

# **PGET-2009**

(Post Graduate Engineering Common Entrance Test)  
(Conducted on behalf of APSCHE)

**2009-2010 Academic Year**

## **INFORMATION BOOKLET**



**UNIVERSITY COLLEGE OF ENGINEERING**

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# PGECET-2009

## Post-Graduate Engineering Common Entrance Test

Post Graduate Engineering Common Entrance Test (PGECET) is a AP State Level Common Entrance Test for admission into Regular PG Courses in Engineering, Technology, Architecture, Pharmacy and Planning (ME / M.Tech./M.Pharmacy / M.Arch / M. Tech. / M. Plg. courses for the academic year 2009-2010 conducted by University College of Engineering, Osmania University on behalf of A.P. State Council of Higher Education (APSCHE), a statutory Body of the Government of A.P., Hyderabad.

### *Objectives :*

Identify at the state level, meritorious and motivated candidates for admission to Post Graduate programmes in Engineering, Technology, Architecture, Pharmacy and Planning.

Serve as bench mark for normalization of the Under Graduate Engineering education in the state.

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## **GENERAL INFORMATION**

Post Graduate Engineering Common Entrance Test (PGECET) is administered and conducted in three zones across the state on behalf of the Andhra Pradesh State Council of Higher Education, a statutory Body of the Government of A.P., Hyderabad. The zones and corresponding examination centres are:

**Zone1 : Hyderabad**

1. JNTU College of Engineering, Kukatpally, Hyderabad
2. University College of Engineering (A), Osmania University, Hyderabad-500007

**Zone2 : Visakhapatnam**

1. Andhra University College of Engineering, Visakhapatnam

**Zone3 : Tirupati**

1. Sri Venkateswara University College of Engineering, Tirupati

The overall co-ordination and responsibility lies with A.P. State Council of Higher Education, Hyderabad. The Common Entrance Test will be conducted by the Convener, PGECET-2009 Osmania University, Hyderabad.

The A.P. State Council of Higher Education, Hyderabad will be issuing a separate notification for admission as per the admission policy for PG professional courses.

Preference will be given to GATE qualified candidates in admissions to various PG professional programmes in the Institutions / Colleges of the State of Andhra Pradesh and only after exhausting GATE qualified candidates, the remaining vacant seats to be filled with those candidates who have secured ranks in the PGECET-2009 as per Merit Order\*

All PG programmes of Part Time / SSS / Sponsored courses shall not come under the purview of this test (PGECET-2009).

However, sponsored seats in all specializations of regular PG programmes come under the purview of admissions based on GATE Score and PGECET-2009 Entrance Test.

**\* - Out of 25 seats available in the units of JNTU and Constituent colleges, 18 seats are filled by GATE scorers and 7 Seats are allocated for sponsored candidates.**

## DETAILS OF THE COURSES AND ELIGIBILITY CRITERIA

All Full-Time PG programmes are categorized as follows based on the specializations and the eligibility criteria:

**I. Conventional Courses** offering M.Tech. / M.E. programmes with various specializations in **Category - I**

**II.** M.Tech. Programmes for the specializations offered in **Category-II**

**III.** M.Tech. Programmes for the specializations offered in **Category-III**

1. Candidates will be required to appear for Test for each programme applied and Test is of 2 hours duration with 120 multiple choice questions, carrying one mark for each question. The cut-off mark in the Common Entrance Test shall be 25% for others and No Minimum Marks for SC & ST candidates.
2. The examination will be held from 9.00 am to 11.00 am and 2.00pm to 4.00 pm as per the Time Table given in this booklet.
3. The Question Papers will be in English only and Objective Type pattern will be used.
4. Before applying for PGE CET-2009 candidate must assure themselves that they have chosen the right paper, which qualifies them to become eligible to seek admission to the specific programme they are interested in. **The choice of the paper is based on the eligibility criteria.**
5. For the information regarding Post Graduate Programmes in various institutes in the state of Andhra Pradesh, the candidates are required to contact the Convener, PGE CET-2009 or can access through AICTE Website.
6. PGE CET-2009 is held at three different cities in the state. Hyderabad, Visakhapatnam, Tirupathi.
7. The Registration for PGE CET-2009 can also be done through **on-line** at the following websites: [www.osmania.ac.in](http://www.osmania.ac.in), [www.pgecet2009.net](http://www.pgecet2009.net) The candidates can also apply / register for PGE CET-2009 using **on-line** facility. However, candidates need to send the copy of the completed online application form along with duly attested photograph in the prescribed space, D. D. and copies of certificates within the stipulated time specified.
8. The application fee for PGE CET-2009 shall be Rs. 500/- (Rupees Five hundred only) for others and Rs. 250/- (Rupees Two hundred and fifty only) for SC / ST candidates. The fee can be paid in the form of Demand Draft drawn on any Nationalized Bank in favour of The Secretary, APS CHE payable at Hyderabad. **The application fee is not refundable.** Applications are available at the following places and can be obtained by paying Rs. 500/- for others (and Rs. 250/- for SC/ST), through D.D. drawn on any Nationalized Bank in favour of Secretary, APS CHE payable at Hyderabad **on or before 30th April 2009. However application can also be sent (a) with a late fee of Rs. 500/- up to 7th May 2009 (b) with a late fee of Rs. 2500/- upto 14th May 2009.**
  - i.) IDC, Behind University College of Engineering Library; UCOE (A) Campus Osmania University, Hyderabad.
  - ii.) Office of the Director, Admissions, JNTU, Kukatpally, Hyderabad.
  - iii.) Office of the Principal, AU College of Engineering, Visakhapatnam
  - iv.) Office of the Principal, SV University College of Engineering, Tirupathi
  - v.) Office of the Director, PG Admissions, Kakatiya University, Warangal
  - vi.) Office of the Principal, Siddartha Engineering College, Vijayawada.
9. The DD should be taken not earlier than the date of notification and not later than the last date for on-line submission of application.
10. In case of candidates sending application through Online The DD should be sent by Post / Courier

to the following address by quoting the candidate's Registration Number and Application Number on the reverse of the DD :

**Prof. Rameshwar Rao**  
**Convener, PGECET-2009**  
Dept. of ECE,  
University College of Engineering(A),  
Osmania University, Hyderabad - 500007

11. The candidates are required to download the Hall Ticket from the website by entering the Application Number and Registration Number. However, the Hall Tickets will be available on the website for on-line access, only on the receipt of the Demand Drafts Incase of application registered through Online.
12. The candidate may appear for more than one test for seeking admission into various courses as per the provisional eligibility criteria. However, for each test, a candidate has to register separately.
13. Candidates can appear in the examination only against the Hall Tickets. If they have not received the Hall Tickets, they should contact the Convener, PGECET 2009 at least two days prior to the test.
14. For Information, announcements, on-line registration and results, visit the PGECET-2009 websites [www.osmania.ac.in](http://www.osmania.ac.in), [www.pgecet2009.net](http://www.pgecet2009.net).
15. Separate Notification will be issued for admission based on GATE Score.
16. A.P. State policy on reservation shall be followed in PG admissions excluding seats available for Sponsored category of seats, from time to time.

**17. For sponsored candidates:**

- a) The number of Sponsored candidates shall not be more than five in each specialization as per AICTE Norms or as prescribed by concerned University.
- b) Admission shall be made into sponsored category only with the candidates who are either GATE / PGECET-2009 qualified or as decided by admission committee.
- c) His/Her application shall be duly recommended by the sponsoring agency for admission to the course and forwarded to the Convener, PGECET -2009, Osmania University, Hyderabad - 500 007.
- d) He/She must be permanent employee with the sponsoring agency for atleast two years as on 30th June, 2009, after obtaining the qualifying degree.
- e) The sponsoring agency must be a Government establishment or a public-sector undertaking, or a reputed private undertaking.
- f) The sponsoring agency shall-certify that the candidates will be granted leave for pursuing the M.E./M. Tech. /M.Pharm /M.Arch. / M. Plan Regular course of study.
- g) The candidates who are working in Research Projects approved by the competent authority are also required to fulfill the above conditions before they are sponsored for admission.

## Mode of PGECET-2009 Entrance Test

- \* PGECET-2009 examinations consists of **each paper of 2 hours duration and carries a maximum of 120 marks.**
- \* **All the question papers of PGECET-2009 will be fully objective type.**
- \* Candidates have to mark the correct answer by **darkening** the appropriate **bubble** against each question on an **Optical Mark Reader (OMR) with HB Pencil only.**
- \* OMR Answer Sheets will be supplied along with the Question Booklet.

### Schedule of the PGECET 2009 Examinations (Tentative) :

Date	9:00 to 11:00 A.M.	2:00 to 4:00 P.M.
26-05-2009 <b>Tuesday</b>	Computer Science and Engg.	ECE/Bio-Technology
27-05-2009 <b>Wednesday</b>	Civil/Mech./EEE/Chemical/ Pharmacy	Bio-Medical Engg./ Marine Engg. and Mech. Handling.
28-05-2009 <b>Thursday</b>	Remote Sensing/Industrial Metallurgy	Geo-Engg/E&I
29-05-2009 <b>Friday</b>	Digital Systems & Computer Electronics/Embedded System	Energy Systems/ Planning (MURP of JNTU)
30-05-2009 <b>Saturday</b>	Nano-Technology	Control Engg. & Instrumentation
31-05-2009 <b>Sunday</b>	Software & IT	Architecture/Spatial Information Tech./Geo-Informatics and Surveying
01-06-2009 <b>Monday</b>	Water & Environment Tech./IPI	Environmental Management/ Planning (A.U)
02-06-2009 <b>Tuesday</b>	Industrial Engg.	

