



**Entrance Test for Post-Graduate  
TECHNOLOGY/ENGINEERING courses  
for academic year 2015  
Uni-GAUGE PGTech 2015**

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## **CALENDAR OF EVENTS**

<b>Date</b>	<b>Day</b>	<b>Event</b>
13/05/2015	Wednesday	Start date for registration and for issue of online Application
19/06/2015	Friday	Last date for Submission of completed application through offline payment (Challan payments)
22/06/2015	Monday	Last date for Submission of completed application through online (net banking, credit card, debit card)
15/06/2015	Monday	Mock Test Release
29/06/2015	Monday	Uploading of Online Test Admission Ticket on the website
04/07/2015	Saturday	"Uni-GAUGE PGTech 2015"
08/07/2015	Wednesday	Test Scores made available online to the candidates

## **I. Introduction**

1. Educational Assessment and Rating Foundation, is a "Not-for-profit" company incorporated under Section-25 of the Indian Companies Act, 1956
2. ERA is an initiative of Educational Assessment and Rating Foundation
3. ERA conducts entrance exam for admission to Post Graduate Technology/Engineering courses 'Uni-GAUGE PGTech 2015' for the academic year 2015-16. These PG courses include M-Tech (Master of Technology) and ME (Master of Engineering).
4. "Uni-GAUGE PGTech 2015" is a pan-India, computer based test. ERA has partnered with TCS-iON, a subsidiary of TCS (Tata Consultancy Services) for conducting this computer based test across India.
5. ERA will conduct "Uni-GAUGE PGTech 2015 in about 16 cities across India.

It will build the Uni-GAUGE brand for the benefit of its participating member universities/institutions

6. ERA will provide a score for "Uni-GAUGE PGTech 2015". This score will be used as one of the criteria for admission by participating Universities/Institutions.

For more details, refer the website, [www.erafoundationindia.org](http://www.erafoundationindia.org) (ERA website).

(Note: This site is updated regularly. It is suggested that all applicants visit it frequently for relevant and updated information)

## **II. Post Graduate Technology/ Engineering Programmes (Uni-GAUGE PGTech 2015 Programmes)**

Candidates appearing for "Uni-GAUGE PGTech 2015" will be eligible to seek admission to Master's degree in Technology/ Engineering programs of the participating universities/Institutions. List of Participating Universities/Institutions are given in Appendix – I.

The respective websites of participating universities/institutions provide details of Programmes/courses, number of seats, admission criteria, eligibility criteria, reservation if any, and the fee structure etc.

### III. Eligibility Criteria

#### **1. Eligibility criteria for Post Graduate Engineering Programmes - ME and M.Tech courses is as follows:**

- A. The qualifying examinations prescribed for admission for M.Tech / M.E. is B.E/ B.Tech or equivalent examination recognized by State / Central Government
- B. For M Tech CSE, Integrated MSc and MCA are also eligible. Eligible candidates of other courses are requested to refer to University website for eligibility criteria.
- C. For M.Tech Bio-Technology – MSc in Physics, MSc in Electronics, MSc in Computer science, MSc in Instrumentation, B Pharm, MSc in Bio Chemistry, MSc in Micro Biology, MSc in Bio Physics, MSc in Bio Technology, MSc in Genetics, MSc in Agriculture, Masters in Veterinary Science, MSc in Software Engg (5 Year Integrated Course) are also eligible The candidates are also requested to refer to the Participating University websites for eligibility criteria.
- D. The General Merit candidates should have passed with a minimum aggregate of 45% marks (40% in respect of SC, ST and OBC candidates) in the qualifying degree examination. However, the candidates are requested to check the eligibility criteria from Participating Universities website since some of the universities may prescribe higher percentage of marks obtained.
- E. Candidates appearing for their final degree exam / final semester exam in the current year for the prescribed qualifying degree and expecting the percentage of marks as at (D) are also eligible to apply.

#### **Other Eligibility Criteria:**

- A. Additional criteria including number of attempts, age limit, reservations for regional, social, economic, linguistic minority, if any, will be made available by participating universities / institutions on their respective websites. Candidates are requested to familiarise themselves with the eligibility criteria by visiting the websites of the participating universities/ institutions.
- B. Candidates are required to provide a declaration about their eligibility to ERA foundation while filling up the application form online. However the relevant proofs are to be submitted directly to Universities / Institutions, as required at the time of admission.

**2. The following candidates are not eligible for participating in Uni-GAUGE PGTech 2015 and hence need not apply:**

- A. Candidates who were caught attempting to impersonate or found following / adopting any of the malpractices earlier including entertaining the touts and agents.

**The Candidates are requested to refer the websites of the participating Universities for complete information on eligibility for admission.**

**IV. Uni-GAUGE PGTech 2015**

Uni-GAUGE PGTech 2015 is being conducted for merit determination, for use by participating Universities/Institutions only.

Uni-GAUGE PGTech 2015 test scores are valid only for admissions during the academic year 2015-2016.

The test will be for admissions into Master's degree in Technology /Engineering (M.E. or M-Tech) courses.

1. The Uni-GAUGE PGTech 2015 Entrance Examination consists of Single paper of 3 Hours durations that contains 85 Questions carrying maximum of 100 marks.
2. The test comprises of three sections, namely:
  - Section A - General Aptitude (Verbal and Numerical) – 20 questions of 1 mark each
  - Section B - Basic Sciences (Physics, Chemistry, Mathematics and Computing) – 30 question of 1 mark each
  - Section C - stream specific question – 20 questions of 1 mark each and 15 questions of 2 mark each.(Section A & B are common for all the streams)
3. Entrance Test will be conducted in the following eight streams:
  - (A) Civil Engineering stream (CE 1)
  - (B) Computer Science & Information Technology (CS 2)
  - (C) Electrical & Electronics Engineering (EE 3)
  - (D) Electronics & Communication Engineering (EC 4)
  - (E) Mechanical Engineering (ME 5)
  - (F) Industrial Production Engineering ( IP 6)
  - (G) Bio-Technology (BT 7)
  - (H) Chemical Engineering (CH 8)

