

## 1. THE INSTITUTE

The North Eastern Regional Institute of Science and Technology (NERIST) was set up by the Government of India, initially as a project of the North Eastern Council, for providing a system of education to create technical manpower at various levels for the development of the North Eastern region of the country. NERIST came in to existence as a unique institute of its kind in the country having unconventional and innovative academic programmes. The approach is to encourage a policy for vocationalisation at matriculation level onwards and to allow only motivated students to go for the degree level while others go out of the Institute to enrich their profession with some years of industrial experience. From April 1, 1994, the institute is totally funded and directly controlled by Ministry of Human Resource Development (MHRD), New Delhi. The institute is managed by a Board of Management comprising representatives of the MHRD, Govt. of India, the eight beneficiary states of the North Eastern region, AICTE and eminent educationists.

The foundation stone of the Institute was laid by late Giani Zail Singh, the then President of India, on 4<sup>th</sup> March, 1984 and the first batch of students was admitted to the Base Module in August, 1986. By July, 2007, sixteen batches of graduates with specialization in Agricultural Engineering, Civil Engineering, Computer Science and Engineering, Electronics and Communication Engineering, Electrical Engineering, Mechanical Engineering and Forestry, have come out. **The institute has been conferred with the “Deemed University” status by UGC on May 31<sup>st</sup>, 2005 and it started functioning as a Deemed University from December 13<sup>th</sup>, 2005.**

## 2. LOCATION

The Institute is located in the picturesque valley at the foothills of the Eastern Himalayas and is situated at Nirjuli in the Papum Pare district of Arunachal Pradesh, on National Highway 52A between Banderdewa (which is the entry point to Arunachal Pradesh and is 10 km from Nirjuli) and Itanagar. It is about 19 km away from Itanagar, the capital complex of Arunachal Pradesh. Arunachal Pradesh is the land of exotic orchids and lush green hills and provides an ideal setting for a seat of technical education with a backdrop of quiet and pristine surrounding.

Located at a distance of 400 km from Guwahati, the Institute can be accessed by rail, road or air. Super Deluxe buses to and from Guwahati are available daily. Taxies can also be hired at Guwahati for coming to the Institute. An overnight train connects Harmuty (the nearest railway station in Assam and is 15 km ahead of NERIST) to Guwahati. Pawan Hans and Jagson Airlines provide helicopter service from Guwahati to Naharlagun (7kms. from the Institute) .

## 3. OBJECTIVES

NERIST aims to achieve the following objectives:

- (i) Developing human resources at three levels, i.e., Technician, Supervisory and Executive level for the development of North Eastern Region in particular and the country in general.
- (ii) Imparting quality education with flexible multi entry/exit systems to cater to the needs of the region.
- (iii) Develop entrepreneurship base in the region.
- (iv) Facilitate competency building in the North Eastern Region.
- (v) Strengthen R & D activities in the region.
- (vi) An advisory role for the overall development of the North Eastern Region.

## 4. TEACHING DEPARTMENTS

To impart quality education, NERIST has created seven degree awarding departments and two Centres. The institute offers degrees in six engineering discipline and one in Applied Science (Forestry). The engineering disciplines are Agricultural Engineering, Civil Engineering, Computer Science and Engineering, Electrical Engineering, Electronics and Communication Engineering and Mechanical Engineering. The Applied Science stream offers a Degree in Forestry. Several Post graduate programmes leading to M. Sc./M.Tech./MBA/Ph.D. are offered by the departments/Centres. The registration to M. Tech. (By Research) and Ph. D (Part time) programmes is offered throughout year for in-service candidates in all disciplines.

## 5. THE FACULTY

A highly qualified and motivated faculty from the premier institutes of the country, led by an eminent and scholarly Director, has helped the Institute to grow into a vibrant seat of education catering to all sections of the industry.

The faculty consists of Ph.D.s/Post-Graduates from abroad, IITs, IISc and other leading institutions of the country. The faculty has published very widely in the reputed international/national journals and some of them

have received awards for their contribution in research and academics.

A good number of the faculty members are engaged in individual research projects funded by CSIR, DST, MHRD, NEC etc., and quite a few have gone abroad on prestigious fellowships such as BOYSCAST Fellowship, INSA Nehru Centenary Fellowship, SERC Fellowship, etc.

## 6. ACADEMIC STRUCTURE

The academic programmes in Engineering and Technology stream at NERIST consist of three independent modules, each module consists of two years duration excluding bridge courses. The three modules are called Certificate (Base), Diploma, and Degree modules. Each module has an entry point through an entrance examination conducted by NERIST. The first entry is after class X. Each module also provides terminality corresponding to an occupational level, and at the same time allows entry to the next higher module, leading finally to a degree in engineering and technology in about six years' time after class X. In Applied Science stream, a two year Base Module and a four year Degree module are offered. The system also allows lateral entry from outside with necessary pre-requisites, at the beginning of each module.

The Certificate and Diploma levels emphasize more on the practical aspects of engineering which go a long way in helping an individual become an entrepreneur or to face the day to day problems of industry. The degree curriculum provides instructions not only in engineering, but emphasizes on management and entrepreneurship aspects as well, making an individuals more suited for today's industries.

## 7. CENTRAL FACILITIES

### 7.1. ADVANCED CENTRAL COMPUTING FACILITY

ACCF was established in 1996 with the objectives of promoting research by faculty members and encouraging advanced computer studies by interested students. Today ACCF plays a key role in the field of computer education not only at the Institute but outside the campus too.

## 7.2. EDUCATIONAL TECHNOLOGY CELL

The cell has been established as a project sponsored by MHRD, with an objective to increase the effectiveness of teaching-learning process with the help of the modern audio-visual equipments. Now the cell consists of a processing laboratory and a seminar room which is well equipped with state of the art audio visual equipments. These equipments are used for Seminars, Conferences, Workshops and special lectures by faculty members and professionals from institutions and industries.

### 7.3. INTERNET & E-MAIL SECTION:

The Institute is well connected to INTERNET through BSNL leased line connectivity. It provides Internet and e-mail services to all the members. Internet facility is likely to be extended to all hostels very soon. Wi-fi & Wi-max connectivity are to be extended to the entire campus.

### 7.4. INSTITUTE LIBRARY

The Central library, with a collection of over 65,000 books, subscribes 49 international and 145 national journals. It also subscribes 10 magazines and 12 national and regional dailies to provide a base for enhanced learning. Library, a member of indest consortia, offers access to 9 international journals to its members. It possesses IS code on CD-ROM and also has a student chapter of IEEE. NERIST is also an institutional member of Indian Liquid Crystal Society, Bangalore and Kaziranga Wild Life Society of Assam to provide literature and information services.

## 7.5. CAMPUS AMENITIES

The Institute has a sub Post Office, a branch of State Bank of India with core banking and ATM facilities, a Co-operative store, Nescafe Coffee Corner, a Medical Aid Centre, a Police out-post, a Kendriya Vidyalaya and a Kinder Garten School for Children. There are also clubs for the ladies, staff, faculty and officers of NERIST in the campus. There is also a canteen for students and staff. The Institute houses a telephone exchange on the campus and has its own EPABX of 1200 lines.

### 7.6. THE STUDENTS

NERIST currently has strength of about 1150 students. The institute is fully residential and to accommodate these students, NERIST has eight hostel blocks which include four double storied

and four single storied hostels. Amongst the four double storied hostels, one is exclusively for girls.

### 7.7. STUDENT GYMKHANA

Students' Gymkhana is the center of co-curricular activities of the students of NERIST. It provides the students with the facilities for their all round development in the field of sports, culture, hobbies and creativity.

### 7.8. TRAINING AND PLACEMENT

Since its inception in 1991, the Training and Placement (T&P) Cell of the institute is providing training, placement and career development opportunities to its students, while simultaneously conducting Industry – Institute Interactions, Public Awareness and Relations, Entrepreneurship Development Programmes and Student Career Counseling.

The Cell also organizes Industrial Training for a period of 50 days at the end of the pre-final year during summer vacations, which is a compulsory requirement in partial fulfillment of the curriculum. These trainings are conducted in reputed organizations such as BHEL, BEL, BRPL, C-DOT, CEERI, CMC, ESCORTS, HAL, HCL-HP, HINDUSTAN MOTORS, HPC, IDPL, INDIAN AIRLINES, IOC, ISRO, ITI, L&T, METRO RAILWAYS, NBCC, NEEPCO, NIC, NSTL, OIL, ONGC, PRAGA TOOLS, SAIL, SIEMENS, TATA UNISYS, TATA MOTORS, ERDL, DRDL, DRDO, ADA, NELCO, GAMMON INDIA, to name just a few.