## ANNEXURE - A

### I. Conventional Courses offering M.Tech. / M.E. programmes with various specializations Category-I

**Table 1.1 Eligibility Criteria**

S. No	Name of the Discipline	Courses	Eligibility** (PGECET Paper Code)
1	<b>M.Tech. (Civil Engg.)</b>	Transportation Engg. Structural Engg. Geo-Environmental Engg. Computer Aided Structural Engg. Water Resources Engg. Soil Mechanics & Foundation Engg. Structural Systems & Design (Structural Engg.) Geotechnical Engineering Hydromechanics & Water Management Environmental Engineering* Hydraulics coastal & Harbour Engg. Environmental Engg. & Management* Structural Engineering and Natural Disaster Management Construction Technology and Project Management	B.E./B.Tech./AMIE in Civil Engg./Construction Engg (or) equivalent  (CE)
2	<b>M.Tech. (Electrical &amp; Electronics Engg.)</b>	Electrical Power Systems Power & Industrial Drives Electrical Power Engg. Power Electronics Advanced Power Systems Electrical Power Systems High Voltage Power Systems (High Voltage) Power Electronics and Electric Drives Power System Control & Automation Power Electronics & Drives Industrial Drives & Control Power Systems Power Systems & Power Electronics Power Electronic Systems Power Systems and Operation control Computer aided Power Systems Power Systems Engg. Power Systems and Automation Control Systems	B.E./B.Tech./AMIE in Electrical Engg. (or) Equivalent  (EE)

\* Except Institute of Science & Technology JNTU

\*\*Qualifying Degrees shown in Eligibility column are only indicative. Candidate with Non-Engineering Degrees and different specializations are required to approach respective colleges or PGECET-2009 for further details

S. No	Name of the Discipline	Courses	Eligibility** (PGECET Paper Code)
3.	<b>M.Tech. (Mechanical Engg.)</b>	Refrigeration & Air Conditioning	B.E./B.Tech./AMIE in mechanical Engg. Automobile Engg. Mechanical Engg. (Mechatronics), Mechanical Engg. (Production Engg.) Aeronautical Engineering Industrial Engg. Production Engineering Industrial and Production Engineering Marine Engineering (or) equivalent  <b>(ME)</b>
		Advanced Manufacturing System	
		Thermal Engg.	
		CAD/CAM	
		Machine Design	
		Industrial Engg. & Mngt.	
		Design for Manufacturing	
		Design and Manufacturing	
		Production Engineering	
		Turbo-Machinery	
		Automation and Robotics	
		Advanced Design and Manufacturing	
		Industrial Engineering (SVU only)	
		Thermal Sciences & Energy Systems	
Computer Integrated Manufacturing			
Heat Transfer in Energy Systems			
4.	<b>M.Tech (Electronics &amp; Communication Engg.)</b>	Digital Electronics & Commun. Systems & Signal Processing	B.E./B.Tech/AMIE in ECE AMIE (Electronics and Telecommunication Engg.) /AMIETE and Electronics & Telematics Engg. (or) Equivalent  <b>(EC)</b>
		Computers & Communications	
		VLSI System Design	
		Digital Electronics & Communication Systems	
		Digital Systems	
		Microwave & Radar Engineering	
		Communications Engineering / Systems	
		Embedded Systems and VLSI Design. DS	
		Electronics Instrumentation and Communication Systems	
		Communications and Signal Processing	
		Communication & Radar Systems	
		Microwave Engg. VLSI Design	
		5.	
Computer Science & Engg.			
Comp. Science Engg.			
Computer Science & Technology (ST)			
Computer Networks			
Artificial Intelligence and Robotics			
Computer Networks and Informatics Security			
Bio-Informatics			

\*\*Qualifying Degrees shown in Eligibility column are only indicative. Candidate with Non-Engineering Degrees and different specializations are required to approach respective colleges or PGECET-2009 for further details



S. No	Name of the Discipline	Courses	Eligibility** (PGECET Paper Code)
6.	<b>M.Tech. (Bio-Technology)</b>	Bio-Technology (JNTU and its affiliated colleges)	B.E./B.Tech. / AMIE: Chemical Engg. / Bio- Technology/ Biochemical Engg. / Bio-informatics / Env. Sciences / Agricultural Engg. or M.Sc. in in Chemistry/Biochemistry <b>(BT)</b> / Micro Biology/Biotechnology / Life Sciences /BV.Sc/M.B.B.S/ B.D.S/B.Pharmacy/Food Technology
		Industrial Bio-Technology *** (SPMVV)	
		Bio-Technology & allied courses (AU,OU, SVU & SPMVV)	
7.	<b>M.E. (Biomedical Engg.)</b>	Bio-Medical Electronics	B.E./B.Tech./AMIE in Biomedical Engineering or ECE or EEE,or EIE or equivalent B.E. / B.Tech. / B.Pharm of AU or its equivalent AMIE & AMIETE <b>(BM)</b>
		Bio-Medical Engineering ***	
8.	<b>M.Tech. (Chemical Engg.)</b>	Chemical Engineering ***	B.E. / B.Tech./AMIE in Chemical Engg. B.E. / B.Tech. Chemical Engineering / AMICHE, AMIE (CHEM) (or) Equivalent <b>(CH)</b>
		CAD in Chemical Engineering	
		Industrial Pollution Control Engineering	
		Mineral Process Engineering	
9.	<b>M. Pharmacy</b>	Pharmaceutics	B. Pharmacy <b>(PY)</b>
		Pharmacology	
		Pharmaceutical Chemistry	
		Pharmaceutical analysis and Quality assurance	
		Pharmaceutical Bio-Technology	
		Pharmacology & Phytochemistry	

\*\*Qualifying Degrees shown in Eligibility column are only indicative. Candidate with Non-Engineering Degrees and different specializations are required to approach respective colleges or PGECET-2009 for further details.

\*\*\* M.Tech (Industrial Bio-Technology), M.E. (Bio-Medical Engineering) & M.Tech (Chemical Engineering) candidates with B.Tech (Industrial Bio-Technology) degree are also eligible at SPMVV.

II. M.Tech Programmes for the following Specializations offered in **Category - II**  
for Courses offered at AU and its affiliated Colleges

<b>S. No</b>	<b>Name of the Discipline</b>	<b>Courses</b>	<b>Eligibility** (PGECET Paper Code)</b>
<b>1.</b>	<b>M.Tech.</b>	Remote Sensing	B.E./B.Tech. in any of the following branches (a) Civil Engg. (b) Computer Sc.&System Engg., ECE, B.Sc. (Agriculture), M.Sc. (Tech.)/ M.Sc. degree in any of the following branches a) Geophysics, b) Meterology and Oceanography (or) Equivalent <b>(RS)</b>
<b>2.</b>	<b>M.Tech.</b>	Geo-Engineering	M.Sc. (Geo-physics) / B.E. / B.Tech in Civil Engineering <b>(GE)</b>
<b>3.</b>	<b>M.Tech.</b>	Industrial Engineering (AU only)	B.E./B.Tech. and AMIE <b>(IE)</b>
<b>4.</b>	<b>M.Tech.</b>	Electronics & Instrumentation	B.E./B.Tech in ECE, EEE, EIE, AMIE / AMIETE (or) Equivalent <b>(EI)</b>
<b>5.</b>	<b>M.Tech.</b>	Nano Technology (JNTU)	B.E. / B.Tech. any branch <b>(except Civil, Architecture and Geo-Engineering)</b> (or) M.Sc. (Physics/Chemistry/ Earth Science / Environmental Science & Tech.) (or) Equivalent <b>(NT)</b>
		Nano Technology (AU,OU & SVU)	B.E. / B.Tech. any branch <b>(except Civil, Architecture and Geo-Engineering)</b> <b>(NT)</b>
<b>6.</b>	<b>M.E.</b>	Marine Engineering and Mechanical Handling	B.E. / B.Tech / AMIE in Mechanical And Marine Engineering / IPE (or) Equivalent <b>(MM)</b>
<b>7.</b>	<b>M.Tech.</b>	Industrial Metallurgy	BE (Metallurgy) / BE (Mech) and BE (Marine) or its equivalent Diploma holder with AMIE (Mech. & Mett) and AMIIM qualified in GATE <b>(IM)</b>
<b>8.</b>	<b>M.Tech.</b>	Industrial Process Instrumentation	B.E./B.TECH (Inst. Tech., E&I) M.Sc (Tech.) / M.Sc. Applied Physics / M.Sc. Instrumentaiton or its equivalent except AMIE <b>(IN)</b>
<b>9.</b>	<b>M.Plan</b>	Planning	B.Arch / B.E./ B.Tech. in Civil Engineering. <b>(MP)</b>

\*\*Qualifying Degrees shown in Eligibility column are only indicative. Candidate with Non-Engineering Degrees and different specialzations are required to approach respective colleges or PGECET-2009 for further details

## ANNEXURE - B

### III. M.Tech Programmes for the following specialization offered in **Category - III**

S No	Name of the Discipline	Courses	Eligibility** (PGECET Paper Code)
1.	<b>M.Tech.</b>	Energy Systems	B.E./B.Tech / AMIE in MEC / EEE/Chem. Engg. (or) Equivalent <b>(ES)</b>
2	<b>M. Tech.</b>	Digital Systems & Computer Electronics	B.E./B.Tech./AMIE in ECE / EEE / CSE / Electronics & Computers Engg./ ETE / IT/CSIT/ Electronics & Control Engg./Instrumentation Engg./Instrumentation Technology / EIE / Electronics Engg., / Instrumentation & Control Engg., /Bio-Medical Engg./ AMIETE and Electronics and Telematics Engg.(or) Equivalent <b>(DS)</b>
		Embedded Systems	
3	<b>M.Tech.</b>	Information Technology	B.E./B.Tech./AMIE in CSE / CSIT / Electronics & Computers Engg./IT & Computer Science and Systems Engineering. (or) Equivalent <b>(ST)</b>
		Software Engineering	
4	<b>M. Tech.</b>	Environmental Management	B.E./B.Tech./AMIE in Civil / Mechanical / Chemical / ECE / EEE / Environmental Engg./ Geoinformatics Engg. / Metallurgy Engg. / Computer Science / Information Technology / CSIT / Agricultural Engg. / Industrial Engg. / Biomedical Engg./Bio-Tech /B.Pharmacy or M.Sc in Mathematics / Hydrology / Physics / Chemistry/ Geology /Geo Physics / Geography / Biological Sciences / Environmental Sciences & Technology / Agriculture / Atmospheric Sciences/ Bio- Technology <b>(EM)</b>
		Environmental Geomatics	
5	<b>M.Tech.</b>	Spatial Information Technology	B.E. / B.Tech. / AMIE : in any branch of Engg.Or Master' s Degree in Science <b>(SI)</b>
		Geo-informatics	
6	<b>M. Tech.</b>	Water and Environmental Technology	Graduate in Engineering or Post Graduate in Sciences <b>(WT)</b>
7.	<b>M.Arch.</b>	Architectural Conservation	B.Arch. / Associate of Indian Institute of Architecture <b>(AR)</b>
		Architecture in Interior Design	
8	<b>M.Tech.</b>	Planning (MURP, JNTU)	B.Arch./B.E./B.Tech./AMIE in Civil; Master' s Degree in Geography/Economics/Sociology <b>(PL)</b>
9	<b>M.Tech.</b>	Control Engineering	B.E./B.Tech./ AMIE in EEE/ECE / Electronics & Instrumentation Engg. / Electronics & Control Engg. / Electronics & Computers Engg. / Instrumentation Engg. / Instrumentation Technology / Electronics Engg./ Instrumentation & Control Engg./ Bio-Medical Engg./ Electronics & Telematics Engg. <b>(CI)</b>
		Instrumentation & Controls.	