Details of Streams and respective branches of qualifying degree (B E/ B Tech) is detailed in **Appendix – III**

4. The test will begin on 04/07/2015 at 10:00 AM and end at 01:00 PM
5. This is an online test – i.e. computer based test.
6. Each correct answer is awarded marks assigned to the respective questions as detailed in clause 2 above.
7. There will be no negative marks for wrong answer.
8. If there is a tie in the score, participating Member Universities will adopt methods to break tie to determine the inter-se merit. (Please refer to section XII – 'Result Details')

#### **V. Fees for Uni-GAUGE PGTech 2015:**

The Fee for Uni-GAUGE PGTech 2015 Entrance Exam is Rs. 1500/- (Rupees one thousand five hundred) only. Payment of fee can be made both online and offline. Online payment through Net Banking/ Debit card/ Credit card on or before 22.06.2015 and offline through Axis Bank Challan payment by 19<sup>th</sup> June 2015

**This fee is non-refundable.**

#### **VI. Test Centres/Cities:**

Uni-GAUGE PGTech 2015 will be conducted in about 16 major cities and towns of India. The lists of cities are given in Appendix-II.

While filling the application, candidates will be asked to select three cities of their choice. However ERA reserves the right to decide the cities for conducting 'Uni-GAUGE PGTech 2015'. Any changes to the stated policy and decision will be communicated on the website ([www.erafoundationindia.org](http://www.erafoundationindia.org))

Each city can have one or more centers. The allocation of centers is done through a computer assisted randomization/optimization process. The allocated centre will be communicated on the online test admission ticket (online TAT)

#### **VII. On line Registration and Application**

To register for Uni-GAUGE PGTech 2015, please refer to ERA website ([www.erafoundationindia.org](http://www.erafoundationindia.org)). This has a registration form along with suitable instructions.

On Registration the applicant will be provided with Login ID and Password.

The application process requires the candidate to complete the prescribed application form and submit it along with relevant documents and prescribed fees. ERA website ([www.erafoundationindia.org](http://www.erafoundationindia.org)) has suitable forms, a facility to upload and download documents, and to pay fees. It will also have suitable instructions.

Please read carefully and follow the instructions for completing application process.

### **VIII. Online Test Admission Tickets and Related Information**

- Online Test Admission Ticket will be available under the **Applicant's login** on ERA website from 29<sup>th</sup> June 2015 till 04<sup>th</sup> July 2015
- Download and obtain printout of the Test Admission Ticket (Online TAT) for taking the scheduled test to be held on 04/07/2015
- Test Admission Ticket (Online TAT) is a mandatory document. Candidates will not be allowed to take the 'Uni-GAUGE PGTech 2015' without this document.
- Test Admission Ticket (Online TAT) gives the details of test centre assigned to the candidate. There is no provision for any request to change the test centre.
- Please note that Test Admission Ticket (Online TAT) will NOT be dispatched in any other form to the candidates under any circumstances.
- After the Entrance test commences, the provision for printing Online Test Admission Ticket will be disabled. Hence the candidates must preserve the Online TAT until the admission process is complete.

### **IX. Test Syllabi**

The syllabus for the Uni-GAUGE PGTech 2015 is detailed in the Appendix-IV. However, it is also posted on ERA Website [www.erafoundationindia.org](http://www.erafoundationindia.org)

### **X. Instructions for Test Applicants**

1. Report 120 minutes before the commencement of the test (i.e. report by 8:00 AM on 04/07/2015) for scrutiny of documents
2. The test centre will be opened 40 minutes before the commencement of the test. Candidates are expected to take their seats immediately. If candidates do not report in time, they are likely to miss some of the general instructions.



3. The candidate must show, on demand, the Test Admission Ticket for admission in the Examination Hall. A candidate who does not possess the Test Admission Ticket downloaded from the ERA website shall not be admitted to the test centre under any circumstances.
4. During the test, the invigilator will check the Test Admission Ticket of the candidates to validate the identity of each candidate. The invigilator will also put his/her signature in the place provided in the Test Admission Ticket.
5. In the test centre the candidate must occupy his / her specific place assigned by the invigilators. If a candidate is found taking the test from a place which is not assigned to him/her, his/her candidature is liable to be cancelled.
6. **Test commences at 10:00 AM**
7. **After 09:30 AM candidates will not be allowed to enter the examination hall to take the test.**
8. Candidates will not be allowed to leave the examination hall before the scheduled time.
9. ERA is not responsible for any delay by any means of transportation to reach the test centre beyond the prescribed time and that the candidate will not be allowed to enter the test centre and take the test in the event of delay beyond the prescribed time. It is advisable to reach the Test Location early.
10. Candidates are advised in their own interest not to carry any of the personal computational devices, Bluetooth devices, cell phones, any electronic gadgets, watches, bands etc. to the venue of the examination as arrangement for safe keeping of the same cannot be assured. The aforesaid items are barred from being carried into test centre.
11. Candidates must not carry any textual material, printed or written, bits of papers, any electronic gadgets except the Test Admission Ticket and an acceptable photo ID inside the test centre
12. There is no provision for re-examination for any reason for candidates who fail to appear for the test on scheduled date and time.
13. It is mandatory for the candidate to bring his/her recent (not older than 6 months) passport size colour photograph during the conduct of Uni-GAUGE PGTech 2015 for submission and verification before the commencement of test. At the back of the photograph, candidate must mention his/her name, and TAT number.
14. The candidates must sign on their Test Admission Ticket in the presence of the invigilator, after the invigilator has verified their TAT.
15. The Uni-GAUGE PGTech 2015 test administration is timed. The Chief Superintendent of the test centre is the official timekeeper.