The T&P Cell is also instrumental in counseling the final year students in securing jobs in consonance with their knowledge and skills by organizing campus interviews, while simultaneously exploring various avenues for their placements. The workshops organized by the Cell for the pre final and final year students provide them with the sufficient exposure in the areas pertaining to their recruitment and selection

and facilitate their entry into leading and highly professional organizations.

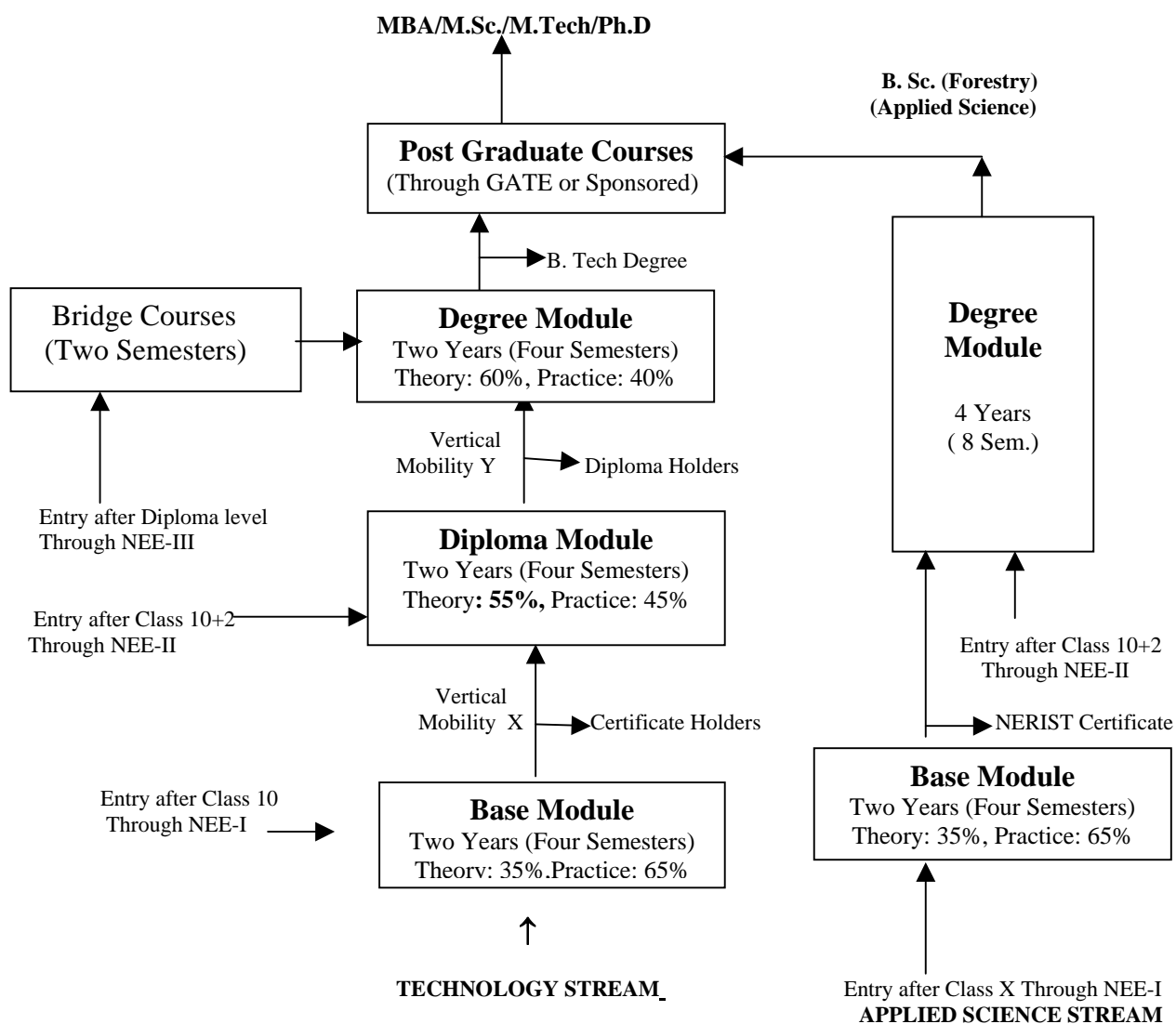
Campus interviews are usually held at NERIST, and at times, at Guwahati on weekends and holidays. Some of the prominent organizations that conducted campus interviews at NERIST recently, include Satyam Computers, Infosys Technologies, Mind Tree, Ashok Leyland, Larsen and Toubro, Gammon India, TVS, Indian Army, ICICI, IOC, OIL, Energy Infratech, Siemens Software, Power Grid, Tata Telecom, Wipro Infotech, TERI, SRIJAN INDIA, CAPART, Tata Elxsi, Vedanta Group, TELCO, Caliber Outsourcing, Maveric Systems, SPML, IBM etc. and selected our students.

Apart from the companies stated above, NERIST students are also placed in such prestigious industries and MNCs world wide as ABB, HCL-HP Ltd, Siemens Software, AT & T, Bells Laboratory, Texas Instruments, Ericsson (USA), CDC, C-DOT, CMC Ltd, Crompton Greaves, Fujitsu Network Switching of America Inc., Hero Cycles, Hewlett Packard (Hong Kong) Ltd., Hindustan Cables, Hindustan Paper Corporation, Indian Railways (through IES), Motorola (India) Electronics Private Ltd., NIC, NIIT, OIL, PCL, Philips India, Reliance Industries, ISRO, Shipping Corporation of India, Siemens, SAIL, Tata Telecom, TCS, Videocon, Mahindra British Telecom, Indian Navy, Indian Air Force etc.

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8. **NERIST ADMISSION PROCEDURE :**

The NERIST Entrance Examination (NEE) is conducted for admission to certificate, Diploma and Degree programmes. The entrance examination is conducted in Three Levels viz., NEE-I, NEE-II and NEE-III for admissions in Base Module, Lateral Entry into the Diploma Module in Engineering & Degree Module in Forestry, and Lateral Entry to the Degree Module of the Engineering branches respectively. NERIST Entrance Examinations are conducted in various Centres located in the North Eastern States of India. The selection of students is done in order of merit. The notification for NEE-I, II & III appear in the national news papers in the month of October/November and is also posted on the Institute's website ([www.nerist.ac.in](http://www.nerist.ac.in)).



**Qualifying percentage of total seats according to:-**

**X :** Vertical Mobility based on **CGPA 3.00/5.00**

**Y :** Vertical Mobility based on **CGPA 3.25/5.00**

## **9. NERIST ENTRANCE EXAMINATION-2008**

The NERIST Entrance Examination (NEE) is conducted for admission to certificate, Diploma and Degree programmes. Three different examinations known as NEE-I, NEE-II and NEE-III are held to take admission at three different levels.

NERIST Entrance Examinations are conducted at various Centres located in the North Eastern States of India.

**9.1. NEE-I** consisting of one paper of 150 marks and three hours duration will be conducted at various centres located in the eight states of North East. **All questions will be of objective type with multiple choice answers. For every wrong answer to a question 25% ( $\frac{1}{4}^{\text{th}}$ ) of the marks carried by the question will be deducted from the aggregate marks obtained by the candidate.**

### **Scheme for NEE-I**

The question paper shall consist of four sections. The subjects and distribution of marks shall be as given below:

Section A ( Physics): 25 marks, 25 questions of 1 mark each

Section B (Chemistry): 25 marks, 25 questions of 1 mark each

Section C (Biology): 25 marks, 25 questions of 1 mark each

Section D (Mathematics):  
75 marks: { 25 questions of 1 mark each,  
25 questions of 2 marks each.

### **ELIGIBILITY:**

(i) **Maximum Age Limit:** 19 years (24 years for SC/ST/PH and 22 years for OBC and female candidates) as on **1<sup>st</sup> August, 2008**

(ii) **Qualification:** Should have passed matric or Class-X examination of 10+2 system or an equivalent examination with Science and Mathematics. The candidate should have passed in Science and Mathematics respectively. Candidates appearing in the above mentioned examination, but whose results

are awaited may also appear in the NERIST Entrance Examination. A certificate to this effect is to be obtained from the Principal of the school and must be attached with the application. In case, such a candidate is selected, he/she must produce the original pass certificate and marks sheet at the time of his/her admission. Otherwise, his/her admission will automatically get cancelled.