\*\*Qualifying Degrees shown in Eligibility column are only indicative. Candidate with Non-Engineering Degrees and different specializations are required to approach respective colleges or PGECET-2009 for the details

# **INSTRUCTIONS FOR FILLING ONLINE APPLICATION FORM**

1. For Online submission of Application for PGECET - 2009, follow the guidelines given below.  
Candidates are advised to follow the complete instruction set about PGECET-2009, which is available for download.
2. Separate Application form along with DD for each Programme/Course to be sent.
3. The fee for PGECET - 2009 is Rs.500/- (Rs.250/- for SC/ST). The payment has to be made by Demand Draft on any Nationalised Bank drawn in favour of “**Secretary, APSCHE (Andhra Pradesh State Council for Higher Education), Hyderabad**”, payable at Hyderabad on or before 30-04-2009 However application could also be sent (a) upto 07-05-2009 with a late fee of Rs. 500/- (b) upto 14-05-2009 with a late fee of Rs. 2500/- payable by D.D. only.

***List of Nationalized Banks are given below:***

- 1) Allahabad Bank
- 2) Andhra Bank
- 3) Bank of Baroda
- 4) Bank of India
- 5) Bank of Maharashtra
- 6) Canara Bank
- 7) Central Bank of India
- 8) Corporation Bank
- 9) Dena Bank
- 10) Indian Bank
- 11) Indian Overseas Bank
- 12) Oriental Bank of Commerce
- 13) Punjab and Sind Bank
- 14) Punjab National Bank
- 15) State Bank of Bikaner & Jaipur
- 16) State Bank of Hyderabad
- 17) State Bank of India (SBI)
- 18) State Bank of Indore
- 19) State Bank of Mysore
- 20) State Bank of Patiala
- 21) State Bank of Saurashtra
- 22) State Bank of Travancore
- 23) Syndicate Bank
- 24) UCO Bank
- 25) Union Bank of India
- 26) United Bank of India
- 27) Vijaya Bank

4. Before filling the 'Online Application Form', you should purchase the Demand Draft and keep it ready for entering the Demand Draft particulars in the Online Application Form.
5. The following fields are mandatory in the Application Form.
  - a) Name
  - b) Father's Name
  - c) Date of Birth
  - d) Sex
  - e) Reservation Category
  - f) Local / Non Local Status
  - g) Programme in which Candidate is appearing for Test
  - h) Choice of Test Centre for Entrance Examination
  - i) Details of qualifying examination
  - j) Year of passing / appearing the qualifying examination
  - k) Percentage of Marks obtained in the qualifying examination
  - l) University / Institutes
  - m) Address for Communication with PIN Code
  - n) Demand Draft Number
  - o) Demand Draft Date
  - p) Issuing Bank
  - q) Amount
  - r) Reservation under Special Category (if applicable)
  - s) Minority Community (if applicable)
6. While applying online, do not use the 'Back' button on the tool bar of your browser. Use the links and buttons available on the page to move from one page to another. Further, when you have completed applying, close all the browser windows so that others cannot copy your personal details.
7. Once you submit the filled-in form, you will not be allowed to change the particulars. Therefore, fill in your application on-line carefully.
8. The system will generate a unique Application number and a Registration number for you. Note down these numbers without fail.
9. The Application number and the Registration number given online should be quoted for any further correspondence with the Convener, PGCET- 2009.
10. Your filled-in Application can be printed by entering the Application number and Registration number.
11. Print two copies of the filled-in Application form.
12. On one of the forms paste a Black & White photograph in the space provided and put the signature in the box meant for. Make sure the following are attached to the application form.
  - \* A DD for Rs.500/- (Rs.250/- for SC/ST) in favour of Secretary, APSCE.
  - \* A Passport size photograph with the candidate's signature and the Registration No. written on the backside placed in an envelope. .
  - \* Other necessary certificates (details available in item 5 above).
  - \* The application form should be submitted in person or by speed post/registered post to "The Convener , PGCET -2009 University College of Engineering, Osmania University Campus, Hyderabad - 500007".
13. The Second copy of the Application form may be retained with the candidate for record purpose.

## PGECET will conduct the following 27 Entrance Tests

(NOTE : The Candidates should also satisfy necessary eligibility criteria as stipulated by various Universities to appear for the test.)

Paper	Code	Paper	Code
Civil Engg.	CE	Bio-Technology	BT
Chemical Engg.	CH	Bio-Medical Engineering	BM
Computer Science & Engg.	CS	Remote Sensing	RS
Electronics & Communication Engg.	EC	Geo-Engineering	GE
Electrical Engg.	EE	Industrial Engineering	IE
Electronics & Instrumentation	EI	Energy Systems	ES
Mechanical Engg.	ME	Digital Systems & Computer Electronics / Embedded System	DS
Industrial Metallurgy	IM	Nano Technology	NT
Pharmacy	PY	Software & IT	ST
Spatial Information Technology	SI	Environmental Management	EM
Architecture	AR	Water & Environmental Technology	WT
Control Engineering & Instrumentation	CI	Planning (MURP, JNTU)	PL
Industrial Process Instrumentation	IN	Marine Engineering and Mechanical Handling	MM
M. Planning	MP		

Codes for Name of Discipline (Specialization)			
Bio Medical Engineering	-	BM	M.Sc. Physics & Allied Fields - PH
Bio Technology	-	BT	M.Sc. Chemistry & Allied Fields - CM
Civil Engineering	-	CE	M.Sc. Maths & Allied Fields - MA
Chemical Engineering	-	CH	M.Sc. Life Sciences & Allied Fields - XL
Computer Science & Engg.	-	CS	M.Sc. Geology & Geo Physics - GG
Electronics & Comm. Engg.	-	EC	Electronics & Instrumentation Engg. - EI
Electronics & Elec. Engg.	-	EE	Instrumentation Engg. - IN
Mechanical Engineering	-	ME	Information Technology - RH
Architecture	-	AR	Others - SI

# PGECET-2009 Syllabi for Conventional Courses

(CIVIL, CHEMICAL, CSE & IT, ECE, EEE, MECHANICAL, Bio-Tech., BME & Pharmacy)

## Category-I

### 1. CE - CIVIL ENGINEERING

#### *ENGINEERING MATHEMATICS,*

**Linear Algebra:** Matrix algebra, Systems of linear equations, Eigen values and eigenvectors.

**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, Stokes, Gauss and Green' s theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy' s and Euler' s equations, Initial and boundary value problems, Laplace-transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

**Complex variables:** Analytic functions, Cauchy' s integral theorem, Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations Integration by trap ezoidal and Simpson' s rule, single and multi-step methods for differential equations.

#### *STRUCTURAL ENGINEERING*

**Mechanics:** Bending moment and shear force in statically determinate beam. 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 mem bers subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of prestressed concrete, analysis of beam sections at transfer and service loads.

**Steel Structures:** Analysis and design of tension and compression members, beams and beamcolumns, 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 and seepage, effective stress principle, consolidation, compaction, shear strength.

**Foundation Engineering:** Sub-surface investigations- scope, drilling bore holes, sampling, penetration test 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 and clays. Deep foundations - pile types, dynamic and static formulae, load capacity of piles in sands and 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.

**Hydrology:** Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

**Irrigation:** Duty, delta, estimation of evapo-transpiration. Crop water requirements. Design of: lined and unlined-canals, waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

## ***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.

**Air Pollution:** Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

**Municipal Solid Wastes:** Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/recycle, energy recovery, treatment and disposal).

**Noise Pollution:** Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

## ***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.

## **2. EE - ELECTRICAL ENGINEERING**

### ***ENGINEERING MATHEMATICS***

**Linear Algebra:** Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

**Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

**Complex variables:** Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent' series, Residue theorem, solution integrals.

**Probability and Statistics:** Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

**Numerical Methods:** Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

**Transform Theory:** Fourier transform, Laplace transform, Z-transform.



## ***ELECTRICAL ENGINEERING***

**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 Nyquist 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.

### 3. ME - MECHANICAL ENGINEERING

#### ***ENGINEERING MATHEMATICS***

**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, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations. and Laplace equation.

**Complex variables:** Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

#### ***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.

**Joining:** Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

**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 nontraditional 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.

**Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

**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*.

## **4. EC - ELECTRONICS AND COMMUNICATION ENGINEERING**

### **ENGINEERING MATHEMATICS**

**Linear Algebra:** Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

**Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

**Complex variables:** Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, Residue theorem, solution integrals.

**Probability and Statistics:** Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

**Numerical Methods:** Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

**Transform Theory:** Fourier transform, Laplace transform, Z-transform.

## ***ELECTRONICS AND COMMUNICATION ENGINEERING***

**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 twintub 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 waveshaping circuits, 555 Timers. Power supplies.

**Digital circuits:** Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinational circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. 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; 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.

## 5. CS - COMPUTER SCIENCE AND ENGINEERING

### *ENGINEERING MATHEMATICS*

**Mathematical Logic:** Propositional Logic; First Order Logic.

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

**Set Theory & Algebra:** Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.

**Combinatorics:** Permutations; Combinations; Counting; Summation; generating functions; recurrence relations; asymptotics.

**Graph Theory:** Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

**Linear Algebra:** Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

**Numerical Methods:** LU decomposition for Systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules.

**Calculus:** Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.

### *COMPUTER SCIENCE AND ENGINEERING*

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

**Digital Logic:** Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic, (fixed and floating point).

**Computer Organization and Architecture:** Machine instructions and addressing modes, ALU and datapath, 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.

**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, Band B+ trees), Transactions and concurrency control.

**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.

## **6. BT - BIO- TECHNOLOGY**

### **Part -I**

#### **Unit-I**

History of Microbiology, Classification of protists, Morphological, Structural and Biochemical characteristics of prokaryotes and Eukaryotes, Growth characteristics of microbes. Methods of microbiology including pure culture techniques and microscopy, industrially important micro organisms and important fermentation products. Media formulation principles of microbial nutrition, construction of culture media.

#### **Unit -II**

Isolation, improvement and preservation of industrial micro-organisms.

Microbial Genetics: Transformation, Transduction and Conjugation, Structure and Classification of viruses, replication of viruses including bacteriophages and animal viruses.