16. Biometric verification could be done once again during the test session (at the discretion of ERA).
17. Candidates are not allowed to go out of the test area even temporarily for any reason during the test duration (request for use of toilet will not be entertained)

## **XI. Grounds for Dismissal**

Uni-GAUGE PGTech 2015 test administrator is authorized to dismiss a candidate from a test session for:

1. Attempting to take the test for someone else (Impersonation).
2. Failing to provide acceptable identification proof when asked for:  
Acceptable original identification proofs are one of the below:
  - i. Voter ID
  - ii. Adhar Card / e-Adhar Downloaded.
  - iii. Passport
  - iv. Driving License
  - v. PAN Card
3. Creating disturbance at the test venue.
4. Giving or receiving unauthorized help.
5. Using any forbidden / unauthorized testing aids such as personal computational devices, Bluetooth devices, cell phones, any electronic gadgets etc.,
6. Leaving the test center before the stipulated time.
7. Refusing to follow directions as stipulated by the invigilators etc.,
8. Photo-mismatch / photos older than six months / smudged or hazy photographs will result in disqualification of the candidate
9. If the candidate has a past history of criminal records or having involved in ragging as defined by the concerned regulatory authorities are not allowed to take the entrance test and at the same time if it is established of the above offences subsequently, such candidates even if selected finally would be debarred from further pursuing a course
10. The UGC regulations on Curbing the Menace of Ragging in Higher Educational Institutions issued in April 2009 is available on the ERA website ([www.erafoundationindia.org](http://www.erafoundationindia.org)) separately
11. Any other misconduct in the opinion of the invigilator compels dismissing the candidate.

Failure to comply with the test procedures and regulations or with the test administrator's directions can result in ERA taking action/s that include, but are not limited to, barring candidates from future testing and or cancelling the test scores. No results would be announced in respect of dismissed candidates

## **XII. Result Publishing**

Test scores of Uni-GAUGE PGTech 2015 will be made available to candidates on 08<sup>th</sup> July 2015 under applicant login on the ERA website ([www.erafoundationindia.org](http://www.erafoundationindia.org)) for all eligible candidates.

The candidates are expected to apply to their desired participating member University/institution in response to the notifications issued by the respective University/Institution along with the test scores.

Universities shall seek the details of the candidates that are participating in their admission process for verification.

### **Inter-se Merit:**

Universities / Institutions shall use the scores in their admission process.

Ties in the test scores, if any, will be resolved by the criteria pre-published by the Universities/Institutions as part of their admission process.

The details of the scores of the candidates will be sent to the member Universities / Institutions on request being made by them.

Candidates will have their score cards available on ERA website [www.erafoundationindia.org](http://www.erafoundationindia.org) as per the calendar of events i.e. on 08<sup>th</sup> July 2015 onwards.

All candidates must note that any form of canvassing or influence exercised, attempted would result in permanent disqualification of the applicant without any further notice.

[www.erafoundationindia.org](http://www.erafoundationindia.org) is the only official website of ERA foundation. ERA is not responsible for any information available on other websites/elsewhere.

ERA does not have any agents, liaison/admission offices, representatives or any other office/s other than the office mentioned in this brochure.

Candidates are requested not to depend upon or deal with any person or organization/s claiming to be associated with the ERA activities or claiming to help with admissions or entrance tests. ERA Foundation will not be responsible for the same.

### **XIII. Online Score Card**

**Online Score Card will be available under Applicant's login of the ERA website from 08/07/2015 onwards.**

Candidates should download and obtain a printout of the Online Score card. Candidates will **not be** entertained by member participating Universities/institutions for admission **without the score Card made available from ERA foundation.**

### **XIV. Biometric Verification**

Candidates taking the Uni-GAUGE PGTech 2015 may be required to undergo biometric verification

- Before and During the test
- During counselling for seat selection at member institutions or
- At any time during the admission process or subsequent thereto.

ERA Foundation reserves the right to change (or) reset the Biometric Verification parameters at any time during the selection process.

Any mismatch at any stage will automatically result in disqualification of the candidate and he/she will not be permitted to participate in any further process of seat selection and admission to PG course.

### **XV. Assistance / Facilities to candidates**

To assist the candidates the ERA Office is operational from 10:00 AM to 05:00 PM, Monday to Friday, and from 10:00 AM to 01:00 PM on Saturday. The ERA office is not operational on Sunday and other public holidays.

No personal Queries will be entertained. The communication can be made only through Email or post.

Address for Correspondence:

ERA Foundation  
No. 1/2a, 6B, 6<sup>th</sup> Floor,  
Lavelle Mansion  
Lavelle Road  
Bangalore 560 001

Telephone/helpline:

1800 103 4791

Email:

helpdesk@erafoundationindia.org

**Kindly Note:**

- a) All information or details with regards to the Member Universities / Institutions have been provided by the Universities / institutions. Should any inadvertent error be present, ERA is not liable and responsible for the same.
- b) ERA cannot be held responsible for denial of Internet service, website unavailability, and unavailability to connect / reach voice / non voice support or any other reasons, beyond the control of ERA.
- c) Applicants are advised NOT to send any documents including their original transcripts to ERA along with the application.
- d) Should there be unforeseen changes in the calendar of events; ERA is not responsible for the same.
- e) The process enlisted in this brochure, is based on guidelines prescribed by the Hon'ble Supreme Court of India and the concerned statutory bodies. Any changes indicated by the statutory bodies during the Uni-GAUGE PGTech 2015 process are binding on ERA for implementation.
- f) Documents and/or declarations collected if any relating to Uni-GAUGE PGTech 2015 will be confidential and would be retained for the current academic year only. Any dispute of whatever nature beyond the academic year would not be entertained.
- g) The information content in this brochure is as on the date of Notification. Please refer to the website for current and updated information.
- h) ERA reserves the right to modify the various terms and conditions and other criteria incorporated in this brochure at its discretion and at any time after notifying the same on its website [www.erafoundationindia.org](http://www.erafoundationindia.org)
- i) All communication to ERA shall have to be in English language.

**XVI. Legal Disputes**

All legal disputes, if any, pertaining to "Uni-GAUGE PGTech 2015" shall be subjected to competent courts / consumer forums located in the jurisdiction of Bangalore city only.