**9.2. NEE-II** consisting of one paper of 150 marks and three hours duration, will be conducted at various centres located in the eight states of North-East. **All questions will be of objective type with multiple choice answers. For every wrong answer to a question 25% ( $\frac{1}{4}^{\text{th}}$ ) of the marks carried by the question will be deducted from the aggregate marks obtained by the candidate.**

### **Scheme for NEE-II**

There shall be three different question papers for the two streams (i) 10+2 PCM/PCB/PCMB, (ii) 10+2 Vocational (Technology) and (iii) 10+2 Vocational (Forestry).

(i) Pattern of question paper for 10+2 PCM/PCB/PCMB candidates seeking admission to Diploma Module in Engineering/Technology or Degree Module in Forestry:

The question paper shall consist of four sections viz. Sections A, B, C and D.

Section A, B and C shall have to be attempted by all candidates seeking admission to technology stream.

Section A, B and D shall have to be attempted by all candidates seeking admission to forestry stream.

The subjects and distribution of marks shall be as given below:

Section A (Physics):  
45 marks: { 25 questions of 1 mark each  
10 questions of 2 marks each

Section B (Chemistry):  
45marks { 25 questions of 1 mark each  
10 questions of 2 marks each

Section C (Mathematics):  
60 marks { 30 questions of 1 mark each  
15 questions of 2 marks each

Section D (Biology):  
60 marks : { 30 questions of 1 mark each  
15 questions of 2 marks each

(ii) Pattern of question paper for 10+2 Vocational candidates seeking admission to Diploma Module in Engineering/Technology: The question paper shall consist of two sections, viz., Section A and Section-B. Section A will

consist of three sub sections: A-1, A-2 and A-3 and the questions will be common for all the trades/vocations.

The subjects and distribution of marks shall be as given below:

A-1 (Physics):  
20 marks { 10 questions of 1 mark each  
5 questions of 2 marks each

A-2 (Chemistry):  
20 marks { 10 questions of 1 mark each  
5 questions of 2 marks each

A-3 (Mathematics):  
30 marks { 10 questions of 1 mark each  
10 questions of 2 marks each

Section B will consist of two sub sections: B-1 and B-2.

Questions of sub section B-1 will be common for all vocations/trades. Questions of sub-section B-2 will pertain to the relevant vocation/trade. The subjects and distribution of marks shall be as given below:

B1: Common Engineering Sciences:  
30 marks: { 20 questions of 1 mark each  
5 questions of 2 marks each

B2: Vocational subject  
50 marks: { 20 questions of 1 mark each  
15 questions of 2 marks each

(iii) Pattern of questions paper for 10+2 Vocational candidates seeking admission to Degree Module in Forestry:

The question paper shall consist of two sections viz. Section A and Section B. Section A will consist of three sub sections: A-1, A-2 and A-3.

The subjects and distribution of marks in Section A shall be as given below:

A-1 (Physics):  
20 marks { 10 questions of 1 mark each  
5 questions of 2 marks each

A-2: (Chemistry):  
20 marks { 10 questions of 1 mark each  
5 questions of 2 marks each

A-3: (Biology):  
30 marks { 10 questions of 1 mark each  
10 questions of 2 marks each

Section B will consist of two sub sections, viz., B-1 and B-2.

The subjects and distribution of marks shall be as given below:

B1: Common Biology Sciences,  
30 marks { 20 questions of 1 mark each  
5 questions of 2 marks each

B2: Vocational subject

Forestry / Horticulture,  
50 marks { 20 questions of 1 mark each  
15 questions of 2 marks each

**The questions of Physics and Chemistry shall be the same for 10+2 Vocational (Technology) and 10+2 Vocational (Forestry) candidates.**

**ELIGIBILITY:**

**(a) Maximum Age Limit:** 23 years (28 years for SC/ST/PH and 26 years for OBC and female candidates) as on **1<sup>st</sup> August , 2008.**

**(b) Qualification:**

**(i) For Engineering and Technology Stream**  
10+2 PCM/ PCMB, 10+2 Vocational in Electronics/ Farm Machinery & Equipment / Electrical / Refrigeration & Air Conditioning / Automobile Technology/ Structure & Fabrication Technology/ Computer Science OR NERIST Certificate (E&T).

**Candidates with 10+2 (Vocational)/ NERIST certificate holders are eligible for admission in Computer Science and Engineering or in their respective branches.**

**10+2 PCM/PCMB candidate should have passed in Physics, Chemistry and Mathematics separately.**

**(ii) For Forestry stream**  
**10+2 PCB/PCMB, 10+2 (vocational in Forestry/ Horticulture) or NERIST Certificate (Forestry).**

**10+2 PCB/PCMB candidates should have passed in Physics, Chemistry & Biology separately.**

Candidates appearing in the above mentioned examination, whose results are awaited, may also appear in the Entrance Examination. A certificate to this effect is to be obtained from the Principal of the school/ college and must be attached with the application. In case such a candidate is selected, he/she must produce the original pass certificate and marks sheet at the time of his/her admission. Otherwise, his/her admission will automatically get cancelled.

**9.3. NEE-III** consisting of one paper of 150 marks and three hours duration will be conducted at various centres located in the eight states of North East. **All questions will be of objective type with multiple choice answers.**

**For every wrong answer to a question 25% (1/4th) of the marks carried by the question will be deducted from the aggregate marks obtained by the candidate**

### Scheme for NEE-III

The question paper shall consist of four sections. The subjects and distribution of marks shall be as given below:

Section A (Physics):

25 marks: 25 questions of 1 mark each

Section B (Chemistry) :

25 marks: 25 questions of 1 mark each

Section C (Mathematics):

25 marks : 25 questions of 1 mark each

Section D (Branch subject):

75marks : { 25 questions of 1 mark each  
25 questions of 2 marks each

Question of sections A, B & C will be common for all candidates

Questions of section–D will pertain to the relevant branch of engineering/technology

### ELIGIBILITY :

**(a)Maximum Age Limit:** 40 years (45 years for SC/ST/PH and 43 years for OBC and female candidates) as on **1<sup>st</sup> August , 2008.**

The admission to Degree Module in engineering is made in the following disciplines/branches:-

- i) Agricultural Engineering
- ii) Civil Engineering
- iii) Computer Science & Engineering
- iv) Electrical Engineering
- v) Electronics & Communication Engineering.
- vi) Mechanical Engineering

Diploma holders in the allied discipline/branches as listed in the appendix are also eligible to apply.

For admission through NEE-III, a candidate must have passed the 3-year Diploma course from any Government recognized polytechnic in the respective or allied discipline/branch **with 60% marks considering the aggregate marks of all the three years**, or NERIST Diploma Module. Those appearing in Final year of three year diploma course may also appear in NEE-III for consideration of provisional admission. All provisional admissions will stand cancelled if proof of having passed the final examination with above mentioned percentage is not submitted by the date of counseling. If an applicant is found

ineligible at a later date even after admission, his/her admission will be cancelled. All admissions will be subject to verification of facts from the original certificates/documents of the candidates.

### 10. RESERVATION OF SEATS

Out of the total number of seats in each of the modules for direct admission, 80% of seats are reserved for the candidates of the eight states of the North East (10% each) as states' quota. 7% of the seats are filled up from the students of North East on merit. 10% of the seats are filled by the candidates from rest of the States under All India (AI) quota. 3% of the seats are reserved for physically handicapped candidates with 40-75% locomotor disability.

### 11. FEE STRUCTURE

The current fee structure including the hostel seat rent per semester is given in the below:-

Module	Semester	GE	SC/ST
Base	First	Rs. 5785	Rs. 5535
	Other	Rs. 3025	
Diploma	First	Rs. 4200	Rs.4125
	Other	Rs. 3125	
	Lateral First	Rs. 6285	Rs. 6035
Degree	First	Rs. 4700	Rs. 4625
	Other	Rs. 3225	
	Lateral First	Rs. 7185	Rs. 6935
Degree Forestry	First	Rs. 5000	Rs.4925
	Other	Rs. 3125	
	Lateral First	Rs. 7085	Rs.6835

**HOSTEL:** Caution Money - Rs. 1000/-, Hostel Establishment charges Rs. 500/-, Mess Advance – Rs. 5000/-

Besides the above, a student has to pay a fee of Rs. 250.00 for a self study course taken during the supplementary term in summer.