#### **Unit-III**

Structure of DNA and arrangement of genes on chromosomes, DNA synthesis and replication, RNAsyntheses and processing, Different classes of RNA and their functions, Riboxymes, Protein expression in prokaryotes and Pukarytes. Plasmids, Transposable elements, TV elements

#### **Unit-IV**

Structure of Bio- Molecules, Metabolsim of carbohydrates, lipids, proteins, amino acids and Nucleic acids, photosynthesis.

#### **Unit - V**

Enzymes, specificity, catalysis, kinetics, inhibition and allosteric enzymes, metabolic organization and regularization of metabolism, Signal transduction.

### **Part - II**

Thermodynamics

First law of thermodynamics: Internal energy, enthalpy, molar heat capacities, reversible and irreversible processes, Isothermal and adiabatic changes. Second law: entropy, free energy change and chemical reaction equilibria. Heat of reaction, Hess's law, heat of formation, combustion etc.

Chemical Reaction Kinemetics :

Rate of reactions: Molecularity, order and rate constants, Arrhenius equation, Energy of activation, catalysis design of Ideal Reactors for single reactions.

Mathematics:

Differential and Integral calculus including integration Ordinary and partial differential equations. Laplace transforms of elementary functions, solution to ordinary differential equation by transform methods. Solutions of a system of linear algebraic equations by matrix method eigen values, of a square matrix. Fourier and Taylor's series. Mean value theorem.

Fluid Mechanics:

Fluids vs solids, Fluids statics and applications, Mass and energy balances in fluid flow, bernoulli's equation, its corrections and applications including pump work. Newton's law of viscosity, flow curves for non-newtonian fluids.

Pressure drop due to skin friction by Rayleigh's method of dimensional analysis - significance of friction, factor and Reynold's number. Boundary layer theory and form friction pressue drop due to form friction. Flow past immersed bodies and drag coefficients. Pressure drop in flow through packed beds, Fluidization and pressure drop across fluidized beds. Flow machinery and control.

Heat transfer Modes of heat transfer and examples, Fourier's law of heat conduction and analogy with momentum transfer, heat transfer through a cylindrical pipe wall.

Convection and concept of heat transfer coefficient, application of dimensional analysis to heat transfer from pipe to a flowing fluid. Thermal boundary layer and Prandtl number. Overall heat transfer coefficient.

Correlations for heat transfer coefficients in natural and forced convection, significance of dimensionless numbers, Overview of heat exchangers and concept of LMTD. Overview of other heat transfer operations, viz. boiling and condensation and evaporation. Overview of radiation, combined heat transfer by conduction-convection and radiation.

Diffusion and Mass transfer Fick's law of diffusion, analogy with momentum and energy transport, diffusivities of gases and liquids, fundamentals of mass transfer coefficient, dimensionless numbers and significance, correlation for mass transfer, overview of separation operations, equipment for mass transfer operations, Equilibrium stage operations.

Mechanical unit operations:

Principles of the following operations for size reduction and size separation, crushing, grinding, filtration, centrifugation.

## **7. BM Bio-Medical Engineering**

### ***ENGINEERING MATHEMATICS:***

Differential and integral calculus. Partial and total differentials. Composite functions. Systems of linear equations. Matrices and determinants, rank, Cramer's rule. Differential equations. Homogeneous and non homogeneous. Power series. Theory of complex variables, Cauchy-Reimann equations. Cauchy's residue theorem. Singular points, evaluation of residues. Probability: Conditional probability, mean, median, mode and standard deviation; random variables; Uniform, Normal, Exponential, Poisson and Binomial distributions.

### ***BIOMEDICAL ENGINEERING***

Bioelectricity: Resting Potential. Action Potential. Nernst Equation. Propagation in myelinated and unmyelinated nerve fibres. Origin of biopotential signals like ECG, EEG, EMG and EOG. Biopotential electrodes.

Medical Instrumentation and Equipment: General characteristics of medical instruments. Analytical Instrumentation. ECG, EEG, EMG, Cardiac Pacemaker, Defibrillator, X-ray machine, Hemodialyser, Ventilator, Heart-lung Machine, and Surgical diathermy.

Biomechanics and Biomaterials: Mechanical properties of bone and soft tissues. Viscoelasticity. Analysis of forces in skeletal joints. Mechanics of blood flow in the cardiovascular system. Biocompatibility. Characteristics of an ideal biomaterial. Metals, polymers and ceramics. .

Biomedical signal processing and Imaging : QRS detection methods. Rhythm analysis. ECG pattern recognition. ECG data compression algorithms. Detection of resting rhythms. Ultrasound, CT, MRI, PET. Techniques of Image enhancement and reconstruction.

Biological Control Systems: General features of biological control systems. Regulation of body temperature, blood pressure, and heart rate.

### ***ELECTRONIC ENGINEERING***

Electronic devices and circuits: p-n junction, BJT, MOSFET characteristics, basic amplifier configurations, biasing of BJT and JFET, difference amplifier, R-C coupled amplifier, frequency response, feedback in amplifiers, power amplifiers, power rectification.

Pulse and digital circuits: Linear and non linear wave shaping, sweep circuits, Multivibrators, logic gates Boolean algebra, arithmetic circuits, TTL, MOS, CMOS, flip-flops, counters, shift registers, 8-bit microprocessor architecture, programming and interfacing.

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

## ***ELECTRICAL ENGINEERING***

Topological description of a network, KVL, KCL, Mesh and nodal analysis. First and second order circuits, RL, RC and RLC circuits. forced and natural response of a network to step, impulse and sinusoidal inputs, Transient and steady state response. Laplace-transform method of solution. Network theorems. Implications of Linearity, Signal analysis, Two port networks.

Electrical machines: Single phase transformer, three phase transformers, DC machines-types winding, generator characteristics, armature reaction and commutation. Starting and speed control of motors. Three phase and single phase induction motors -principles.

Control systems: Principles of feedback, transfer function, block diagrams, steady-state errors. Stability. Routh and Nyquist techniques.

## ***ELECTRONICS AND INSTRUMENTATION ENGINEERING***

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 multi-meters. Phase, time and frequency measurement. Q-meters; oscilloscopes, Potentiometric recorders. Transducers: Basic requirements, passive and active transducers. Operating principles of transducers for measurement of displacement, temperature, pressure and flow. Signal conditioning circuits. Applications.

## **8. CH - CHEMICAL ENGINEERING**

### ***ENGINEERING MATHEMATICS***

**Linear Algebra:** Matrix algebra, Systems of linear equations, Eigen values and eigenvectors.

**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, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

**Complex variables:** Analytic functions, Cauchy's integral theorem, Taylor and Laurent series, Residue theorem.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods :** Numerical solutions of linear and non-linear algebraic equations Integration by trap ezoidal and Simpson's rule, single and multi-step methods for differential equations.

### ***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 pipe-line 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.

## 9. PY - PHARMACY

**Pharmacognosy & Phytochemistry:** Chemistry of natural products, tests, isolation, purification & characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavonoids, Purines, lipids, proteins. Pharmacognosy of crude drugs and herbal products. Standardization of raw materials. Modern techniques used for evaluation.

**Pharmaceutical Chemistry:** Structure, nomenclature, classification, synthesis, SAR and metabolism of the following category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Introduction to drug design. Stereochemistry of drug molecules. Hypnotics and Sedatives, Analgesics, NSAIDS, Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anaesthetics, Cardio Vascular drugs - Antianginal agents Vasodilators, Adrenergic & Cholinergic drugs, Cardiotonic agents, Diuretics, Antihypertensive drugs, Hypoglycemic agents, Antilipemic agents, Coagulants, Anticoagulants, Antiplatelet agents. Chemotherapeutic agents - Antibiotics, Antibacterials, Sulphadiazine. Antiprotozoal drugs, Antiviral, Antitubercular, Antimalarial, Anticancer, Antiamoebic drugs. Diagnostic agents.

**Pharmaceutics:** Formulation, Development and Storage of different dosage forms and new drug delivery systems. Biopharmaceutics and Pharmacokinetics and their importance in Pharmaceutical calculations. Study of physical properties of drugs: Particle size and shape, pKa, solubility, partition coefficient, crystallinity, polymorphism and hygroscopicity. Study of chemical properties of drugs: Hydrolysis, oxidation, reduction, racemization, polymerization and their influence on formulation and stability of drug products.

**Pharmacology:** General pharmacological principles including Toxicology. Drug interaction and Pharmacology of drugs acting on Central nervous system, Cardiovascular system, Autonomic nervous system, Gastro intestinal system and Respiratory system. Pharmacology of Autocoids, chemotherapeutic agents including anticancer drugs, Bioassays, Immuno Pharmacology. Drugs acting on the blood & blood forming organs. Clinical Pharmacy Therapeutic Drug Monitoring Dosage regimen in Renal and hepatic impairment. Drug - Drug interactions and Drug - food interactions, Adverse Drug reactions. Medication History, interview and Patient counseling

**Pharmaceutical Analysis and quality assurance:** Concepts of qualitative and quantitative analysis, fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards; concept of error, precision, accuracy, specificity, sensitivity, detection limit, linearity and range. Ruggedness, standards, standardization, calibration of analytical equipments. Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible & IR). Fluorimetry, Flame photometry, Potentiometry, Conductometry and Plarography. Pharmacopoeial assays and chromatography methods. Quality assurance and quality control methods, concepts of GMP and GLP and forensic pharmacy.

**Pharmaceutical Biotechnology:** Isolation, classification and taxonomy of microorganisms. Pure culture techniques, theory and practice of sterilization, microbial growth phases and kinetics, microbial transformation of steroids. Fermentation technology- batch and continuous fermentation. General characteristics and manufacture of antibiotics, vaccines and hormones. Application and scope of recombinant DNA technology in manufacture of biological products such as insulin and human growth hormones. Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Metabolic pathways-glycolysis and TCA cycle and transport across cell membranes.