**XVII. Change Request**

Candidates are cautioned to fill up the online application carefully as the request for change in any application data entered and submitted will not be entertained.

## **XVIII. Frequently Asked Questions (FAQs)**

1. What is Computer based test?

Response: It is a test conducted using the Local Area Network (LAN) to make it safe, secure and un-interrupted.

2. Is Computer based test (CBT) based on Internet?

Response: No

3. What computer knowledge is required to appear for CBT Mode?

Response: The candidate needs to know only how to operate the computer mouse. That is all that is required for the test.

4. What are the advantages in opting for CBT?

Response: The test can be organized in many cities simultaneously which will eliminate the need to travel from city to city. This saves cost and time.

Advantages while taking the examination are:

- Countdown timer will display the remaining time available to complete the examination.
- Question Palette displayed on the right side of screen will show the status of each question.
- You can easily navigate to any question by clicking on the question number in the Question Palette.
- You can mark a question for review and then come back to it for saving the correct option.
- You can easily navigate between multiple sections by clicking the respective section displayed on the top bar of the screen.
- You can view the answering status for a Section by placing the mouse over the name of the Section.
- You can view all the questions by clicking on the Question Paper button.
- You can shuffle between different sections or change the optional Sections any number of times.

5. What will be the medium of CBT?

Response: Medium of examination will be English language ONLY.

6. Can a student select date/shift of CBT?

Response: No. There is only one single day/shift

7. Can I get an examination centre of my choice?

Response: You can choose three cities at the time of filling the application form. The list of cities is given in Appendix II.

ERA will endeavour to allocate the city of any one of your choice. However, ERA reserves the right to decide the cities for conducting 'Uni-GAUGE PGTech 2015'. Any changes to the stated policy and decision will be communicated on the website ([www.erafoundationindia.org](http://www.erafoundationindia.org)).

Each city can have one or more centres. The allocation of centres is done through a computer assisted randomization/optimization process. The allocated centre will be communicated on the online test admission ticket (online TAT)

8. How secure is the CBT?

Response: It is very secure as human intervention is minimal, No; manipulation of answers, cheating and loss of time.

9. How can I practice for CBT?

Response: You can practice through web based mock test which will be available on ERA Foundation website from 15<sup>th</sup> June 2015.

10. What will happen in case there is some problem in computer during the examination?

Response: There will be enough buffer systems available in the examination centre to take care of such problems and time lost in change of system will be duly taken care as each and every second will be recorded by the server.

11. Will there be a question booklet like in offline examination?

Response: In CBT mode exam the questions will appear on computer screen along with the answer options. Instruction page will also be displayed before the actual test begins. The time of reading of instructions will not be part of examination duration.

12. Will I get the Question paper and Answer keys of CBT after the exam?

Response: No, the question paper and the answer keys will not be provided.

13. In case of problem in computer etc. will there be somebody to assist?

Response: Yes, each lab will have an invigilator to assist the candidate in case of any problems with the computer.

14. How will I answer a question in the CBT?

Response: There will be four options for each question. You have to click one of the options using your computer mouse which can be reviewed or re-answered any time during the duration of the examination.

15. How will I come to know which questions are left unanswered?

Response: There will be a panel on computer screen showing all the question numbers in different colour scheme which will indicate the questions answered, left unanswered and marked for review.

16. Can I change my answer?

Response: Changing an answer is an important feature of CBT. You can change the answer before submitting your answer sheet and during designated examination duration on the day of the exam.

17. Will I get sheets/papers for rough work/calculations etc.?

Response: Yes

18. Will there be call centre support?

Response: Yes. There will be call centre support for candidates appearing in CBT. You can call @ Toll Free no. 1800 103 4791 or email us at [helpdesk@erafoundationindia.org](mailto:helpdesk@erafoundationindia.org)

19. When will the results be declared?

Response: The test results will be uploaded under Applicant's login on the ERA website ([www.erafoundationindia.org](http://www.erafoundationindia.org)) for all eligible candidates as per the calendar of event i.e. from 08<sup>th</sup> July 2015.

20. When will I have to report at exam centre?

Response: The test commences at 10AM. However, you are advised to report two hours before – i.e. at 8AM. Please note that candidates reporting after 9:30AM will not be allowed to enter the examination hall.



21. What is the eligibility PG Engineering Courses?

Response:

- A. The qualifying examinations prescribed for admission for M.Tech / M.E. is B.E/ B.Tech or equivalent examination recognized by State / Central Government
- B. For M Tech CSE, Integrated MSc and MCA are also eligible. Eligible candidates of other courses are requested to refer to University website for eligibility criteria.
- C. For M.Tech Bio-Technology – MSc in Physics, MSc in Electronics, MSc in Computer science, MSc in Instrumentation, B Pharm, MSc in Bio Chemistry, MSc in Micro Biology, MSc in Bio Physics, MSc in Bio Technology, MSc in Genetics, MSc in Agriculture, Masters in Veterinary Science, MSc in Software Engg (5 Year Integrated Course ) are also eligible The candidates are also requested to refer to the Participating University websites for eligibility criteria.
- D. The General Merit candidates should have passed with a minimum aggregate of 45% marks (40% in respect of SC, ST and OBC candidates) in the qualifying degree examination. However, the candidates are requested to check the eligibility criteria from Participating Universities website since some of the universities may prescribe higher percentage of marks obtained.
- E. Candidates appearing for their final degree exam / final semester exam in the current year for the prescribed qualifying degree and expecting the percentage of marks as at (D) are also eligible to apply.

22. Is the Entrance Test open only to some students of any particular state?

Response: No, this test is open to all the eligible students.

23. Where can I find the list of courses offered?

Response: The list of courses is provided in the respective ERA member University/Institution website.

24. When is the last date to apply?

Response: Online application portal shall be open till 22<sup>nd</sup> June 2015 by 05:00 PM. However, offline payment through challan (Axis bank) will be accepted only till 19<sup>th</sup> June 2015.