### 12. Stipend

The SC/ST students of North Eastern states are generally provided with stipends by the concerned state governments at varying rates from Rs. 500.00 to Rs. 600.00 per month. The North Eastern Council also provides scholarship to the students of the region for study at Diploma and higher levels at rates which vary between Rs. 700 and Rs. 800 per month. The

continuance of stipend is subject to the following conditions:

- (i) That his/her contribution to his/her maintenance of discipline in the institute is consistently good and he/she is regular in the classes. Unauthorised absence from the institute/hostel is treated as lapse of discipline.
- (ii) Stipend is payable for the winter break and summer vacation period on students' rejoining after the break/vacation.

### **13. Daily Work Schedule:**

The institute remains open for five days a week with Saturday and Sunday being off day. Classes are scheduled from 8. a.m. to 5. p.m. with one hour flexible lunch break from 12 noon to 2 p.m.

### **14. Attendance:**

All students are expected to attend classes regularly. Permission of the teacher concerned must be taken for any unavoidable absence from classes. A student should have a minimum of 75% attendance in the lecture/laboratory/workshop/drawing classes prescribed for each course, failing which he/she is not evaluated. In extreme situations a 10% relaxation is permitted on medical grounds.

### **15. Evaluation Procedure:**

The evaluation procedure for the theory component of each course consists of three components: teacher's evaluation (class tests, assignments and quizzes etc.), one mid term examination of two hours duration and an end term examination of three hours duration. The practical components of the courses are evaluated based on the performance in the practical classes, practical tests and viva voce.

### **16. Awards:**

The most outstanding students of Certificate/Diploma/Degree are awarded gold medals at the time of convocation.

### **17. Instructions for Filling the Application Form :**

Please read carefully the instructions given in this section before filling in the Application Form. To avoid mistakes and overwriting you

should complete the entries item wise first on a plain paper, and after proper scrutiny, transfer the same onto the Application Form. The Application Form must be filled in English only. Use capital letters as far as possible, except for signature. Note that only one application is admissible. If however, more than one application is submitted it must clearly be marked with the word "DUPLICATE" at the top in red ink. **All information including recent photographs in the forms must be identical.** Examination fee in the form of crossed demand draft in favour of 'Director, NERIST', payable at SBI, NIRJULI (Branch Code 9535) must be enclosed with each application. The fee is non-refundable. Any violation of the instructions may make your application invalid. Incomplete applications will be rejected. **Applications without requisite examination fee will be summarily rejected.** For filling up the items at Serial Numbers 1 to 6 use one box for each letter. **Leave a box blank after each word.**

**17.1. Name in Full:** Write your full name as given in the records of matriculation or Class-X examination or equivalent in **CAPITAL LETTERS in the given box.**

**17.2. Father's Name:** Write the name of your father in the given box in CAPITAL LETTERS.

**17.3.(i) Legal Guardian's Name:** Write the name of legal guardian if (a) You are an adopted ward (b) Both your father and mother are not alive.

Attach legal guardianship certificate from First Class Magistrate with the application form.

**17.3 (ii). Relationship with the legal guardian:** Write your relationship (like uncle, brother etc.)

**17.4. Permanent address of Parent/Legal Guardian:** Write the permanent address of parent/ legal guardian with PIN code in capital letters.

**17.5. Mailing Address:** Write the complete postal address in **Capital Letters** including PIN Code at which communications are to be made. Also write the name of the nearest Telegraph Office and your telephone number in space provided.

**17.6. Date of birth :** Write your date of birth as per the class-X certificate/ school records in the boxes provided.

**For Example -** If the date of birth is March 5, 1987, then the entries should be –

Day		Month		Year			
0	5	0	3	1	9	8	7

**17.7 (a) Candidate's choice of Information Codes:** Fill up the State Code, Region Code, Reservation Code and Examinee's Centre code from the list of codes given below. In case the number of candidates in a centre is less than a certain number then the candidates may be accommodated in a nearby centre. Use one box for one digit only.

**17.7 (b) Exam code :** NEE-I or NEE-II or NEE-III

Exam Centre Code		State Code	
Code	Exam Centre	Code	Description
01	Agartala	1	Arunachal Pradesh
02	Aizawl	2	Assam
03	Dibrugarh	3	Manipur
04	Gangtok	4	Meghalaya
05	Guwahati	5	Mizoram
06	Imphal	6	Nagaland
07	Itanagar	7	Sikkim
08	Jorhat	8	Tripura
09	Kohima	9	Others
10	Shillong		
11	Silchar		

NOTE : State code of the state from which seat is being claimed is to be written in application form.

Region Code	
Code	Description
1	PRC holder of any of the eight north eastern states
2	Others

Reservation Code for PRC holders (for Region code 1)	
Code	Description
01	General
02	OBC
03	SC
04	ST from plain area of Assam
05	ST from Hill area of Assam
06	Khasi/Jayantia from Meghalaya
07	Garo from Meghalaya
08	Other ST from Meghalaya
09	ST of all other states except Assam & Meghalaya
14	Most backward classes of Sikkim (Local with Sikkim subject certificate/ Certificate of Identification)

Reservation Code for Others (for Region code 2)	
Code	Description
01	General
02	OBC
03	SC
09	ST of all other states except Assam & Meghalaya
10	Wards of Central/State government or undertaking employees serving in Assam
11	Wards of State government or state undertaking employees of Arunachal Pradesh
12	Wards of Central government or central government undertaking employees serving in Arunachal Pradesh
13	Others (Non PRC holders) residing in Arunachal Pradesh for not less than three years and not covered in any of the above Reservation categories.
15	Others (Children of business community and state government employees of Sikkim)

**17.7 (c)** Write yes or No in the column asking whether you are physically handicapped, in case you are physical handicapped with 40 to 75% locomotor disability only.

**Physically Handicapped (PH)** certificate should be in prescribed format from a Medical Board attached to the Special Employment Exchange/Vocational Rehabilitation Centre for physically handicapped or a Medical Board at District level which should have an orthopaedic surgeon/specialist in Physical Medicine and Rehabilitation as a member.

**Permanent Resident Certificate (PRC)** should be issued by D.C. or any other duly authorized Revenue Officer. The certificate should bear the office seal, signature with date, name, and the seal of the issuing officer.

**Govt. Employee Certificate (GEC)** should be issued by the Employer of the candidate's parent/legal guardian.

**ST/SC/OBC** certificate should be issued by the prescribed authority in the prescribed format.

**17.8. Sex:** Write M or F in the box as the case may be.

Sex code	
Code	Description
M	Male
F	Female

**17.9. Nationality:** Mention your nationality.

**17.10. Details of Examination passed :** For filling in the details of the examination at class X and

other level (if any), write in the appropriate column, the name of the examination, name of the School/College/Institute from which appeared/due to appear, name of Board/ University, and the year of the examination if already passed. If not passed, enter month and year when appearing or due to appear. In the column Subjects, write subjects taken at qualifying examinations.

**Attested photocopies of certificates & mark sheets are to be attached. The candidate appearing in final qualifying examination is allowed to appear in the Entrance Test provisionally. However, he/she has to produce the original certificates & mark sheets at the time of counselling.**

**17.11.** If you are currently registered at NERIST, write your roll number in the space provided.

**17.12. Details of Bank Draft :** Examination fee of **Rs.650/- (Rs. 300/-** for SC/ST/handicapped candidates) must be paid along with the completed application in the form of crossed demand draft. Those who have down loaded the brochure and application form from internet should pay Rs. 750/- (Rs.400/- for SC/ST/PH Candidates) along with the submission of filled in application form. The demand draft should be drawn in favour of **‘Director, NERIST’ payable at SBI NIRJULI (Code No. 9535)**. Please ensure that the draft is not defective in any way. **The fee shall not be refunded in any case.**

**17.13. Declaration by the Applicant :**

This must be signed with date by the applicant and countersigned with date by applicant’s Parent /Legal Guardian, otherwise the application will be treated as incomplete and rejected.