## ***Category - II***

### **1. RS - M. Tech Remote Sensing**

Continents .Earth composition. Earth - Orbit, Rotation, Time,  
Oceans - Depth, Bottom, Relief  
Meteorological parameters, wind, temperature and humidity  
Maps and their uses - scale on maps  
Geomorphology, agents of landforms, Wind and associated land forms  
Rocks, kinds of rocks, minerals & physical properties of mineral  
Principles of Remote sensing. History of Remote sensing. Remote sensing in India  
Light, heat and Electromagnetic energy  
History of aerial photography - types of photographs  
River basin - size, shape, physiography, slope, climate, drainage  
Study of rainfall, estimation of run-off and evapotranspiration  
Flora, fauna. Agriculture in India  
Environment - meaning, scope, components of environments  
Computer fundamentals (hardware and software)

### **2. GE - M.Tech Geo-Engineering**

Continents. Earth composition. Earth - Orbit, Rotation, Time,  
Oceans - Depth, Bottom, Relief  
Definition of rock  
Kinds of rocks, minerals & physical properties of mineral  
Introduction to Geophysical methods.  
Physical properties of rocks: Mineral composition, rock structure.  
Soils and Clay Minerals, soil strength, soil porosity and permeability  
Maps and their uses - scale on maps  
Geomorphology, agents of landforms, Wind and associated land forms  
Study of rainfall, estimation of run-off and evapotranspiration. Water table  
Watershed. Watershed characteristics - size, shape, physiography, slope, climate, drainage  
Dams and reservoirs, tunnels and air fields  
Environment - meaning, scope, components of environments

### **3. IE - INDUSTRIAL ENGINEERING**

#### ***ENGINEERING MATHEMATICS***

**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, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

**Complex variables:** Analytic functions, Cauchy's integral theorem', Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

## ***GENERAL ENGINEERING***

**Engineering Materials:** Structure and properties of engineering materials and their applications; effect of strain, strain rate and temperature on mechanical properties of metals and alloys; heat treatment of metals and alloys, its influence on mechanical properties.

**Applied Mechanics:** Engineering mechanics - equivalent force systems, free body concepts, equations of equilibrium; strength of materials - stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns.

**Theory of Machines and Design:** Analysis of planar mechanisms, cams and followers; governors and fly wheels; design of elements - failure theories; design of bolted, riveted and welded joints; design of shafts, keys, spur gears, belt drives, brakes and clutches.

**Thermal Engineering:** Fluid mechanics - fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum; thermodynamics - zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; basics of internal combustion engines and steam turbines; heat transfer - fundamentals of conduction, convection, and radiation, heat exchangers.

## ***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, electroslag, thimlit, 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 nontraditional 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, interchangeability, 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.

## **4. EI - ELECTRONICS & INSTRUMENTATION (for M.Tech. EI)**

### ***ENGINEERING MATHEMATICS :***

**Linear Algebra:** Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

**Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals Stokes, Gauss and Green's theorems.

**Differential equations:** First order equation (linear and nonlinear), Higher order linear differential equations

with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

**Complex variables:** Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, Residue theorem, solution integrals.

**Probability and Statistics:** Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

**Numerical Methods:** Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

**Transform Theory:** Fourier transform, Laplace transform, Z-transform.

## ***INSTRUMENTATION ENGINEERING***

**Basics of Circuits and Measurement Systems:** Kirchoff's laws, mesh and nodal Analysis. Circuit theorems. One-port and two-port Network Functions. Static and dynamic characteristics of Measurement Systems. Error and uncertainty analysis. Statistical analysis of data and curve fitting.

**Transducers, Mechanical Measurement and Industrial Instrumentation:** Resistive, Capacitive, Inductive and piezoelectric transducers and their signal conditioning. Measurement of displacement, velocity and acceleration (translational and rotational), force, torque, vibration and shock. Measurement of pressure, flow, temperature and liquid level. Measurement of pH, conductivity, viscosity and humidity.

**Analog Electronics:** Characteristics of diode, BJT, JFET and MOSFET. Diode circuits. Transistors at low and high frequencies, Amplifiers, single and multi-stage. Feedback amplifiers. Operational amplifiers, characteristics and circuit configurations. Instrumentation amplifier. Precision rectifier. V-to-I and I-to-V converters. Op-Amp based active filters. Oscillators and signal generators.

**Digital Electronics:** Combinational logic circuits, minimization of Boolean functions. IC families, TTL, MOS and CMOS. Arithmetic circuits. Comparators, Schmitt trigger, timers and mono-stable multi-vibrator. Sequential circuits, flip-flops, counters, shift registers. Multiplexer, S/H circuit. Analog-to-Digital and Digital-to-Analog converters. Basics of number system. Microprocessor applications, memory and input-output interfacing. Microcontrollers.

**Signals, Systems and Communications:** Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first- and second order systems. Convolution, correlation and characteristics of linear time invariant systems. Discrete time system, impulse and frequency response. Pulse transfer function. IIR and FIR filters. Amplitude and frequency modulation and demodulation. Sampling theorem, pulse code modulation. Frequency and time division multiplexing. Amplitude shift keying, frequency shift keying and pulse shift keying for digital modulation.

**Electrical and Electronic Measurements:** Bridges and potentiometers, measurement of R,L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes. Extension of instrument ranges. Q-meter and waveform analyzer. Digital voltmeter and multi-meter. Time, phase and frequency measurements. Cathode ray oscilloscope. Serial and parallel communication. Shielding and grounding.

**Control Systems and Process Control:** Feedback principles. Signal flow graphs. Transient Response, steady-state-errors. Routh and Nyquist criteria. Bode plot, root loci. Time delay systems. Phase and gain margin. State space representation of systems. Mechanical, hydraulic and pneumatic system components. Synchro pair, servo and step motors. On-off, cascade, P, PI, P-I-D, feed forward and derivative controller, Fuzzy controllers.

**Analytical, Optical and Biomedical Instrumentation:** Mass spectrometry. UV, visible and IR spectrometry. X-ray and nuclear radiation measurements. Optical sources and detectors, LED, laser, Photo-diode, photo-resistor and their characteristics. Interferometers, applications in metrology. Basics of fiber optics. Biomedical instruments, EEG, ECG and EMG. Clinical measurements. Ultrasonic transducers and Ultrasonography. Principles of Computer Assisted Tomography.

## 5. NT - M.TECH (NANO-TECHNOLOGY)

### **ENGINEERING MECHANICS & STRENGTH OF MATERIAL**

Concurrent forces in a plane and its equilibrium. Centroids of composite plane figures. General case of forces in a plane. Moment of inertia of plane figures. Parallel axis theorem. Polar MI. Concept mass MI. Rectilinear translation. Kinematics. Principal of dynamics Motion of a particle under constant force. Force proportional to displacement and free vibrations (SHM). D' Albert's principle. Momentum. Impulse work and energy. Rotation of a rigid body about a fixed axis kinematics. Equation of motion of a rigid body about a fixed axis. Rotation under constant moment. Torsional vibration.

Simple stresses and strains. Stresses on inclined plane. 2-Dimensional stress systems. Principal stress and principal planes. Mohr's circle. Shearing force and bending moment. Types of loads. Types of Supports. SF and BM diagrams for formula. Bending stresses in the above types of beams with rectangular and circular sections. Torsion of circular shafts. Determination of shear stress.

#### **Text books :**

1. Engineering mechanics - S. Timoshenko (relevant sections only)
2. Elements of Strength of Materials - S. Timoshenko (relevant sections only)
3. Engineering Mechanics - S. Timoshenko (relevant sections only)
4. Elements of Strength of Materials - S. Timoshenko (relevant sections only)

### **FLUID MECHANICS AND HEAT TRANSFER**

Classification of flows - Steady, Unsteady, Uniform, Non-uniform, Laminar, Turbulent, Rotational, Irrotational flows, Vorticity, and circulation-Conservation of mass-Equation of continuity, Conservation of momentum-Euler's equation, Conservation of energy - Bernoulli's equation and its applications. One-dimensional Viscous flow. Couette flow-Plane Couette flow. Two dimensional Viscous Flow; Navier Stokes equations and solutions.

Laminar Boundary Layer. Momentum integral equation-Flow over a flat plate-Displacement thickness, Momentum thickness and energy thickness. Turbulent Boundary Layer. Laminar-Turbulent transition-momentum equations and Reynold's stresses. Dimensional Analysis and Modelling Similitude. Fundamental and derived dimensions - Dimensionless groups - Buckingham Theorem - Rayleigh method.

Elements of heat transmission. steady state conduction, convection and radiation. Furnaces. Classification of furnaces and their use in metallurgical industries. Heat utilization in furnaces, available heat, factors affecting it. Heat losses in furnaces and furnace efficiency. Heat balance and sankey diagrams. Principles of waste heat recovery. Recuperators and regenerators. Types and applicability. AMTD and LMTD in recuperators. Protective atmosphere and their applications Salt bath furnaces.

#### **Text Book**

1. *Fluid Mechanics*, A.K. Mohanty, Prentice Hall of India Pvt. Ltd.,
2. *Fuels, furnaces and refractories* by O.P. Gupta

#### *Reference:*

1. *Fluid Mechanics and Hydraulic Machines*, R.K. Bansal, Laxmi Publications.
2. *Foundations of Fluid Mechanics*, Yuan, Prentice Hall of India.
3. *Fluid Mechanics and its applications*, S.K. Gupta and A.K. Gupta, Tata McGraw Hill, New Delhi.

### **ELEMENTS OF MATERIALS SCIENCE**

Introduction, classification of materials, Space lattice and unit cells, crystal systems. Indices for planes and directions. Structures of common metallic materials.

Crystal defects: point, Line and surface defects. Dislocations, types, Burgers' Vector, Dislocation movement by climb and cross slip. Dislocation sources, Dislocation point - defect interaction and pileups.

Plastic deformation of single crystals. Deformation by slip, CRSS for slip. Deformation of single crystal. Deformation by twinning. Stacking faults,

Hot working, cold working. Recovery, recrystallization and grain growth. Hall-Petch equation. Tensile stress-strain diagrams, proof stress, yield stress, modulus of elasticity. Typical stress-strain diagrams for mild steel cast iron and aluminum alloy.

**TEXT BOOKS:**

1. *Material Science and Engineering* by V.Raghavan
2. *Physical Metallurgy* by S.H.Avner. ...

**REFERENCE BOOKS:**

1. *Material Science and Engineering* by L.H. Van Vleck, 5th edition, Addison Wealey( 1985)
2. *Structure and properties of Materials* by R.M.Rose, L.A.Shepard and J. Wulff, Vol. 1,4 John Willey (1966)
3. *Essentials of Material Science* by A.G.Guy, McGraw Hill( 1976).
4. *The Science and Engineering Materials* by D.R Askeland. 2nd Edition, Chapman and Hall (1990).

