced courses in biology.

S.No	Topics to be Covered	Learning Outcome
1.	• Introduction • Prokaryotic cell • Eukaryotic cell • Cell cycle and Division • Cellular Respiration and ATP synthesis • Photosynthesis	• Students will gain knowledge on the basic fundamentals of cell biology and different biochemical processes.
2.	• Proteins: structure and sequencing • Enzymes: mechanism, kinetics and inhibition • DNA: structure • DNA: replication and recombination • RNA synthesis • Genetic code and protein biosynthesis • Recombinant DNA technology	• Students will gain knowledge on the important macromolecules, their structure and synthesis

3.	• Noncovalent interactions • Free energy changes in biological processes • Transport Phenomena in biological systems • Blood Rheology • Fluid mechanical aspects of some diseases and organs • Bio-Micro devices • Crop management and Disease control • Biological Hazards and safety • Unsolved Problems in Biology	• Students will be familiarized to the mechanistic insights of biological processes. • Students can understand Implication Biosafety & Ethical protocols in biology.

Text Books:

1. Lehninger Principles of Biochemistry, David L. Nelson and Michael Cox, WH Freeman publishers.
2. Molecular Cell Biology by Lodish et al., WH Freeman publishers.

References:

1. Biochemistry by Donald Voet & Judith Voet, John Wiley & Sons.

Electrical and Electronics Lab						
Course Type	Course Code	Name of Course	L	T	P	Credit
	IC1207	Electrical and Electronics Lab	0	0	3	2

Objectives:

1. To familiarize on operation or function of various electrical and electronic measuring instruments or meters (voltmeter, ammeter, wattmeter, CSO, multimeter, Function generator etc).
2. Aims to develop the experimental setup for verifying/understanding the theoretical concepts related to some electrical and electronics circuits or theorems in the laboratory.

Learning Outcomes:

1. Knowledge of the functioning or uses of various electrical and electronics measuring instruments (volt meter, ammeter, wattmeter, CSO, multimeter, Function generator etc) and ability to connect them in the circuit for measuring various parameters.
2. Ability to build the laboratory experimental setup consisting of electrical source, measuring instruments, load as per the theoretical concept or schematic diagram and verifying the same in laboratory.

S.No	Topics to be Covered	Learning Outcome
1.	Verification of Kirchhoff's Laws	1. Knowledge on the functioning or uses of various electrical and electronics measuring instruments (volt meter, amme- ter, wattmeter, CSO, multimeter, Function generator etc) and ability to connect them in the circuit for measuring various parameters. 2. Ability to build the laboratory experimental setup consisting of electrical source, measuring instruments, load as per the theoretical concept or schematic diagram and verifying the same in laboratory.
2.	Verification of Ohm's Law and Measurement of Filament Lamp Resistance	
3.	Verification of Superposition Theorem	
4.	To measure the single phase power by using three voltmeter method.	
5.	Measurement of Power in 3-ϕ Circuit by Two Wattmeter Method	
6.	Familiarization with electronic components, Oscilloscope, Signal Generator and usage of Multimeters	
7.	Frequency response and Square wave testing of R-C, and C-R Networks.	
8.	Voltage Rectifiers-Half Wave, Full Wave Rectifier with and without Filters.	
9.	Characteristics of P-N Diode and Bipolar Junction Transistor.	
10.	Studies on Logic Gates-Verification of Logic Gates, Adders and Flip-flops.	

Text Books:

1. "Engineering Circuit Analysis" by William H. Hayt, Jack E. Kemmerly.
2. "Electronic Circuits, Analysis and Design" by Donald A. Neamen.

References:

1. "Electronic Devices and Circuits; An Introduction" by Allen Mottershead (Goodyear Publishing).
2. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N. O. Sadiku.
3. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky.
4. "Digital Logic and Computer Design" by Morris Mano.

Workshop						
Course Type	Course Code	Name of Course	L	T	P	Credit
Core	IC1208	Workshop	0	0	3	2

Objectives:

1. To study the basics of workshop engineering practice
2. To identify the hand tools and instruments and acquire measuring skills.
3. To acquire practical skills by performing the experiments in different shops of workshop.

Learning Outcomes:

1. The student will be able to use different manufacturing (machining, welding, foundry, sheet-metal working, etc) processes required to manufacture a product from the raw materials.
2. Learn to use different measuring, marking, cutting tools used in workshop.
3. Get to know about various safety precautions while working in workshop.