25. What is the procedure of seat selection?

Response: For the academic year 2015-2016, selection of seats for the Post Graduate courses in Member Participating Universities/Institutions will be as per their admission policies/ process declared by them from time to time – however will be based on score of the candidate in Uni-GAUGE PGTech 2015

26. How will I know my test results?

Response: The test results will be uploaded under Applicant's login on the ERA website ([www.erafoundationindia.org](http://www.erafoundationindia.org)) for all eligible candidates.

27. Can I upload a black & white photograph with the Application Form?

Response: No. You have to upload identical colour photographs with application form. Photographs should not be more than 6 months old. Application with smudged or tampered or hazy photograph will not be accepted.

28. What is Mode of Payment?

Response: Both online and offline payment modes are available. Online payment through debit card/credit card /net banking is available and offline through challan payment from Axis bank is acceptable.

29. Whether ERA sends a hard copy of Test Admission Ticket to the candidates?

Response: No. Test Admission Tickets (Online TAT) have to be downloaded and printed from ERA website by the candidates themselves. Copies would NOT be dispatched.

30. Does ERA Foundation send a hard copy of the score card to the candidates?

Response: No. Score cards have to be downloaded and printed from ERA website. Scorecards copies will NOT be dispatched.

31. How to apply to Different Universities accepting Uni-GAUGE score?

Response:

- Applicant to download Test Score card from [www.erafoundationindia.org](http://www.erafoundationindia.org)
- Applicant to check Eligibility criteria in individual Participating University for the course applicant is interested in. This information is available in participating University website. Link is also available in Era Foundation website [Click Here](#)
- Applicant to apply separately to participating university that he/she is interested in along with Uni-GAUGE test score card and the prescribed documents as mentioned in the participating university website.
- University verifies the Uni-GAUGE Test Score Card submitted by applicant.
- University prepares the merit list of applicants who have submitted applications to them and conduct admission process.

## Appendix –I

### List of Participating Universities – Uni-GAUGE PGTech 2015

<b>Sl. No.</b>	<b>Name of the University</b>	<b>Location</b>
1	M S Ramaiah University of Applied Sciences	Bangalore, Karnataka
2	Reva University	Bangalore, Karnataka
3	Saveetha University	Chennai, Tamil Nadu
4	SCSVMV University	Kanchipuram, Tamil Nadu
5	PeriyarManiammai University	Thanjavur, Tamil Nadu
6	KL University	Vijayawada Andhra Pradesh
7	Karpagam University	Coimbatore, Tamilnadu

## Appendix –II

List of likely cities for 'Uni-GAUGE PGTech 2015'

Sl. No	State	CITY
1	Andhra Pradesh	GUNTUR
2	Andhra Pradesh	HYDERABAD
3	Karnataka	BENGALURU
4	Karnataka	HUBLI
5	Karnataka	MANGALORE
6	Kerala	ERNAKULAM
7	Maharashtra	GREATER MUMBAI
8	Tamil Nadu	CHENNAI
9	Tamil Nadu	COIMBATORE
10	Tamil Nadu	KANCHEEPURAM
11	Tamil Nadu	VELLORE
12	Tamil Nadu	THANJAVUR
13	Rajasthan	JAIPUR
14	West Bengal	KOLKATA
15	Delhi NCR	Delhi NCR
16	BIHAR	PATNA

### Appendix –III

#### Details of Streams and respective branches of qualifying degree (B.E/ B.Tech)

Sl no	Stream	Branches of Engineering (B E/ B Tech)
1	Civil Engineering Code: CE 01	Civil Engineering
		Environmental Engineering
		Transportation Engineering
		Construction Technology
2	Computer Science and Information Technology Code: CS 02	Computer Science and Engineering
		Information Science and Technology
		Computer Science
		Information Science
		Computer Science and Systems Engineering
		Master of Computer Applications
		Integrated M Sc (Computer Science)
Computer Engineering		
3	Electrical and Electronics Engineering Code: EE 03	Electrical Engineering
		Electrical and Electronics Engineering
		Instrumentation technology
		Instrumentation and Controls
		Electronics and Instrumentation
4	Electronics and Communications Engineering Code: EC 04	Electronics Engineering
		Electronics and Communication Engineering
		Telecommunication Engineering
		Medical Electronics
		Bio Medical Engineering
5	Mechanical Engineering Code: ME 05	Communication Engineering
		Aero Space Engineering
		Aeronautical Engineering
		Automobile Engineering
		Automotive Engineering
		Mechanical Engineering
		Marine Engineering
		Mining Engineering
		Mechotronics Engineering
		Metallurgical Engineering
Tool Engineering		
6	Industrial Production Engineering Code: IP 06	Industrial Engineering and Management
		Industrial Production Engineering
		Manufacturing Engineering
7	Bio Technology Code: BT 07	Bio Technology
		M Sc in Bio Technology
8	Chemical Engineering Code: Ch 08	Chemical Engineering
		Polymer Science and Technology
		M Sc in Chemistry

## **Appendix –IV Syllabus**

### **Section A –General Aptitude** (Common to all Streams) – 20 Marks

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#### **1) Verbal Ability**

- Word problems (Synonyms and Antonyms)
- Sentence completion
- Word analogy

#### **2) Critical Reasoning**

- Arithmetical Reasoning
- Logical Analysis reasoning
- Verbal deductions

#### **3) Numerical Ability**

- Number Systems
- Profit and Loss
- Ratio and Proportion
- Average
- Simple and Compound Interest
- Time and Work
- Progression
- Data Interpretation

## Section B –Basic Sciences (Common to All streams) 30Marks

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### ENGINEERING MATHEMATICS

10 Marks (Ten Questions 1 Mark Each)

**Linear Algebra:** Matrix algebra, systems of linear equations, eigen values and eigen vectors.

**Calculus:** Functions of single variable, limit, continuity and differentiability, mean value theorems, evaluation of definite and improper integrals, partial derivatives, total derivative, maxima and minima, gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals. Theorems of Stokes, Gauss and Green.