**METALLURGICAL THERMODYNAMICS**

Introduction - Basic concepts in thermodynamics. Objectives and limitations of classical thermodynamics. Zeroth law of thermodynamics

- \* First Law of Thermodynamics - Forms of Energy, Heat and Work, Joules Experiments, Conservation of Energy, Concept of Maximum Work, Isothermal Expansion, Reversible, Adiabatic Expansion, Constant Pressure Processes, Constant Volume Processes, Enthalpy.
- \* Second Law of Thermodynamics -Efficiency of cyclic process. Carnot cycle.
- \* Entropy. Thermodynamic equation of state. Statistical Entropy
- \* Physical Meaning of Entropy, Boltzman Equation, Mixing Entropy, Stirling's Approximation Auxiliary Functions
- \* Fundamental Equations of State, Maxwell Relationships, Other Thermodynamic Relations, Chemical Potential, Gibbs-Helmholtz Equation, Criteria of Equilibria.
- \* Third law of Thermodynamics
- \* Heat Capacity and Entropy Changes.
- \* Sensible Heats, Transformation Heats, Reaction Heats,  $\Delta C_p$ ,  $\Delta H=f(T)$ ,  $\Delta S=f(T)$ , Adiabatic Flame Temperatures, Heat Balances.
- \* Phase Equilibria in One Component Systems
- \* Clausius-Claperyon Equation, Heats of Vaporization From Vapor Pressure Data, Shift in Transformation
- \* Temperature with Pressure
- \* Fugacity, activity and equilibrium constant. Vant Hoff's isotherm. Ellingham diagrams and application.

**Text books:**

1. *Introduction to Metallurgical Thermodynamics*, David R. Gaskell.
2. *Problems in Thermodynamics & Kinetics*, GS. Upadhyaya and R.N.Dubey.

**Reference:**

1. *Chemical Metallurgy*, J.J.Moore
2. *Physical Chemistry of Metals*, L.S.Darken and G Gurry, Tata Mc-Graw hill.
3. *Metallurgical Thermodynamics*, ML Kapoor Part I & II
4. *Metallurgical Thermodynamics*, Tupkary

## ***ADVANCED MATERIAL SCIENCE***

Electrical and Electronic properties of materials, Electronic conductivity, free electron theory and band theory of solids. Intrinsic semi-conductors. Super conductivity. Magnetic properties, Dia, para, ferro, ferri magnetism. Soft and hard magnetic materials and applications. Optical properties of materials. Refractive index, absorption emission of light, optical fibers. Opto-electronic materials.

Polymerization, cross linking glass transition, classification of polymers. Mechanical properties, dielectric behaviour of materials. Uses of polymers. Ceramics and glasses, crystalline and non-crystalline ceramics. Structure of ceramics and glasses. Major mechanical and optical properties.

Composite materials. Classification. Matrices and reinforcements. Fabrication methods. Examples and applications. Nano Materials: Importance, Emergence of Nano- Technology, Bottom-Up and Top-down approaches, challenges in Nano- Technology. Applications.

### ***TEXT BOOKS:***

1. Material Science and Engineering by V.Raghavan
2. Physical Metallurgy by S.H.Avner.

### ***REFERENCE BOOKS:***

1. Material Science and Engineering by L.H. Van Vleck, 5th edition, Addison Wealey( 1985)
2. Structure and properties of Materials by R.M.Rose, L.A.Shepard and J. Wulff, Vol. 1,4 John Willey (1966)
3. Essentials of Material Science by A.GGuy, McGraw Hill( 1976).
4. The Science and Engineering Materials by D.R.Askeland. 2nd Edition, Chapman and Hall (1990).

## **6. MM . Marine Engineering and Mechanical Handling**

### ***ENGINEERING MATHEMATICS***

**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, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

**Complex variables:** Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

### ***APPLIED MECHANICS AND DESIGN***

**Engineering Machanics :** 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 :** Strees and strain, strees-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 coloumns; 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 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, 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 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 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.

Joining : Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

**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.

**Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning. 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.

## 7. IM. Industrial Metallurgy

### *ENGINEERING MATHEMATICS*

**Linear Algebra:** Matrices and Determinants, Systems of linear equations, Eigen values and Eigen vectors.

**Calculus:** Limit, continuity and differentiability; Partial Derivatives; Maxima and minima; Sequences and series; Test for convergence; Fourier series.

**Vector Calculus:** Gradient; Divergence and Curl; Line; surface and volume integrals; Stokes, Gauss and Green's theorems.

**Differential Equations:** Linear and non-linear first order ODEs; Higher order linear ODEs with constant coefficients; Cauchy's and Euler's equations; Laplace transforms; PDEs - Laplace, heat and wave equations.

**Probability and Statistics:** Mean, median, mode and standard deviation; Random variables; Poisson, normal and binomial distributions; Correlation and regression analysis.

**Numerical Methods:** Solutions of linear and non-linear algebraic equations; integration of trapezoidal and Simpson's rule; single and multi-step methods for differential equations.

### *METALLURGICAL ENGINEERING*

**Thermodynamics and Rate Processes:** Laws of thermodynamics, activity, equilibrium constant, applications to metallurgical systems, solutions, phase equilibria, Ellingham and phase stability diagrams, thermodynamics of surfaces, interfaces and defects, adsorption and segregation; basic kinetic laws, order of reactions, rate constants and rate limiting steps; principles of electro chemistry- single electrode potential, electrochemical cells and polarizations, aqueous corrosion and protection of metals, oxidation and high temperature corrosion - characterization and control; heat transfer - conduction, convection and heat transfer coefficient relations, radiation, mass transfer - diffusion and Fick's laws, mass transfer coefficients; momentum transfer - concepts of viscosity, shell balances, Bernoulli's equation, friction factors.

**Extractive Metallurgy:** Minerals of economic importance, comminution techniques, size classification, Flotation, gravity and other methods of mineral processing; agglomeration, pyrohydro- and electro-metallurgical processes; material and energy balances; principles and processes for the extraction of non-ferrous metals - aluminium, copper, zinc, lead, magnesium, nickel, titanium and other rare metals; iron and steel making - principles, role structure and properties of slags, metallurgical coke, blast furnace, direct reduction processes, primary and secondary steel making, ladle metallurgy operations including deoxidation, desulphurization, sulphide shape control, inert gas rinsing and vacuum reactors; secondary refining processes including AOD, VAD, VOD, VAR and ESR; ingot and continuous casting; stainless steel making, furnaces and refractories.

**Physical Metallurgy:** Crystal structure and bonding characteristics of metals, alloys, ceramics and polymers, structure of surfaces and interfaces, nano-crystalline and amorphous structures; solid solutions; solidification; phase transformation and binary phase diagrams; principles of heat treatment of steels, cast iron and aluminum alloys; surface treatments; recovery, recrystallization and grain growth; industrially important ferrous and non-ferrous alloys; elements of X-ray and electron diffraction; principles of scanning and transmission electron microscopy; industrial ceramics, polymers and composites; electronic basis. of thermal, optical, electrical and magnetic properties of materials; electronic and opto-electronic materials.

**Mechanical Metallurgy:** Elasticity, yield criteria and plasticity; defects in crystals; elements of dislocation theory - types of dislocations, slip and twinning, source and multiplication of dislocations, stress fields around dislocations, partial dislocations, dislocation interactions and reactions; strengthening mechanisms; tensile, fatigue and creep behaviour; super-plasticity; fracture - Griffith theory, basic concepts of linear elastic and elastoplastic fracture mechanics, ductile to brittle transition, fracture toughness; failure analysis; mechanical testing - tension, compression, torsion, hardness, impact, creep, fatigue, fracture toughness and formability.

**Manufacturing Processes:** Metal casting - patterns and moulds including mould design involving feeding, gating and risering, melting, casting practices in sand casting, permanent mould casting, investment casting and shell moulding, casting defects and repair; hot, warm and cold working of metals, Metal forming fundamentals of metal forming processes of rolling, forging, extrusion, wire drawing and sheet metal forming, defects in forming; Metal joining - soldering, brazing and welding, common welding processes of shielded metal arc welding, gas

metal arc welding, gas tungsten arc welding and submerged arc welding; welding metallurgy, problems associated with welding of steels and aluminium alloys, defects in welded joints; powder metallurgy; NDT using dye-penetrant, ultrasonic, radiography, eddy current, acoustic emission and magnetic particle methods.

## **8. IN - Industrial Process Instrumentation**

### ***ENGINEERING MATHEMATICS***

**Linear Algebra:** Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

**Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems. Differential equations: First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

**Complex variables:** Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent series, Residue theorem, solution integrals.

**Probability and Statistics:** Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

**Numerical Methods:** Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

**Transform Theory:** Fourier transform, Laplace transform, Z-transform.

### ***INSTRUMENTATION ENGINEERING***

Basics of Circuits and Measurement Systems: Kirchoff's laws, mesh and nodal Analysis.

Circuit theorems. One-port and two-port Network Functions. Static and dynamic characteristics of Measurement Systems. Error and uncertainty analysis. Statistical analysis of data and curve fitting.

**Transducers, Mechanical Measurement and Industrial Instrumentation:** Resistive, Capacitive, Inductive and piezoelectric transducers and their signal conditioning. Measurement of displacement, velocity and acceleration (translational and rotational), force, torque, vibration and shock. Measurement of pressure, flow, temperature and liquid level. Measurement of pH, conductivity, viscosity and humidity.

**Analog Electronics:** Characteristics of diode, BJT, JFET and MOSFET. Diode circuits. Transistors at low and high frequencies, Amplifiers, single and multi-stage. Feedback amplifiers. Operational amplifiers, characteristics and circuit configurations. Instrumentation amplifier. Precision rectifier. V-to-I and I-to-V converters. Op-Amp based active filters. Oscillators and signal generators.

**Digital Electronics:** Combinational logic circuits, minimization of Boolean functions. IC families, TTL, MOS and CMOS. Arithmetic circuits. Comparators, Schmitt trigger, timers and mono-stable multi-vibrator. Sequential circuits, flip-flops, counters, shift registers. Multiplexer, S/H circuit. Analog-to-Digital and Digital-to-Analog converters. Basics of number system. Microprocessor applications, memory and input-output interfacing. Microcontrollers.

**Signals, Systems and Communications:** Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first-and second order systems. Convolution, correlation and characteristics of linear time invariant systems. Discrete time system, impulse and frequency response. Pulse transfer function. IIR and FIR filters. Amplitude and frequency modulation and demodulation. Sampling theorem, pulse code modulation. Frequency and time division multiplexing. Amplitude shift keying, frequency shift keying and pulse shift keying for digital modulation.

**Electrical and Electronic Measurements:** Bridges and potentiometers, measurement of R,L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes. Extension of instrument ranges. Q-meter and waveform analyzer. Digital voltmeter and multi-meter. Time, phase and frequency measurements. Cathode ray oscilloscope: Serial and parallel communication. Shielding and grounding.

**Control Systems and Process Control:** Feedback principles. Signal flow graphs. Transient Response, steady-state-errors. Routh and Nyquist criteria. Bode plot, root loci. Time delay systems. Phase and gain margin. State space representation of systems. Mechanical, hydraulic and pneumatic system components. Synchro pair, servo and step motors. On-off, cascade, P, PI, P-I-D, feed forward and derivative controller, Fuzzy controllers.