S.No	Topics to be Covered	Learning Outcome
1.	Safety Precautions in workshop Welding Shop 1. To study about various welding processes and the tools and equipment's use in welding shop. 2. To prepare a joint (lap butt T) using gas welding.	Students will get to know about various safety precautions while working in workshop. Students will learn about welding methodology and metal joining processing by using welding.
2.	**Foundry Shop** 1. To study about tools and equipments use in foundry shop and how to make a mould. 2. To prepare an aluminium sand casting using the mould prepared by the students.	Students will get to know about mould making and foundry process.
3.	**Machine Shop** 1. To study about various machine tools (lathe, milling, shaper, drilling, grinding and EDM drill) available in machine shop. 2. To study about various machining process performed on lathe machine tool in detail and to study the cutting tools used for various machining processes in lathe. 3. To perform facing, step turning, taper turning and knurling on a given work-piece material.	Students will get to know about using various machine such as Lathe, milling, grinding. In lathe machine they will perform various turning operations.
4.	**To study about the carpentry, fitting and sheet-metal shop.** 1. To study about the job holding devices, machine tools 2. To study about the measuring, marking, cutting and plain tools	Learn to use different measuring, marking, cutting tools used in workshop.

Text Books:

1. Hajra S. K. and Chaudhary, Workshop Technology I & II, Khanna Publisher.
2. Raghuvansi B. S., Workshop Technology I & II.

References:

1. Chapman W. A. J., Workshop Technology Vol. 1, 2, 3 & 4, Butterworth-Heinemann.
2. Gupta I. C., Engineering Metrology, Dhanpat Rai & Sons.
3. Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House.
4. Gupta K. M., Material Science and Engineering, Umesh Publication.
5. Callister W. D., Material Science & Engineering, John Wiley & Sons.

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Annexure-9

ANNEXURE - 09

VISAKHAPATNAM

विद्या प्रशस्यते लोके

INDIAN INSTITUTE OF PETROLEUM AND ENERGY

Main Building, II Floor, AU College of Engineering
(A)Andhra University, Visakhapatnam – 530003
Telephone No.: 0891-2585152, Email: office@iipe.ac.in, website: www.iipe.ac.in

Post-Doctoral Fellowship (PDF) Guidelines

Objective:

Indian Institute of Petroleum and Energy (IIPE) invites applications for the position of PDFs to identify motivated young researchers and support them in frontier areas of science, technology, engineering, and mathematics. The fellows will work under a mentor, and this fellowship will provide them with a platform to develop as independent researchers.

Duration:

The PDFs are available for a maximum period of three years, with an initial offer for a period of 1 year extendable every year on satisfactory progress as certified by the Performance Appraisal Committee (PAC)

Mentors:

1. The selected PDFs will be attached to regular faculty members of IIPE, who will act as mentors.
2. They will be attached to mentors primarily to facilitate their research work. The Fellow is expected to undertake the research objectives by themselves during the entire fellowship duration. They will work with the mentors instead of working under them.
3. Mentors shall have at least 5 years of post-doctoral experience (after PhD thesis submission).

Age Limit:

1. Maximum 35 years (to be relaxed per Government of India guidelines). Age will be calculated by taking the date of closure of the respective advertisement for PDF.

   ST and SC: 40 years
   OBC: 38 years
   General: 35 years
   Female: 40 years
   EWS
   PwD (As per GoI Norms)

Eligibility:

1. The applicant must have obtained Ph.D./M.D./M.S. degree from a recognized University. Those who have submitted their PhD/M.D./M.S. thesis and are awaiting the degree award are also eligible to apply. However, such candidates, if selected, will be offered a lower fellowship amount till they qualify for the eligible degree. However, the total duration will be three years **and the thesis should be awarded within SIX months of the start of fellowship.**
2. The applicant (within 5 years of completion of PhD) with at least two papers (as first or corresponding author) in Journals of repute (SCI/SCIE and Q1/Q2)
3. PhD holders of IIPE are not eligible to apply.
4. PDF at IIPE can be availed only once by a candidate in their career.
5. A mentor shall have up to two PDF fellows at any time.
6. International applicants are also encouraged to apply

Selection Process:

1. The call for applications for PDF will be notified through the website (www.iipe.ac.in)
2. Applications received by the Office of Dean (R&D) will be forwarded to the Department's Faculty Screening Committee for recommendation. The Central Faculty Screening Committee will approve the recommended candidates, followed by an interview. Such candidates will be reimbursed Second AC to and fro fare from their place of stay by the shortest route for attending the interview.
3. Candidates from abroad may be interviewed through Video conferencing.