**Differential Equations:** First order linear and nonlinear equations, higher order linear ODEs with constant coefficients, Cauchy and Euler equations, initial and boundary value problems, Laplace transforms. Partial differential equations and separation of variables methods.

**Numerical methods:** Numerical solution of linear and nonlinear algebraic equations, integration by trapezoidal and Simpson rule, single and multi-step methods for differential equations.

**Probability:** Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.

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### COMPUTING

10 Marks (Ten Questions 1 Mark Each)

Introduction to C language, Operators and Expressions, Managing Input and Output Operations, Decision making and branching, Decision making and looping, Arrays, Character Arrays and Strings, User defined Functions, Structures, Pointers.

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### PHYSICS

05 Marks (Five Questions 1 Mark Each)

**Dynamics of Rigid Bodies and Elasticity:** Rotational motion--Review of M.I., Radius of gyration, parallel and perpendicular axes theorems—Expressions for moments of inertia of a rectangular plate and circular plate about different axes—Kinetic energy of rotation. Stress, strain and Hooke's law---Relation between  $K$ ,  $\alpha$  and  $\beta$ --Relation between  $n$ ,  $\alpha$  and  $\beta$ —Relation between  $Y$  and  $\alpha$  – Relation between  $Y$ ,  $k$ ,  $n$  and  $\sigma$ —Twisting of a cylinder and expression for couple per unit twist—torsion pendulum—Bending of beams –bending moment of a beam—cantilever loaded at free end.



**Lasers and Optical fibers:** Review of general principle of Laser, Expression for Energy density of radiation in terms of Einstein coefficients. Three and four level lasers--Principle and operation of Carbon Dioxide and semiconductor Laser—. Applications - Laser cooling, Laser fusion and Industrial applications. Propagation mechanisms in optical fibers, Angle of acceptance and Numerical aperture of step and graded index optical fibers. Attenuation in optical fibers. Optical fiber sensors and applications

**Concepts of Modern Physics :** De Broglie principle and matter waves—phase velocity and group velocity of matter waves –Expression for group velocity and its equivalence to velocity of particle—Heisenberg's uncertainty relationships. Wave function and its attributes—One dimensional time independent Schrodinger's wave equation—Solving of wave equation for a particle in an infinite one dimensional potential well and extension to three dimensional case--Step potential—Expression for reflection and transmission coefficients for the cases of (i)  $E < V$  and (ii)  $E > V$ —Potential barrier and tunnel effect—Scanning tunnelling microscope.

**Electrical conduction in solids:** Metals: Review of classical free electron theory and its drawbacks—Quantum free electron theory—Fermi –Dirac distribution function—Expressions for density of states in a metal and Fermi energy at 0 K. Qualitative discussion of periodic potential, energy band formation and distinction between metals, semiconductors and insulators. Effective mass of an electron and concept of a hole from E-k curve.

**Semiconductors:** density of states in conduction and valence bands and expressions for electron and hole concentrations—law of mass action—position of intrinsic Fermi level in semiconductors. Hall Effect and its applications.

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## **CHEMISTRY**

05 Marks (Five Questions 1 Mark Each)

**Electrochemical Cells:** Basic concepts of electrochemistry - electrode potential, Origin of single electrode potential, Derivation of Nernst equation, Galvanic cells, Classification of galvanic cells, Reference electrodes - calomel electrode, Ag|AgCl electrode. Measurement of single electrode potential. Ion-selective electrode-Glass electrode- Determination of pH using glass electrode. Concentration cells. Numerical problems on electrode potential EMF of cells and concentration cells.

## **Batteries and Fuel Cells:**

**Batteries:** Basic concepts, Mechanism of battery operation, battery characteristics. Classification of batteries – Primary, secondary and reserve batteries. Classical batteries – construction, working Ni-Cd batteries. Modern batteries- construction, working and applications of Zn-air, Nickel-metal hydride and Lithium-MnO<sub>2</sub> batteries.

**Fuel Cells:** Introduction, Definition, differences between a battery and a fuel cell, advantages. Types of fuel cells –Alkaline fuel cell, Phosphoric acid, Molten carbonate Solid polymer electrolyte fuel cell. Description and working of H<sub>2</sub>-O<sub>2</sub> and MeOH-O<sub>2</sub> fuel cells.

**Corrosion Science:** Metallic corrosion - Definition, Electrochemical theory of corrosion. Types of corrosion - Differential metal corrosion, differential aeration corrosion -pitting and waterline corrosion. Stress corrosion. Factors affecting the rate of corrosion. Corrosion control: metal coating- Anodic and cathodic metal coatings with examples. Inorganic coatings- anodizing and phosphating. Corrosion inhibitors. Cathodic Protection-sacrificial anode method.

## **Water Technology**

Hardness – definition, types of hardness and its determination by EDTA method – numerical problems; Alkalinity– Definition and its determination by phenolphthalein and Methyl orange indicator. Biological Oxygen Demand–definition, determination and numerical problems. Chemical Oxygen Demand – Definition, determination and numerical problems. Determination of Nitrate by phenol disulphide (spectrophotometric). Sulphate by gravimetric, Chloride by argentometric. Fluoride content, hazards, defluorination. Determination of dissolved (DO) oxygen by Winklers method. Sewage treatment – Primary treatment, Secondary treatment by activated sludge treatment and tertiary treatment. Potable water – Definition, purification of water by reverse osmosis. Purification of water for industries-Ion exchange method.

**Energy Sources:** Introduction to energy; conventional sources: calorific value– Definition, net and gross calorific values, units (SI), determination of calorific value of a solid fuel by bomb calorimeter. Numerical problems, Liquid fuels: Petroleum cracking - fluidized bed catalytic cracking, Reformation of petrol. Knocking – mechanism, octane number, cetane number, prevention of knocking, unleaded petrol. Bio energy-bio fuels.