**Analytical, Optical and Biomedical Instrumentation:** Mass spectrometry. UV, visible and IR spectrometry. X-ray and nuclear radiation measurements. Optical sources and detectors, LED, laser, Photo-diode, photo-resistor and their characteristics. Interferometers, applications in metrology. Basics Of fiber optics. Biomedical instruments, EEG, ECG and EMG. Clinical measurements. Ultrasonic transducers and Ultrasonography. Principles of Computer Assisted Tomography. Concept continuum, Macroscopic approach. Thermodynamic system, closed and open, Intensive and extensive properties thermodynamic equilibrium. State of system, state diagram path process. Zeroth law of Thermodynamic properties of pure substances in solid, liquid and vapour phases. P- V- T behaviour of simple compressible substances. Equations of state. Compressibilities and expansion coefficient. Thermodynamic property tables and charts. First law of Thermodynamics, Kelvin-planch and Clausius statements. Carnot theorem. Reversible and irreversible processes. Thermodynamic (absolute) temperature scale. Clasius inequality and the concept of entropy. Principle of increase of entropy. Availability and irreversibility. applications of second law. Power and Refrigeration cycles, Carnot, Rankine, Air standard Joule (Brayton) Otto, Diesel and Dual. Vapour Compression, Refrigeration. Relations between power, torque and speed of rotating electrical machines Kirchhoff's laws. Resistors, inductors, capacitors and cells in series and parallel, energy stores in inductors and capacitors. Alternating voltage and current, instantaneous, maximum, average and RMS values, phasor addition, lagging and leading, power in a.c.circuits, power factor, three-phase systems, star and delta connections power measurement in three-phase systems. Single-phase transformers: emf, equation, losses, efficiency, and regulation.

Three-phase induction motors, and slip-ring, slip power, torque slip characteristic. Starting methods, speed control.

Alternators synchronous impedance, voltage regulation. Utilization, Industrial applications of electric motors, selection of motors, motors for particular services. Utilization, Luminous, flux and intensity, laws of illumination. Electric lamps, street-lighting. Simple Tariff systems.

## **9. MP - M.Planning Same as PL-Planning (MURP, JNTU)**

### ***Category - III***

#### **1. ES Energy Systems**

##### ***Energy systems***

One-dimensional steady and unsteady state heat conduction: Electrical analog, dimensional analysis, forced convection over flat plates and inside tubes, free convection over vertical and horizontal plates, concepts of radiative heat transfer, Fick's Law of mass diffusions basic of convective mass transfer.

Concept continuum, Macroscopic approach. Thermodynamic system, closed and open, Intensive and extensive properties thermodynamic equilibrium. State of system, state diagram path process. Zeroth law of Thermodynamic properties of pure substances in solid, liquid and vapour phases. P-V-T behaviour of simple compressible substances. Equations of state. Compressibilities and expansion coefficient. thermodynamic property tables and charts.

First law of thermodynamics, Kelvin-planch and Clausius statements. Carnot theorem. Reversible and irreversible processes. Thermodynamic absolute) temperature scale. Clasius inequality and the concept of entropy. Principle of increase of entropy. Availability and irreversibility, application of second law.

Power and Refrigeration cycles, Carnot, Rankine, Air standard Joule (Brayton) Otto, Diesel and Dual. Vapour compression, Refrigeration.

Relations between power, torque and speed of rotating electrical machines Kirchhoff's laws. Resistors, inductors, capacitors and cells in series and parallel, energy stores in inductors and capacitors. Alternating voltage and current, instantaneous, maximum, average and RMS values, phasor addition, lagging and leading, power in a.c.circuits, power factor, three-phase systems, star and delta connection power measurement in three-phase systems.

Single-phase transformers: emf, equation, losses, efficiency, and regulation.

Three-phase induction motors, and slip-ring, slip power, torque slip characteristic. Starting method, speed control.

Alternators synchronous impedance, voltage regulation. Utilization, Industrial application of electric motors, selection of motors, motors for particular services. Utilization, Luminous, flux and intensity, laws of illumination. Electric lamps, street lighting. Simple Tariff systems.

## **2. DS - M.Tech.(Digital Systems & Computer Electronics / Embedded Systems)**

Semiconductor Devices: Characteristics, Applications, Amplifiers and Oscillator Circuits, Power Amplifiers and Tuned Amplifiers, Network Theorems, Noise, Fourier Transforms, Convolution, Laplace Transforms, Z-Transforms.

Boolean Algebra, Combinational Circuits, Sequential Circuits, Linear and non-linear Wave Shaping, Multi vibrators, Sweep Circuits, Linear and Digital ICs, A/D, D/A Converters. .

EM Theory - Maxwell's Equations, Uniform Plane Waves, Transmission Lines, wave guides, Modulation Theory - AM, FM, PM, Pulse Modulation, PCM, DM, ADM, ASK, PSK, FSK Schemes. Antennas characteristics and Types, Wave Propagation.

Computer Components, 8085, 8086 Microprocessors, Data Communication Networking, ISDN, Micro controllers.

Electronics measuring instruments, CROs, Time and Frequency Measurements, DVMs, Transducers, Measurement of Physical Parameters.

Control Systems: Transfer function of Linear Systems, Sensitivity function. Time Domain Analysis and Feed Back Control System, Root Locus Techniques.

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## **3. ST - M.TECH. (SOFTWARE & INFORMATION TECHNOLOGY)**

Discrete mathematics, Computer hardware and organization, 8086 microprocessor organization, programming in C, Object oriented concepts, Data Structures, Theory of computation, Operating Systems, assemblers, Compilers, Principles of Programming languages, design and analysis of algorithms, DBMS, Data Communication and Computer Networks, Computer Graphics, Artificial intelligence, Software Engineering.

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## **4. EM - M.Tech. (Environmental Management / Environmental Geo-Informatics)**

### ***PART - 1***

#### **A. Ecology & Environment**

1. Nature of ecosystems
2. Energy flow in ecosystems-energy fixation by Autotrophs -Energy beyond the producers
3. Biogeochemical cycles and ecosystems
4. Ecology of populations - population growth - age structure - equilibrium level
5. Dynamics of ecological communities.

Recommended Books: Concepts of Ecology, E. J. Kormondy, Prentice-Hall 1984

#### **B. Microbiology**

1. Major characteristics of microorganisms - bacteria - metabolism
2. Growth microorganisms - Fungi, molds and yeasts - algae - protozoa - Viruses.
3. Control of microorganisms - physical and chemical agents.
4. Microorganisms in aerobic & anaerobic biological waste treatment- major groups of microbes and their role.

5. Microorganisms, growth kinetics- bacterial growth curve, various phases of growth, growth rate and doubling time.

Recommended Books: Microbiology, M. I. Pelczar, E. C. S. Chan, McGraw - Hill, 1996

## **Part - II**

### **A. Environmental Chemistry**

1. Basic concepts and scope of environmental chemistry - Environmental Segments.
2. Atmosphere - Structure - Chemical and photo chemical reactions - and ozone chemistry - green house effect.
3. Hydrosphere - hydrologic cycle-chemistry of water and waste water.
4. Lithosphere - micro and macro nutrients - Wastes and pollution of soil, air and water.
5. Environmental technologies, Environmental effects of pollution - Health effects of pollution.

Recommended Books: Environmental Chemistry AK De, Willey Eastern Ltd. 1992

### **B. . Pollution Control Engineering.**

1. Solid, Liquid and Gaseous Wastes, Various Pollutants and their Harmful effects.
2. Waster quality, water purifcatrion systems.
3. Waste water characteristics, Primary / Secondary.treatment methods.
4. Air Pollution control methods.
5. Dispersion of pollutants and self-purification aspects.

### **Books**

1. Environmental Pollution and Control by C.S.Rao.
2. Environmental Engineering by GS. Birdie.

## **Part III :**

1. Origin and age of the earth, internal Constitution of the earth, Geological processes - Exegetic and endogenic, ligneous, metamorphic and sedimentary rocks, distinguishing features of these three types of rocks, basic principle of structural geology, geology of dams and reservoirs.
2. Geomorphic cycle, geomorphic agents, definition of weathering, types of weathering physical and chemical, definition of erosion and denudation, cycle of erosion, landforms created by geomorphic agents.
3. Map terminology: map reading, topographic map, conventional symbols, locating points, map projec-tions and classification of maps.
4. Aerial photogrametry: Definition, photo scale, classification of Ariel photographs, Air photo interpreta-tion key elements, photo grammetric terminology.
5. Remote Sensing: Electromagnetic energy, Electro magnetic spectrum, various satellites and sensors, latest advancements in satellite remote sensing, General knowledge on Indian remote sensing Programmes.

## **Suggested Reading**

1. A text book of Geology by P.K.Mukharjee
2. Text book of Geomorphology by Thombury
3. Principle of Remote Sensing by P.J.Curran
4. Elements of Photo grammeteries by K.K. Rampal

## *B. Elementary Mathematics, Statistics and Computer Science*

1. Elementary Mathematics: Solutions of simultaneous linear equations, quadratic equations, progressions, permutations and combinations, concepts of matrices and determinants.
2. Statistics: sample mean and variance, random variable, distributed and continuous distributions, mean and variance of distribution, correlation, coefficient, confidence intervals, goodness of fit, test, pairs of measurements, fitting straight lines.
3. Introduction to computers and programming: components of computers, characteristics of computer, modes of operation, type of computer algorithms, flowcharts, programming languages, operating systems, fundamentals of C, structure of C, variables and constants, arithmetic and logical expressions, standard output-input functions, conditional statements and looping in C, various types of functions.

Suggested -Reading:

1. Computer Programming with C by E. Balaguruswamy.
2. Elements of Statistics by Gupta.

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## **5. SI - M.TECH. (SPATIAL INFORMATION TECHNOLOGY & GEO INFORMATICS AND SURVEYING TECH.)**

### ***COMPUTER GRAPHICS AND PROGRAMMING COMPUTER GRAPHICS***

Representative uses of computer graphics, frame work of interactive graphics, input devices, 'raster graphics features, scan' converting lines, Incremental algorithm and mid point line algorithm for scan converting lines

#### ***INTRODUCTION to C***

Fundamentals, structure of C functions, variables, constants, data types and arithmetic expressions, standard input-output functions conditional statements.

#### ***PROGRAMMING IN 'C'***

Logical operations, programme looping operators, arrays. functions, :-structures, pointers, modular programming, user defined data types, input output from files libraries and generalized functions, recursion.

*Suggested Reading Material* .