Fellowship Amount:

The fellowship is purely a temporary assignment for a maximum period of 3 years. The fellows will be entitled to receive the grants as given below:

Year	**Consolidated Fellowship per month (inclusive of all)**	**HRA**
1st Year	Rs. 70,000/- Rs. 55,000/- for candidates who have submitted the thesis but the degree not awarded	HRA at the prevailing rates will be paid if the institute cannot provide accommodation in hostels/quarters.
2nd Year	Rs. 75,000/-	
3rd Year	Rs. 80,000/-	
Contingency Grant: Rs. 2,00,000 /- Per annum		

Contingency grants can be used for minor equipment, consumables, contingencies and domestic/International travel travel. It can be also be Cumulative similar to PhD Scholars. There is no provision for supporting research personnel under this scheme.

Application Forms and details:

1. Application Form and related attachments
2. Age Proof Certificate
3. Qualifications Certificate and Mark sheets
4. Category Certificate
5. Undertaking Form

Nature & Duration of Support:

1. PDFs will be eligible to serve as co-guides for guiding U.G./P.G. students enrolled for projects/dissertation work along with their mentors.
2. Apart from the research pursued by the post-doctoral fellow, the Department will utilise their services for teaching and research assistance in the departmental work, including teaching, evaluation, handling tutorials, laboratory classes and research project execution.
3. The fellows are not eligible to receive any other fellowship from any government or non-governmental source during the fellowship's tenure.
4. The fellows will not be allowed to work with the PhD guide/co-guide.

Progress Report & Performance Appraisal:

1. PDFs shall present a progress report every six months to a Performance Appraisal Committee detailing the research work carried out and reprints/preprints/manuscripts of title papers published/accepted for publication or communicated, patents filed, etc., for this purpose.

Leave:

1. Thirty (30) days leave with fellowship will be provided annually. The leave can be availed pro-rata after the fellowship has been completed.
2. Participation in scientific workshops in India or abroad will be treated as on duty.
3. Maternity (180 days) /Paternity (15 days) leave as per the Govt. of India instructions issued occasionally.
4. Leave up to 6 weeks can also be granted for miscarriage, including medical termination of pregnancy if supported by a proper medical certificate. Such leave can be combined with any other leave due and will not entail any loss of fellowship.

Medical benefits:

1. PDF and their legal dependents will be provided medical benefits under the Group Insurance Policy applicable to academic staff per the institute's norms.

Termination of the Fellowship:

1. If PDF wishes to terminate the fellowship before the end of the tenure, they can do so with the prior approval of the competent authority, giving one month's notice.
2. IIPE reserves the right to terminate the Fellowship at any stage if the fellow's performance (or) conduct is unsatisfactory/ grant has not been appropriately utilized after giving one month's notice to the Post-Doctoral Fellow.

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Annexure-10

INDIAN INSTITUTE OF PETROLEUM AND ENERGY
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Global Internship Programme

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1. Preamble

1.1 The Indian Institute of Petroleum & Energy, Visakhapatnam has initiated the Global Internship Programme (GIP) from the year 2022. The GIP is open to only the students in regular education courses and pursuing BS/MS (or equivalent students) in higher semester from foreign institutions (outside India) are eligible. The duration is of eight (8) weeks. The GIP at the IIPE provides the students abroad a platform to sharpen their adaptability, communication, and problem-solving skills in a diverse environment. The selected candidates will experience a different way of life firsthand, fostering intercultural awareness and broadening their horizons. This will serve as an opportunity to undertake assignments and focused research projects in diverse areas with faculty at the IIPE. The purpose of the GIP is to create a transformative experience for the global citizens of earth to pursue ground-breaking career in science, technology, engineering and environment.

2. Definitions

2.1 **'Institute'** refers to Indian Institute of Petroleum and Energy, Visakhapatnam.

2.1 **'President'** refers to President of Board of Governors of Institute.