**18. Identification Record :**

Write your full name in capital letters and sign at the appropriate places. Ensure that a recent passport size photograph, identical to that pasted at the top right corner of the Application Form, is also pasted and properly attested on the front side. Write the name of one of the examination centres from where you intend to appear at the Entrance Examination. The examination centres are **Agartala, Aizwal, Dibrugarh, Gangtok, Guwahati, Imphal, Itanagar, Jorhat,**

**Kohima, Shillong, and Silchar.** However, candidates opting for Itanagar centre may be allotted centre in NERIST at Nirjuli or in any school at Naharlagun or Itanagar, at the discretion of the Institute.

**19. Admit Card and Envelope:** Write your full name in capital letters and sign at the appropriate place on the Admit Card provided with the Application Form. Ensure that a recent passport size photograph identical to the ones pasted on the Application Form is pasted at the correct place of admit card. Also, write in capital letters your name and complete postal address with PIN Code on the envelope marked ‘Admit Card’. You need not affix any postage stamps on the envelope. Your Admit card will be sent to you in this envelope. You must not mutilate the Admit Card or change any entry made on it, after it has been authenticated.

**20. Acknowledgement Card:** The purpose of the acknowledgment card is to intimate you about the receipt of your application by the Institute. Write Application Number (as on application form), your name and complete postal address in capital letters with PIN Code at the appropriate places provided in the acknowledgment card. **Affix postage stamp of Rs.6/- on the acknowledge card. The information brochure is to be retained by the applicant for reference.**

**21. How to send your completed Application Form?:** The completed application form along with all the enclosures should be sent to **Member Secretary (NEE), North Eastern Regional Institute of Science and Technology, P.O. NIRJULI, Arunachal Pradesh, PIN - 791 109** by **Registered Post/Speed Post**. Hand delivery of applications is not accepted. You should firmly tie or staple together the Application Form, Bank draft, acknowledgement card, self-addressed envelope and other enclosures. The application form along with these enclosures should properly be folded and sent in the envelope marked ‘Application Form’ sent to you along with the Application Form and Information Brochure.

**Original Certificates should not be sent but only true copies of these certificates duly attested** (with official seal) must be enclosed with the completed application form. The attestation should be done by the Head of the Institution in which the applicant is currently

studying/last attended or by a Class-I Gazetted Officer, if not currently studying.

You are advised to see the check list to ensure that all necessary items have been sent.

**22. Deadline for receipt of application:**

The last date for receipt of completed application form along with requisite fee at NERIST is **February 04 , 2008.**

**Any application received after this date will not be considered. Any delay in receiving the blank Application Form by the candidate will not be considered as a valid reason for the late submission of the completed Application Form. The Institute will not be responsible for any postal delay or irregularity.**

**23. Date of Examination:**

NEE-II & NEE – III April 19<sup>th</sup> , 2008

(Saturday) ;

NEE-I April 20<sup>th</sup> , 2008(Sunday).

**24. Proof of sending completed**

**Application Form:**

a) The Institute will send the acknowledgment card with a reference number to the applicant.

b) No claim of submission of Application Form will be entertained unless it is supported by the acknowledgement card sent by the Institute.

c) No correspondence with regard to the application, eligibility, admits card etc. will be entertained unless the application number given on the acknowledgment card is quoted.

**25. Declaration of result:**

The result shall be declared in first week of **June, 2008.** It will be published in local news papers and put on NERIST web site **[http: // www.nerist.ac.in](http://www.nerist.ac.in)**

**RAGGING IS BANNED IN NERIST AND ANY ONE INDULGING IN RAGGING DURING THE ENTIRE PERIOD OF HIS/HER STUDY IN NERIST IS LIKELY TO BE PUNISHED APPROPRIATELY WHICH MAY INCLUDE EXPULSION FROM THE INSTITUTE, SUSPENSION FROM THE INSTITUTE OR CLASSES FOR A LIMITED PERIOD, OR FINE WITH A PUBLIC APOLOGY. THE PUNISHMENT MAY ALSO TAKE THE SHAPE OF**

**2.WITHHOLDING SCHOLERSHIPS OR OTHER BENEFITS.**

**3.SUSPENSION OR EXPULSION FROM HOSTEL OR MESS OR COLLECTIVE PUNISHMENT, IF THE INDIVIDUALS COMMITTING OR ABETTING RAGGING ARE NOT INDENTIFIED, AND/OR AN ENTRY IN THE CONDUCT CERTIFICATE MENTIONING THE ACT OF RAGGING INDULGED IN BY THE STUDENTS CONCERNED.**

**1. WITHHOLDING RESULTS.**

## SYLLABI FOR NEE-I

Full Marks: 150

TIME : 3Hours

### Section-A

PHYSICS:

25 Marks

**Measurement in Science and Technology :** Measurements and measurement systems; Historical developments in measurement science; The modern measurement system; The international system of units (SI); Maintenance of standards of measurements; Multiples and fractions; Indian national standards of measurements;

**Structure of Atom :** Fundamental Experiments and discharge tube and the discovery of the electron; Canal rays or positive rays; X-rays and radioactivity; Atomic nucleus; Structure of atom; Discovery of the neutron; Atomic Number and atomic mass; isotopes

**Motion :** Motion of living and non living objects; Distance and displacement; Uniform and Non Uniform motion, Velocity; Non uniform motion and acceleration; Graphs and their uses; Uniform circular motion.

**Gravitation :** Universal law of gravitation; Motion of particles under gravity; Motion of a projectile, Mass and weight; Geotropism

**Work, Energy and Power :** Work, work done when the force is not along the direction of motion; Energy; Power, Transformation of energy, Conservation of energy.

**Heat :** Heat and temperature; Thermal equilibrium; Mercury thermometer, Heat as a form of energy, Effects of Heat; Changes of state.

**Wave motion and sound :** Simple Pendulum, Wave motion; Transverse and longitudinal waves; Graphical representation of simple harmonic waves characteristic of harmonic waves; Relation between wave velocity, frequency and wave length for a periodic ; Nature and propagation of sound; speed of sound; Range of hearing in humans, Reflection of sound, practical applications

of reflected sound; Echoes; Sonar and Application of Ultrasound.

**Light reflection and refraction :** Nature of light; reflection of light by mirrors-by plane mirror, spherical mirrors, new Cartesian sign convention for reflection by spherical mirrors and derivation of mirror formula, magnification; Refraction of light-the refractive Index, reflection through a rectangular glass slab, refraction by spherical lenses, sign convention with spherical lenses - Lens formula, power of a lens, total internal reflection, some optical phenomena in nature; dispersion of white light by a glass prism; color of objects-primary colours of light and pigments.

**Optical Instruments :** The human eye; defects of vision and their correction; microscope and the astronomical telescope.

**Electricity, its heating and chemical effects :** Electric charges and its properties; conductors and Insulators; electric current-charges in motion; electric potential and potential difference; circuit diagram; Ohms law-resistance, resistivity, resistors in series and in parallel; heating effect of electric current-electric energy and electric power.

**Magnetic effects of electric current :** Magnetic field and field lines; magnetic field around a current carrying straight conductor; force on a current-carrying conductor in a magnetic field; electric motors; electromagnetic induction; electric generators; domestic electric circuits; the electric fuse-A safety device.

**Nuclear Fission and Fusion :** Nuclear reactions; Nuclear fission; Fission products; Energy released in fission reactions; Chain reaction; Theory of Nuclear fission; Nuclear reactors; Nuclear hazards and safety measures.

**The Universe :** The solar system- the sun, the terrestrial planets, the Jovian planets, asteroids, meteorites and comets. The Structure and evolution of the earth; The stars and constellations; Milky way galaxy and other galaxies; Space exploration-Space Programme in India.

### SECTION-B CHEMISTRY

25 Marks

**Matter Around Us:** Physical nature of matter, states of matter; General concept about mixture, solution, colloidal solution, suspension, distillation, condensation, evaporation,

sublimation and fusion; Effect of pressure and temperature on states of matter.

**Atomic Structure:** Daltons atomic theory, elements, compounds, cathode ray, X-ray, Thomson's model of an atom, Rutherford's model of atomic structure. Bohr's model of atomic structure. Electronic configuration (in terms of Shells only) of elements up to Atomic No. 20; Atomic number, Mass number, Isotopes and Isobars; Radioactivity.

**Classification of Elements:** Mendeleef and Modern periodic table, Periodic trend of metallic and nonmetallic character, atomic size, nature of bonding, oxides and related chemical properties, prediction of properties of an atom.