1. Programming in C by Stephen G Koehan
2. Computer Graphics by Foley, Vandam, Fiener, Hughes

## ***II. CONVENTIONAL SURVEYING, REMOTE SENSING &PHOTOGRAMMATRY CONVENTIONAL SURVEYING AND MAPPING***

Surveying methods, Topographic Surveying, Theodolite application General features of Survey of India topographic sheets, . mapscale;- Introduction to Map projections, Introduction to cartography.

#### ***REMOTE:SENSING - PHYSICS AND SATELITES***

Physical principles of Remote Sensing, Source of Electro magnetic energy, Electro Magnetic Spectrum, General aspects of Indian-Space program

#### ***PHOTOGRAMMETRY***

Aerial Photo formats, Scale of aerial photograph, Relief displacement, Elements of Photogrammetry, stereoscopic products and applications.

*Suggested reading material*

Photogrammetry by Wolf. PR,

Remote Sensing by. Paul Curran

Cartography by Prof Ramesh G,

Surveying by Kanetkar

### **III. GEO-SCIENCES**

#### **GEOGRAPHY**

Landforms origin, classification and distribution, elements of weather and climate, heating of -atmosphere, temperature, atmospheric pressure, winds, humidity, evaporation and condensation, precipitation.

#### **SOILS**

Mechanical composition of soil-soil texture, soil structure irrigation methods, soil salinity and water quality. Soil conservation -Soil erosion, types of water erosion factors affecting soil erosion Control. wind erosion, factors influencing wind erosion control of wind erosion..

Suggested Reading material

1. Physical Geography by Tikka
2. Soil physics by MC Oswal
3. Geology by PK Mukharjee

### **IV. PROBABILITY AND STATISTICS**

#### **PROBABILITY**

Sample space and events, axioms of probability, finite Probability spaces, infinite sample, Spaces, conditional Probability, multiplication theorem for conditional probability, independence, independent or repeated trails binomial distribution: normal distribution.

#### **STATISTICS**

Sample mean and sample variance, random variable discrete and continuous distribution, Mean and variance of a distribution estimation of Parameters, confidence intervals, testing of hypothesis.

Suggested Reading Material

1. Probability and Statistics Schaum's Series

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### **6. WT. M. TECH. (WATER AND ENVIRONMENTAL TECHNOLOGY)**

#### **I. FUNDAMENTALS OF SURFACE HYDROLOGY:**

Hydrologic Cycle - Precipitation: Different types and forms of precipitation and their mechanism. Rain gauges, Evaporation and Transpiration: Concepts, measurements and factors affecting evaporation and transpiration. Infiltration - Concept, measurement and factors affecting infiltration, runoff, Definition and factors affecting runoff, stream gauging - computation of run off.

Suggested Reading Material:

1. Hydrology by H.M. Raghunath
2. A Text book of Hydrology by P. Jayarami Reddy

#### **II. FUNDAMENTALS OF GROUND WATER HYDROLOGY:**

Occurrence of ground water in consolidated and unconsolidated formations - Types of aquifers. Properties: Porosity, Specific Yield, Storativity, Hydraulic conductivity and transmissivity - Darcy's Law, Ground Water management - artificial recharging methods.Types of wells, Openm wells, Tube wells, Construction of wells.



Suggested Reading Material:

1. Ground Water Hydrology by D.K. Todd
2. Ground Water by H.M. Raghunath

### **III. ECOLOGY & ENVIRONMENT:**

Nature of Ecosystems, Energy flow in Ecosystems, energy fixation by Autotrophs, Energy beyond the Producers, Biogeochemical cycles and ecosystems, Ecology of populations, Population growth, Dynamics of ecological communities, National water Resources Problems with reference to the environment of major river valley projects

Suggested Reading Material:

1. Concepts of Ecology by E.J. Korrnondy.

### **IV. WATER POLLUTION AND WASTE WATER TREATMENT:**

Water Quality requirements for Drinking, Agricultural and Industrial uses, Surface and Ground water Pollution problems with reference to BOD, COD and suspended matter in the surface water, Fluoride, Nitrate, Arsenic and Iron Pollution problems in ground water of India, Water Treatment Process, Sedimentation, Coagulation and Filtration, Water Treatment process, Sedimentation, Coagulation and Filtration.

Suggested Reading Material:

1. Elements of Public health Engineering by K.N. Duggal
2. Environmental Engineering by G.S. Birdie
3. Waste water Treatment and Disposal by Metcalf and Eddy

## **7. -AR - M.ARCH. (Architectural Conservation & Interior Design)**

Visual and Urban Design: Principles of visual composition, proportion, scale. Rhythm, symmetry, asymmetry, harmony, balance of form and color, sense of place and space, division, focal point, vista, visual survey. History of Architecture: Indian - Indus Valley, Vedic, Buddhist, Indo Aryan Dravidian and Mughal periods, European - Egyptian, Greek, Roman, Medieval, and Renaissance periods.

Development of Contemporary Architecture: Development and impact on Society since industrial revolution, influence of modern art on architecture, works of national and international architects, post - modernization in architecture. .

Building Services: Civil - Water supply, Sewerage and drainage systems, sanitary fittings and fixtures, electrical and mechanical- principles of electrification of buildings, elevators, their standards and uses, airconditioning systems.

Landscape Design: Principles of Landscape design, landscape elements, materials, planning design.

Environmental and Building Science: Elements of environmental Science, ecological principles concerning environment, role of micro-climate in design, climatic control through design elements, elements of solar architecture, principles of lighting and illumination, basic principles of architectural acoustics, noise pollution and control.

Construction systems and management: Building systems and prefabrication of building elements, principles of jointing and principles of modular coordination.

Structural Systems: Behavioral characteristics of traditional building materials like mud, timber, bamboo etc., principles of strength of materials; design of structural elements in wood, steel and RCC, elastic and limit state design, complex structural systems, and principles of pre-stressing.

Computer Aided Design: Application of computers in architecture and planning, understanding, elements of hardware and software, programming Visual Basic, Java.

Housing: Concepts of shelter, housing design and policies, role of government agencies, finance and management.

City Planning: Historical development of city planning, principles of city planning, new town, survey methods, site planning, and planning regulations and building bye-laws.

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## 8. PL - Planning (MURP JNTU) & MP- M.Planning

City Planning: Historical development of city planning, principles of city planning, new towns, survey methods, site planning, regulations and building bye-laws.

Housing: Concept of shelter, housing design and policies, role of government agencies, finance and management.

Landscape Design: Principles of landscape design, landscape elements, materials, planting design. Computer Aided Design: Application of computers in architecture and planning, understanding elements of hardware and software, programming Visual Basic, Java.

Environmental and Building Science: Elements of environmental science, ecological principles concerning environment, role of micro-climate in planning and design, climate control through site planning, elements of solar energy in planning, principles of lighting and illumination, noise pollution and control.

Planning Theory: Planning process, comprehensive planning, land use and density in residential and nonresidential areas, central place theory, rank size rule, settlement pattern, land utilization and district level planning.

Techniques of planning: Application of remote sensing techniques in urban and regional planning, planning surveys, methods of preparation of urban and regional development plans, structure plans, strategy plans etc and site planning principles and design.

Traffic and Transportation Planning: Principles of traffic engineering and transportation planning, methods of conducting traffic and parking surveys, design of roads, intersections and parking areas, hierarchy of roads and levels of services, traffic and transport management in urban areas, traffic safety and traffic laws. Urban Service and Networks: Planning principles of distribution and supply systems for water supply, sewerage, drainage, solid waste disposal and power supply, health and demography related aspects of standards at town, neighborhood and site levels.

Urban Administration and management: Concept and meaning of planning laws, development control of zoning regulations, laws relating to land acquisition, land ceiling regional and urban plan preparations, local taxation, revenue resources, and fiscal management.

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## 9. CI - M.TECH (CONTROL ENGINEERING & INSTRUMENTATION & CONTROLS)

**NETWORK THEORY:-** R, L, C, Parameters - Response of RL-RC-RLC for Impulse, Step and Sinusoidal Excitations - Network Theorems - Series and Parallel Resonance - Three phase circuits - Analysis of balanced and unbalanced circuits - Two port networks - Filters - LPF - HPF - BPF.

**ELECTRO MECHANICS:** - DC Machines - EMF equation - Types of DC Generators and Characteristics, Applications - Types of DC Motors - Torque equation - Efficiency — Speed control methods - Applications - Single phase transformers - Equivalent circuit - Parallel operation - Regulation - Induction motor types - Operating principle - Applications - Speed control- Alternator - Principle of operation - Armature Reaction Synchronous Motor - types of excitation - Applications.

**POWER SYSTEM:** - Types of Generating Plants - Merits and demerits of each type plant - Types of Conductors - transmission - Line performance - Short, medium and long line - ABCD constants - Insulators - Underground cables - Power factor Improvement - Fuses - Circuit breakers - Power system transient and steady state stability analysis.

**CONTROL SYSTEM:** - Mathematical models of physical systems, block diagram algebra - Signal flow graphs - Feedback characteristics - PID controllers - Time response analysis - Concept of stability - Frequency response analysis.

**POWER ELECTRONICS AND SEMI CONDUCTOR DEVICES:** - Basic theory of operation of Diode, Transistor, SCR, BJT, MOSFET, DIAC, TRIAC, IGBT, GTO - ON and OFF Methods -  $di/dt$ ,  $dv/dt$  protection - Line commutated converters - Mid point & Bridge type - 1 -  $\phi$  and 3 -  $\phi$  with R & R - L Load - Inverters - Series, Parallel - Cyclo converter operation - Dual converter operation - Voltage controller with R, R-L Loads - Types of Commutation.

**PULSE AND DIGITAL CIRCUITS & LINEAR AND DIGITAL IC APPLICATIONS:** - Linear wave

shaping, Multi-vibrators, Sweep circuits OP-amps characteristics and applications - 555, 565, Active filters - Logic Families - ADC - DAC.

**MICRO PROCESSORS AND MICRO CONTROLLERS:** - 8085 - 8086 - Architecture and Addressing modes - Instruction set - Micro controllers - 8051 - Addressing modes - Instruction formats.

**MEASUREMENTS AND INSTRUMENTATION:-** Measuring Instruments - Classification - Deflection Torque & Control Torque - Ammeter, Voltmeter, Wattmeter, Energy meter (1 - ph only) - Bridges for Resistance, Inductance and Capacitance Measurements. Active and passive transducers, Strain gauges, LVDT, DVM's, CRO's and Spectrum Analyzers - Measurement of Pressure, Velocity, Temperature, Time Period.

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