## SECTION C- STREAM SPECIFIC SYLLABUS

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### **Civil Engineering (CE 1)**

(50 Marks)

#### **Structural Engineering**

**Mechanics:** Bending moment and shear force in statically determinate beams. Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, flexural and shear stresses, unsymmetrical bending, shear centre. Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses.

**Structural Analysis:** Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force/ energy methods, analysis by displacement methods (slope deflection and moment distribution methods), influence lines for determinate and indeterminate structures. Basic concepts of matrix methods of structural analysis.

**Concrete Structures:** Concrete Technology- properties of concrete, basics of mix design. Concrete design- basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of pressurised concrete, analysis of beam sections at transfer and service loads.

**Steel Structures:** Analysis and design of tension and compression members, beams and beam columns, column bases. Connections- simple and eccentric, beam-column connections, plate girders and trusses. Plastic analysis of beams and frames.

#### **Geotechnical Engineering**

**Soil Mechanics:** Origin of soils, soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability & seepage, effective stress principle, consolidation, compaction, shear strength.

**Foundation Engineering:** Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes-infinite slopes, finite slopes. Foundation types-foundation design requirements. Shallow foundations-bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands & clays. Deep foundations-pile types, dynamic & static formulae, load capacity of piles in sands & clays, negative skin friction.

## **Water Resources Engineering**

**Fluid Mechanics and Hydraulics:** Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

## **Environmental Engineering**

**Water requirements:** Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment Unit operations and unit processes of domestic wastewater, sludge disposal.

## **Transportation Engineering**

**Highway Planning:** Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements.

**Traffic Engineering:** Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

## **Surveying**

Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, errors and adjustments, curves.

## SECTION C- STREAM SPECIFIC SYLLABUS

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### Computer Science and Information Technology (CS 2)

(50 Marks)

**Computer Organization and Architecture:** Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

**Programming and Data Structures:** Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

**Algorithms:** Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes – P, NP, NP-hard, NP-complete.

**Theory of Computation:** Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.

**Compiler Design:** Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

**Operating System:** Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

**Databases:** ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

**Information Systems and Software Engineering:** information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

**Computer Networks:** ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security – basic concepts of public key and private key cryptography, digital signature, firewalls.

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## SECTION C- STREAM SPECIFIC SYLLABUS

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### Electrical and Electronics Engineering (EE 3)

(50 Marks)

**Electric Circuits and Fields:** Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phase circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

**Signals and Systems:** Representation of continuous and discrete-time signals; shifting and scaling operations; linear, time-invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

**Electrical Machines:** Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; autotransformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

**Power Systems:** Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of overcurrent, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

**Control Systems:** Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

**Electrical and Electronic Measurements:** Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

**Analog and Digital Electronics:** Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

**Power Electronics and Drives:** Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.



## SECTION C- STREAM SPECIFIC SYLLABUS

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### Electronics and Communication Engineering (EC 4)

(50 Marks)

#### **Networks:**

Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

#### **Electronic Devices:**

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERS. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process.

#### **Analog Circuits:**

Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

#### **Digital circuits:**

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shiftregisters. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor(8085): architecture, programming, memory and I/O interfacing.

**Signals and Systems:**

Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

**Control Systems:**

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

**Communications:**

Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.

**Electromagnetics:**

Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain.

## SECTION C- STREAM SPECIFIC SYLLABUS

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### Mechanical Engineering (ME 5)

(50 Marks)

#### **Applied Mechanics and Design**

**Engineering Mechanics:** Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

**Strength of Materials:** Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

**Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

**Vibrations:** Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

**Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; *principles* of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

#### **Fluid Mechanics and Thermal Sciences**

**Fluid Mechanics:** Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

**Heat-Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

**Thermodynamics:** Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. Irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

**Applications:** *Power Engineering:* Steam Tables, Rankine, Brayton cycles with regeneration and reheat. *I.C. Engines:* air-standard Otto, Diesel cycles. *Refrigeration and air-conditioning:* Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. *Turbomachinery:* Pelton-wheel, Francis and Kaplan turbines — impulse and reaction principles, velocity diagrams.

## **Manufacturing and Industrial Engineering**

**Engineering Materials:** Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

**Metal Casting:** Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

**Forming:** Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy.

**Machining and Machine Tool Operations:** Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures

**Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

**Inventory Control:** Deterministic and probabilistic models; safety stock inventory control systems.

**Operations Research:** Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

## SECTION C- STREAM SPECIFIC SYLLABUS

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### Industrial Production Engineering (PI6)

(50 Marks)

#### **Production Engineering**

**Metal Casting:** Casting processes – types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

**Metal Forming:** Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire /rod drawing; metal working defects.

**Metal Joining Processes:** Welding processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electro slag, thermit, resistance, forge, friction, and explosive welding; other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes – ultrasonic, electron beam, laser beam; thermal cutting.

**Machining and Machine Tool Operations:** Basic machine tools; machining processes-turning, drilling, boring, milling, shaping, planing, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining

parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of non-traditional machining processes – USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

**Tool Engineering:** Jigs and fixtures – principles, applications, and design; press tools – configuration, design of die and punch; principles of forging die design.

**Metrology and Inspection:** Limits, fits, and tolerances, interchange ability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

**Powder Metallurgy:** Production of metal powders, compaction and sintering.

**Polymers and Composites:** Introduction to polymers and composites; plastic processing – injection, compression and blow molding, extrusion, calendaring and thermoforming; molding of composites.

**Manufacturing Analysis:** Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process planning; parameter selection and comparison of production alternatives; time and cost analysis; manufacturing technologies – strategies and selection,

**Computer Integrated Manufacturing:** Basic concepts of CAD, CAM, CAPP, cellular manufacturing, NC, CNC, DNC, Robotics, FMS, and CIM.

## **Industrial Engineering**

**Product Design and Development:** Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering.

**Engineering Economy and Costing:** Elementary cost accounting and methods of depreciation; break-even analysis, techniques for evaluation of capital investments, financial statements.

**Work System Design:** Taylor's scientific management, Gilbreth's contributions; productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement – stop watch time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration; business process reengineering.