**Chemical Bonding:** Octet rule or inert gas configuration as criteria of stability. Ions, atom and valency. Ionic bonds, covalent bonds (in simple cases), shape of Molecules of  $H_2O$ ,  $NH_3$ ,  $CH_4$ ,  $CCl_4$ ,  $C_2H_4$ ,  $SF_6$ ,  $PCl_5$ ,  $CO_2$ .

**Chemical reactions and Some basic concepts:** Decomposition, Displacement reactions, Isomerization reaction, Combination reactions, Reversible and Irreversible reactions, Reversible reaction and Chemical equilibrium, Law of chemical equilibrium, chemical formula and equations, Atomic and Molecular masses, Mole concept, gram atomic mass and gram molecular mass, Determination of formula of unknown compounds, Balancing of chemical reactions.

**Energetics:** Bond energy, Energy involved in a reaction. Photo chemical reactions and generation of free radicals. Electrolysis of water and  $NaCl$ , Electrochemical cells (Galvanic cell) with reference to dry cells and storage cells. Sun and Nuclear energy, Sun and its source of energy( Nuclear fusion), Nuclear fission, Chain reaction, Nuclear reactors, Nuclear hazards, simple nuclear reactions.

**Metals:** Physical and chemical properties, Reaction with  $O_2$ , dilute acid,  $Cl_2$ . Elementary metallurgy of Cu, Fe, Al, and uses of the metals. Washing soda, Baking soda, lime, preparation of Bleaching Powder, Plaster of Paris, Cement, Glass, Steel. Some common

alloys of copper, iron and aluminium. Corrosion of metals.

**Non-Metals:** Physical and chemical properties, reactions with  $O_2$ , acid,  $Cl_2$ ,  $H_2$ . Preparation and properties of Si, P, S, ammonia, hydrogen and sulphuric acid. Carbon and its compounds: Allotropes of carbon. Hydrocarbon: Alkanes, Isomerism in alkanes. Petroleum; Preparation and properties of Methanol, Ethanol, Methanal, Propanone, General properties of organic acids and esters, Synthetic polymers including addition polymers (PE, PP, PVC, Teflon) and condensation polymers (nylons and polyesters); Rubber and its vulcanization; Soaps, detergents; Cleansing action of soaps and detergents.

**Bio-mass as fuel:** Fossil fuel, Coal, Petroleum, Natural gas; Classification of Fuel. Calorific value of fuel, Ignition temperature, Combustion of fuel, Characteristics of an ideal fuel.

**Environmental Pollution:** Types of pollution and pollutants, Acid rain, Green House Effect, Eutrophication and Soil erosion. Conservation and protection of environment.

## SECTION-C BIOLOGY

25 Marks

### Cell and Cell structure :

Structure of cell; Cell organelles seen under electron microscope; Prokaryotic and Eukaryotic cells; cell division.

**Tissues in plants and Animals :** Plant tissues and Animal tissues.

**Diversity in the Living World :** Importance of classification; Nomenclature; Classification of plants and animals.

**Food Nutrition and Health :** Components of food; Balanced diet.; under-nutrition and malnutrition, food adulteration; Quality of drinking water or potable water; Health and its importance ; community health and personal health; conditions essential for good health.

**Health and Diseases :** Types of diseases; Communicable diseases (symptoms, Prevention & control); Nutritional disorders (symptoms, prevention and control).

**Our natural resources :** Types of natural resources; Management of natural resources.

### Food Resources : Crop production system.

Human dependence on plants and animals for food: Nutrients as food for plant; Water; Crop production; Scientific storage of grains.

**Food Resources : Sustainable Agriculture** :Sustainable agriculture; Mixed farming; Mixed cropping; Crop rotation; Varietal Improvement.

**Food Resources : Animals** :Milk producing animals; Poultry; Fish farming; Meat providing livestock.

**Our Environment** :Habitat and adaptation; habitat alteration and conservation.

**Nutrition and Respiration** :Modes of nutrition-autotrophic and heterotrophic (saprophytic, parasitic, holozoic); Nutrition in plants-chlorophyll traps solar energy, site of photosynthesis, raw materials for photosynthesis, mechanism and factors affecting photosynthesis. Nutrition in Animals-nutrition in amoeba and grass-hopper; Human digestive system. Respiration-breathing and respiration, aerobic and anaerobic respiration, respiration in plant and animals, respiration in human beings.

**Transportation and excretion** :Transportation of minerals in plants-transportation of water, minerals, foods and other substances; Transportation in human being-composition and function of blood, blood clotting, blood groups and blood transfusion; Heart and other parts, human circulatory system; lymphatic system. Excretion in animals-amoeba and earthworm; Excretion in human beings; Osmoregulation, renal failure and technology for survival-Dialysis.

**Heredity and Evolution**:Heredity and variation; Chromosomes, genes and structure of chromosome and DNA, DNA and genetic engineering; sex determination; Organic evolution-evidences of evolution, theories of evolution.

**Environment and Environmental Problems** :Environmental problems-pollution and pollutants (air, water and lead pollution); soil erosion; Inter-relationship of population, environmental and development; conservation and protection of environment.

**Control and coordination** :Co-ordination in plants and animals; Nervous system and hormones in Human beings.

**Reproduction**:Types of reproduction-asexual reproduction (fission, budding, spore formation, regeneration, vegetative

propagation); Sexual reproduction in plants-pollination and fertilization; Human reproductive systems-male reproductive system, sexual cycle in females, fertilization; Population control; reproductive health and sexually transmitted diseases.

## SECTION - D

### MATHEMATICS

75 Marks

#### (A) Algebra :

**Number System**: Whole numbers, Integers, Rational and Irrational numbers, Surds and rationalization of surds, Real numbers

**Polynomials** :Definition of a polynomial, Factorization of polynomials Factorization of quadratic and cubic expressions, HCF and LCM of polynomials.

**Rational Expressions**: Addition, Multiplication and Division of rational expressions

**Linear Equations in one & two variables**: Solution of Linear equations in one and two variables, Solution of a systems of Linear equations by cross multiplication. Application to practical problems.

**Quadratic Equations** :Zeros of quadratic equations, Solution of quadratic equations by (i) factorization (ii) method of completion of square: quadratic formula, Application quadratic equations.

Arithmetic Progression(AP) Definition, nth term of an A.P. , Sum of finite number of terms an A.P.

#### (B) Geometry :

**Lines, Angles and Triangles**:Geometrical concepts of a point, Angle and a triangle, Angles made by a transversal with two lines, Sum of the angles of a triangle, Different criteria for congruence of two triangles, Properties of Isosceles triangle, Similar triangles, Proportionality theorems, Concurrent Lines in a triangle.

**Parallelograms**:Definition , Properties of a parallelogram, Types of parallelograms, some theorems on parallelograms.

#### Circles:

Definition, congruence of circles, chords of a circle Arcs of a circle, Angles subtended by Arcs and chords at a point on a circle, angles in a cyclic quadrilateral Tangents to a circle, Properties of tangents to a circle, Chord of a circle intersecting in a point, Alternate segments and its angles, Common tangents to circles.

**(C) Trigonometry** : Trigonometric ratios of angles of measures  $0^{\circ}$ ,  $30^{\circ}$ ,  $45^{\circ}$ ,  $60^{\circ}$ ,  $90^{\circ}$ . Trigonometric ratios of some specific angles, solution of right angles. Trigonometric ratios of complementary angles, Simple problems on heights and distances, Angles of elevation and depressions

**(D) Mensuration**: Area of a triangle, quadrilateral, Circle, sector and segment of a circle, Trapezium, Concept of perimeter of these figures. Lateral and Total surface area of right triangular prisms, volume of a right triangular prism.

Lateral surface area and volume of a right pyramid, surface Area and volume of a tetrahedron, Lateral and total surface area and volume of a cuboid, cube, right circular cylinder, right circular cone hemisphere and surface area and volume of a sphere, surface area and volumes of combinations of these solids, volume and surface are of a frustum of a right circle cone

**(E) Statistics and Probability**: Mean, Median Mode and their properties, Measure of central tendency, Probability as a measure of uncertainty.

**(F) Coordinate Geometry (2D)**: Distance between two points, section formula between two points.

## SYLLABI FOR NERIST

### ENTRANCE EXAMINATION-II

(Common for PCM/PCB/PCMB students seeking admission in Diploma Module in Engineering & Technology or Degree Module in Forestry).