2.2 **'Faculty'** refers to all permanent faculty members of Institute.

2.4 **'GIP Interns'** refers to all applicants who were selected for the Summer Internship Programme during that particular year.

3. Subject Areas of Internship

3.1 One of the following subject areas must be proposed by the applicant while applying for internship.

3.2 The areas of internship include, but are not limited to:

a. Biosciences/Biotechnology/Bioinformatics
b. Chemical Engineering
c. Chemistry
d. Computer Science and Engineering
e. Earth Sciences
f. Electrical Engineering
g. Mathematics
h. Mechanical Engineering
i. Petroleum Engineering
j. Energy Science & Engineering
k. Environmental Engineering

4. Faculty and their area of expertise

Refer IIPE website (https://www.iipe.ac.in/allfaculty). Faculty preference may be provided by the applicant while applying for global internship programme (GIP). However, the faculty preference is subject to the availability of faculty.

4.1 The applicant may fill the Faculty preferred for his internship programme.

4.2 However, the applicant is free to approach the concerned faculty at any time to seek approval.

4.3 In case approval from Faculty is not provided, the Selection Committee reserves the right to allot another faculty member to the GIP, depending on the area of research.

5. Funding

Eight (8) weeks as per academic calendar of the Institute. A maximum of two GIP Interns will be allowed under a faculty at any given time. All applicants selected under this programme will be funded by Institute. The selection of candidate depends on the availability of the faculty.

6. Cost of internship application

The applicants shall be required to pay an application fee through Payment Gateway. Application fees once paid will not be refunded under any circumstances.

7. GIP selection committee

The application received by Office of Dean (R&D) will be forwarded to appointed GIP Selection Committees to recommend the applications. The GIP selection Committee is a three-member committee comprising of Dean of R&D / Associate Dean of R&D as Chairperson, and two additional faculty members nominated by the Dean of R&D.

8. Selection criteria

8.1 Only the students in regular education courses and pursuing BS/MS (or equivalent students) in higher semester are eligible.

8.2 The applicant selection is based on the CGPA and academic background, past experience, awards, proposed work, letters of recommendations, and personal interaction if required..

8.3 Students with pending backlog and/or disciplinary action are not eligible.

9. Evaluation of GIP interns during Internship

The Interns are required to give a progress presentation of the work carried out at the end of 4-5 weeks during the internship programme, as recommended by the assessment committee. The assessment committee constitutes the Dean of R&D / Associate Dean of R&D as Chairperson, Mentor of the concerned intern and one faculty member nominated by the Dean of R&D. The Assessment committee gives feedback and suggests possible improvements in the work. At the end of the internship, all the Interns need to make a poster/oral presentation of the work carried out (as recommended by the Assessment Committee), which is open to the public. A commendation certificate will be given to the GIP Interns who display research inquisitiveness and innovative mind during the internship. All Interns will also receive a Certificate of Completion from the Institute on successful completion of the internship.

10. Other Guidelines

10.1 These GIP Guidelines and/or modifications shall take effect from the date the President approves.

10.2 Maximum of two GIP interns will be allowed under any particular faculty of IIPE at any given time.

10.3 GIP interns can be funded from Institute Funded Category.

10.4 The living/hostel/transport expenses will be borne by the Institute.

10.5 The student is not covered under the institute medical policy. It is advised to have a valid

medical insurance policy during the period of internship in India.

10.6 GIP is a mandatory 8-week internship programme. A commendation/completion certificate will only be awarded after completion of 8 weeks of internship. Any leave/late-joining allowed under special circumstances should be compensated by extended period of internship beyond the last date.

10.7 All interns will be issued a temporary institute ID card to avail the library, sports, computer centre, internet, and other institute and departmental research facilities. She/he will be required to abide by the conduct rules of the institute, failing which the internship will be terminated and the intern will be asked to leave immediately.

10.8 Applications with all required documents need to be submitted on online portal available on institute website. The applications are to be signed and stamped by the Head of Department stating that there is no pending backlog and/or disciplinary action against the said student.

10.9 The queries/issues can be resolved by sending an email to gip@iipe.ac.in and Link Global internship page - https://www.iipe.ac.in/gip.

10.10 All doubts and dispute arising out of or in connection with the interpretation of these guidelines shall be referred to the Director, IIPE, whose decision shall be final and binding on all.

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