**Facility Design:** Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

**Production Planning and Inventory Control:** Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; MRP and MRP-II; order control and flow control; routing, scheduling and priority dispatching; push and pull production systems, concept of JIT manufacturing system; logistics, distribution, and supply chain management; Inventory – functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.

**Operation Research:** Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models, constrained optimization and Lagrange multipliers; simple queuing models; dynamic programming; simulation – manufacturing applications; PERT and CPM, time-cost trade-off, resource leveling.

**Quality Management:** Quality – concept and costs, quality circles, quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000; design of experiments – Taguchi method.

**Reliability and Maintenance:** Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; preventive maintenance and replacement, total productive maintenance – concept and applications.

**Management Information System:** Value of information; information storage and retrieval system – database and data structures; knowledge based systems.

**Intellectual Property System:** Definition of intellectual property, importance of IPR; TRIPS and its implications, patent, copyright, industrial design and trademark.



## SECTION C- STREAM SPECIFIC SYLLABUS

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### Biotechnology (BT 7)

(50 Marks)

#### **Biotechnology**

**Microbiology:** Prokaryotic and eukaryotic cell structure; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration, photosynthesis); Nitrogen fixation; Chemical basis of mutations and mutagens; Microbial genetics (plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses.

**Biochemistry:** Biomolecules and their conformation; Weak inter-molecular interactions in bio macromolecules; Chemical and functional nature of enzymes; Kinetics of single substrate and bi-substrate enzyme catalyzed reactions; Bioenergetics; Metabolism (Glycolysis, TCA and Oxidative phosphorylation); Membrane transport and pumps; Cell cycle and cell growth control; Cell signalling and signal transduction.

**Molecular Biology and Genetics:** Molecular structure of genes and chromosomes; DNA replication and control; Transcription and its control; Translational processes; Regulatory controls in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extrachromosomal inheritance; Chromosomal variation; Population genetics; Transposable elements, Molecular basis of genetic diseases and applications.

**Process Biotechnology:** Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exopolysaccharides, antibiotics and pigments etc.; Microbial production, purification and bioprocess application(s) of industrial enzymes; Production and purification of recombinant proteins on a large scale; Chromatographic and membrane based bioseparation methods; Immobilization of enzymes and cells and their application for bioconversion processes. Aerobic and anaerobic biological processes for stabilization of solid / liquid wastes; Bioremediation.

**Bioprocess Engineering:** Kinetics of microbial growth, substrate utilization and product formation; Simple structured models; Sterilization of air and media; Batch, fed-batch and continuous processes; Aeration and agitation; Mass transfer in bioreactors; Rheology of fermentation fluids; Scale-up concepts; Design of fermentation media; Various types of microbial and enzyme reactors; Instrumentation in bioreactors.

**Plant and Animal Biotechnology:** Special features and organization of plant cells; Totipotency; Regeneration of plants; Plant products of industrial importance; Biochemistry of major metabolic pathways and products; Autotrophic and heterotrophic growth; Plant growth regulators and elicitors; Cell suspension culture development: methodology, kinetics of growth and production formation, nutrient optimization; Production of secondary metabolites by plant suspension cultures; Hairy root cultures and their cultivation. Techniques in raising tangencies.

**Characteristics of animal cells:** Metabolism, regulation and nutritional requirements for mass cultivation of animal cell cultures; Kinetics of cell growth and product formation and effect of shear force; Product and substrate transport; Micro & macro-carrier culture; Hybridoma technology; Live stock improvement; Cloning in animals; Genetic engineering in animal cell culture; Animal cell preservation.

**Immunology:** The origin of immunology; Inherent immunity; Humeral and cell mediated immunity; Primary and secondary lymphoid organ; Antigen; B and T cells and Macrophages; Major histocompatibility complex (MHC); Antigen processing and presentation; Synthesis of antibody and secretion; Molecular basis of antibody diversity; Polyclonal and monoclonal antibody; Complement; Antigen-antibody reaction; Regulation of immune response; Immune tolerance; Hyper sensitivity; Autoimmunity; Graft versus host reaction.

**Bioinformatics:** Major bioinformatics resources (NCBI, EBI, ExPASy); Sequence and structure databases; Sequence analysis (bimolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategies; Comparative genomics; Understanding DNA microarrays and protein arrays); Molecular modelling and simulations (basic concepts including concept of force fields).

## SECTION C- STREAM SPECIFIC SYLLABUS

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### Chemical Engineering (CH 8)

(50 Marks)

#### Chemical Engineering

**Process Calculations and Thermodynamics:** Laws of conservation of mass and energy; use of tie components; recycle, bypass and purge calculations; degree of freedom analysis. First and Second laws of thermodynamics. First law application to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: equation of state and departure function, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibria.

**Fluid Mechanics and Mechanical Operations:** Fluid statics, Newtonian and non-Newtonian fluids, Bernoulli equation, Macroscopic friction factors, energy balance, dimensional analysis, shell balances, flow through pipeline systems, flow meters, pumps and compressors, packed and fluidized beds, elementary boundary layer theory, size reduction and size separation; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, mixing and agitation; conveying of solids.

**Heat Transfer:** Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, boiling, condensation and evaporation; types of heat exchangers and evaporators and their design.

**Mass Transfer:** Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stagewise and continuous contacting and stage efficiencies; HTU & NTU concepts design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption.

**Chemical Reaction Engineering:** Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; residence time distribution, single parameter model; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis.

**Instrumentation and Process Control:** Measurement of process variables; sensors, transducers and their dynamics, transfer functions and dynamic responses of simple systems, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response and controller tuning, cascade, feed forward control.

**Plant Design and Economics:** Process design and sizing of chemical engineering equipment such as compressors, heat exchangers, multistage contactors; principles of process economics and cost estimation including total annualized cost, cost indexes, rate of return, payback period, discounted cash flow, optimization in design.

**Chemical Technology:** Inorganic chemical industries; sulfuric acid, NaOH, fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries; polyethylene, polypropylene, PVC and polyester synthetic fibers.