**Full Marks : 150**

**Time: 3 Hours**

#### SECTIONS :

<b>A</b>	<b>Physics</b>	<b>45 marks</b>
<b>B</b>	<b>Chemistry</b>	<b>45 marks</b>
<b>C</b>	<b>Mathematics</b>	<b>60 marks</b>
<b>D</b>	<b>Biology</b>	<b>60 marks</b>

**Section-A Physics 45 marks**  
**Physical World and Measurement :** Physics scope and excitement, physics, technology and society, Forces in nature, Conservation laws, Examples of

Gravitational, electromagnetic and Nuclear forces from daily-life experiences (qualitative only). Need for measurement, Units of measurement, systems of units, SI units, Fundamental and derived units, length, mass and time measurement, Accuracy and precision of measuring instruments. Errors in measurement, significant figures. Dimensions of Physical quantities. Dimensional analysis and application. Elementary concept of differentiation and integration for describing motion.

**Kinematics** : Uniform motion in a straight line, Position time graph, speed and velocity, Uniform and non-uniform motion, average speed and instantaneous velocity . Uniformly accelerated motion, velocity time graph, relations for uniformly accelerated motion (Graphical method). Scalar and vector quantities, position and displacement vectors, Equality of vectors, multiplications of vectors by real number, Addition and subtraction of vectors, Unit vector, Resolution of a vector in a plane. Rectangular components, Scalar and Vector products of two vectors, vectors in 3 dimensions (elementary idea only) Motion in a plane, Uniform velocity and uniform acceleration, projectile motion, uniform circular motion.

**Laws of Motion** : Force and inertia, Newton's first law of motion, Momentum, Newton's second law of motion, Impulse , Newton's third law of motion, conservation law of linear momentum and its application, Equilibrium of concurrent forces, Friction, static and dynamic friction, laws of friction, rolling and sliding friction, lubrication. Dynamics of uniform circular motion, centripetal force, Vehicle on a level road, Vehicle on a banked road. Inertial and non-inertial frames (Idea only).

**Work, Energy and Power** : Work done by a constant force and variable force, kinetic energy, Potential energy, work-energy theorem, power. Potential energy of a spring, conservative and non-conservative forces, conservation of mechanical energy (kinetic and potential energies), collisions, Elastic and inelastic collision in 1 dimension and 2 dimensions. Different forms of Energies in nature, Mass-Energy equivalence (Qualitative Idea).

**Motion of system of particles and Rigid Body** : Centre of mass of two particle system, generalization to N-particles, momentum

conservation and centre of mass motion, Application to familiar systems, centre of mass of a rigid body.

**Gravitation** : The universal law of Gravitation, Gravitational constant, Acceleration due to gravity and its variation with altitude, latitude, depth and rotation of earth, Mass of the earth, Gravitational potential energy near the surface of earth, gravitational potential, Escape Velocity. Orbital Velocity of a Satellite. Weightlessness, Motion of Satellites, geostationary and polar satellites, Kepler's laws of planetary motion. Proof of second and third law, (for circular orbit) Inertial and gravitational mass. Moment of force, torque, angular momentum, Physical meaning of angular momentum, conservation of angular momentum with some examples ( Planetary motion). Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion. Moment of Inertia & its physical significance, radius of gyration, parallel and perpendicular axis theorem (statement only) M.I. of circular ring, disc, cylinder and thin straight rod. Rolling of a cylinder without slipping. Examples of binary system in nature (Binary Stars, Earth-moon system, diatomic molecules).

**Mechanics of Solids and Fluids** : States of matter, inter atomic and inter molecular forces.

a) **Solids** : Elastic behavior, stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity & some practical examples.

b) **Fluids** : Pressure due to fluid column, Pascal's law and its application (hydraulic lift and brakes) Effect of gravity on fluid pressure . Buoyancy, flotation, and Archimedes principle, Viscosity, Stoke's law, terminal velocity, stream line flow, trubulent flow. Reynold's number. Bernoulli's theorem and its applications.

c) Surface energy and surface tension, angle of contact, application of surface tension, excess pressure inside a liquid drop and bubble, capillary rise and action of detergent.

**Heat and Thermodynamics** : Kinetic theory of gases-assumptions, concept of pressure, kinetic energy and temperature,

r.m.s. speed, degree of freedom, law of equipartition of energy (statement only), mean free path and Avogadro's number.

Thermal equilibrium and temperature (Zeroth law of thermodynamics) Heat, work and internal energy, thermal expansion-thermometry. First law of thermodynamics, specific heat, specific heat of gas at constant volume and pressure (mono atomic, diatomic gases). Specific heat of solids (Dulong and Petits' law).

Thermodynamic variables and equation of state, phase diagram; ideal gas equation, isothermal and adiabatic processes, reversible and irreversible processes carnot's engine and refrigerator or heat pump. Efficiency and co-efficient of performance, second law of thermodynamics (statement only); and some practical applications.

Transfer of heat-Conduction, convection and radiation. Thermal conductivity of solids, Black body radiation, kirchhoff's laws, weins displacement law, Stefan's law (statement only) Newton's law of cooling, solar constant and determination of surface temperature of sun using Stefan's law.

**Oscillations** : Periodic motion- period, frequency, displacement as a function of time and periodic functions. Simple Harmonic Motion (SHM) and its equation, Expression for velocity and acceleration of SHM. Oscillations of a spring, restoring force and force constant, Energy in SHM-Kinetic and potential energies, Simple pendulum- derivation of its time period, Free, forced and damped oscillations (qualitative idea only), resonance, coupled oscillations.

**Waves** : Longitudinal and transverse wave, wave motion, Displacement relation for progressive wave. Principle of superposition of waves, Reflection of waves, Standing waves in strings and pipes, fundamental and higher harmonics, Beats, Doppler's effect, speed of sound in media.

**Electrostatics** : Frictional electricity, charges and their conservation, coulomb's law, Forces between two point electric charges. Forces between multiple electric charges; Superposition principle and continuous charge distribution. Electric fields and its physical significance, electric field due to a point charge, electric field lines, electric field due to a dipole and behavior of a dipole in a uniform electric field. Electric potential-physical meaning, potential difference,

electric potential due to a point charge, a dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field. Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Conductors and insulators, presence of free charges and bound charges inside a conductor, Dielectrics and electric polarization, general concept of a capacitor and capacitance : Combination of capacitors in series and parallel, energy stored in a capacitor, capacitance of a parallel plate capacitor with and without dielectric medium between the plates; Van de Graff generator.

**Current Electricity :** Electric current, flow of electric charge in a metallic conductor, drift velocity and mobility and their relation with electric current, ohm's law, electrical resistance, V-I characteristics, Exception, of ohm's law (Non-linear V-I characteristics), Electrical resistivity and conductivity, classification of materials in terms of conductivity; Superconductivity (elementary idea); Carbon resistors, colour code for carbon resistors, combination of resistances-series and parallel.

Temperature dependence of resistance, Internal resistance of a cell, Potential difference and e.m.f. of a cell, combinations of cells in series and in parallel. Kirchhoff's laws- illustration by simple application. Wheatstone bridge and its Applications for temperature Measurements. Metre bridge-special case of whetstone's bridge. Potentiometer-principle and application to measure potential difference, and for comparing e.m.f. of two cells.

Electric power, thermal effects of current and Joule's law, Chemical Effects of Current: Faraday's laws of electrolysis; Electrochemical Cells- Primary (Voltaic Lechlanche, Dry Daniel,) and secondary-rechargeable cells (lead accumulators, alkali accumulators) solid state cells. Thermoelectricity- origin, elementary idea

of Seebeck effect; Thermocouple. Thermo e.m.f. neutral and inversion temperatures. Measurement of temperature using a thermocouple.

**Magnetic effects of current & magnetism :** Concept of magnetic field, Oersted's experiment, Bio-Savart law, magnetic field due to an infinitely long current carrying straight wire and a circular loop: Amperes's circuital law and its application to straight and toroidal solenoids; Force on a moving charge in uniform magnetic and electric fields, cyclotron; Force on a current carrying conductor in a uniform magnetic field, Forces between two parallel current-carrying conductors, definition of ampere. Torque experienced by a current loop in a uniform magnetic field, moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter. Current loop as a magnetic dipole and its magnetic dipole moment, magnetic dipole moment of a revolving electron, Magnetic field intensity due to magnetic dipole (bar magnet) along the axis and perpendicular to the axis; Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; Bar magnet as an equivalent solenoid, Magnetic field lines. Earth's magnetic fields and magnetic elements : Para,dia and ferromagnetic substances With examples. Electromagnets and permanent magnets.

**Electromagnetic Induction & Alternating currents :** Electromagnetic Induction, Faraday's Laws, Induced e.m.f. and current, Lenz's law, Eddy currents, Self and mutual inductance. Alternating currents peak and r.m.s. values of Alternating current/voltage, reactance and impedance; LC oscillations, LCR series circuit (Phasor diagram) Resonant circuits and Q-factor, Power in AC circuits, wattless current. AC generator and transformer.

**Electromagnetic Waves :** Electromagnetic waves and their characteristics (qualitative idea only); Transverse nature of electromagnetic waves.

Electromagnetic spectrum (Radio-microwaves, infrared, optical, Ultraviolet, gamma rays) including elementary facts about their uses, Propagation of electromagnetic waves in atmosphere.

**Optics :** Refraction of light, total internal reflection and its application, spherical lenses, thin lens formula, lens maker's formula; Magnification, Power of a lens, combination of this lenses in contact; Refraction and dispersion

of light due to a prism, Scattering of light. Blue colour of the sky and reddish appearance of the sun at sun-rise and sun set.

Optical Instruments – Compound Microscope, astronomical telescope (refraction and reflection type) and their magnifying powers.

Wave front and Huygen's principle; Reflection and refraction of plane wave at a plane surface using wave fronts (qualitative idea); Interference- Young's double slit experiment and expression for fringe width, Coherent sources and sustained interference of light; Diffraction-due to a single slit, width of central maximum, difference between interference and diffraction.

Resolving power of microscope and telescope, Polarization-plane polarized light, Brewster's Law, Use of plane polarized light and polaroids.

**Dual Nature of Matter and Radiation :** Photo-Electric effect, Einstein's Photo-electric equation, Particle nature of light, Photo Cell, Matter waves-Wave nature of particles, De-Broglie relation, de Broglie wave length of an electron. Davisson Germer Experiment.

**Atomic Nucleus :** Alpha-particle scattering experiment, size of the nucleus, composition of the nucleus, protons and neutrons, Nuclear instability-Radioactivity-Alpha, Beta and Gamma particles/rays and their properties, radioactive decay law, simple explanation of decay, beta- decay and gamma-decay. Mass-energy relation, mass defect, binding energy per nucleon, its variation with mass number. Nature of nuclear forces, nuclear reaction, Nuclear fission and Nuclear fusion.

**Solid and Semi-conductor Devices :** Energy bands in solids (qualitative idea only), difference between metals, insulators and semiconductors using band theory; intrinsic and extrinsic semiconductors, p-n junction, semi-conductor diode-characteristics in forward and reverse bias, diode as a rectifier, solar cell, photodiode. LED, Zener diode as a voltage regulator, Junction transistor, transistor action, characteristics of a transistor. Transistor as an amplifier

(common emitter configuration) and oscillator. Logic gates (OR,AND,NOT,NAND and NOR); Elementary ideas about IC.

## **SECTION-B Chemistry 45 marks** (Common for PCM/PCB/PCMB Students seeking admission in Diploma Module in Engineering & Technology or Degree Module in Forestry).

**Some Basic concepts of chemistry:** Nature of matter, properties of matter and their measurements, Law of Chemical combination, Dalton's Atomic Theory, Atomic and molecular masses, Mole concept, Stoichiometry and stoichiometric calculations.

**Structure of Atoms and Chemical Bonding:** Constituent of the atom, electronic structure of atom, understanding electron behavior, Bohr's model of hydrogen and hydrogen like atoms, spectrum of hydrogen, Dual behaviour of matter, de Broglie equation, Heisenberg's uncertainty principle; Quantum numbers, shapes of orbital, Aufbau principle, Pauli's exclusion principle, Hund's rule of maximum multiplicity; Electronic configuration of elements up to atomic numbers 30. Chemical bonding: Lewis structure, Hybridization and VSEPR theory with reference to  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{CCl}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_4^+$ ,  $\text{H}_3\text{O}^+$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{C}_2\text{H}_4$  and  $\text{C}_2\text{H}_2$ . Molecular orbital theory with reference to simple homodiatom molecules upto atomic number 10. Hydrogen bond. Dipole moment in simple molecules.

**States of Matter:** The gaseous state: Kinetic molecular theory of ideal gases. Laws governing the ideal behavior of gases, deviation from the ideal behavior; van der Waals equation of state for real gases. Concept of critical constants, Liquefaction of gases.

Solid State: Structure of simple ionic compounds, Close-packed structure, ionic radii; Silicates, Imperfections in solids, properties of crystalline solids and amorphous solids.

**Solutions:** Types of solution, Vapor pressure of solution and Raoult's law, Ideal and non-ideal solutions. Colligative properties, Abnormal molecular masses.

**Chemical Thermodynamics:** Some basic concepts; Energy changes during a chemical reaction, Internal energy and Enthalpy. Enthalpy of reaction, First law of thermodynamics,

Concept of Entropy and Free energy, Spontaneity of a process, Second and Third law of thermodynamics.

**Chemical Equilibrium:** Equilibrium involving physical change and chemical system, Law of Mass action and its application to equilibrium. Le-Chatelier's principle and its applications. Ionic Equilibria; Ostwald's dilution law; Arrhenius, Bronsted-Lowry and Lewis concept of acids and bases. pH scale, Buffer solutions and Solubility product.

**Chemical Kinetics:** Rate of reaction, Instantaneous rate of a reaction, Molecularity and order of a reaction, Factors affecting the rate of a reaction, Elementary and complex reactions, Determination of the order of a reaction, Dependence of reaction rate on temperature and catalyst, Photochemical reactions, Mechanism of a reaction.

**Surface Chemistry:** Adsorption, Colloidal solutions, Emulsions. Homogeneous and heterogeneous catalysis.

**Redox Reactions:** Oxidation and reduction as an electron transfer process, Oxidation number, balancing of redox equations.

**Electrochemistry:** Electrolytic conductance, Equivalent and molar conductivities, Galvanic cell, Electrode potential and EMF of a Galvanic cell, Dependence of EMF on concentration and temperature Electrochemical cell and free energy, Electrolysis, Quantitative aspect of electrolysis, Faraday's Laws, and Criteria for product formation; Some commercial batteries, Corrosion.

**s-Block Elements:** General trends, characteristics of compounds of Alkali and Alkaline earth metals. Anomalous behaviour of Lithium and Beryllium. Some important compounds of Sodium and Calcium. Chemistry of Hydrogen, Water and Hydrogen peroxide.

**p-Block Elements:** General trends. Anomalous behaviour of Boron and Carbon. Allotropy: Different allotropes of Carbon, Sulphur, Phosphorus, and Tin. Chemistry of some important compounds of Boron, Carbon, Silicon, Nitrogen, Phosphorus, Oxygen, Sulphur, and Halogens. Characteristics of Group-18

elements, and Chemistry of Xenon. Metallurgy of Aluminium.

**d- & f-Block Elements:** General trends, Characteristic properties of transition and inner transition elements. General properties of first row transition metal compounds. Metallurgy of Iron and Copper. Manufacture of steel, Chemistry of some heavy metals like Silver, Gold, Zinc, Mercury, and Compounds such as Potassium permanganate and Potassium dichromate.

**Co-ordination and Organo-metallic Compounds:** Co-ordination compounds, Isomerism and bonding in co-ordination compounds; Stability of co-ordination compounds in solution; Importance of co-ordination compounds. Organo-metallic compounds.

**Organic Chemistry:** Classification and nomenclature of organic compounds, Isomerism and stereochemistry. Fundamental concepts in organic reaction mechanism, Methods of purification; Qualitative and quantitative analysis of organic compounds; Modern methods of structure elucidation.

**Hydrocarbons:** Preparation and properties of alkanes, alkenes and alkynes; Aromatic hydrocarbons, aromaticity. Preparation, properties and structure of Benzene.

**Organic compounds with functional group :** General methods of preparation, physical and chemical properties and important uses of haloalkanes, haloarenes, polyhalogen compounds, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids and derivatives of carboxylic acids, cyanides, isocyanides, amines, nitro and azo compounds.

**Polymers:** Nomenclature and classification of polymers, Types of polymerization, Molecular mass of polymers; Some commercially important polymers.

**Bio-molecules:** Structure and function of carbohydrates, proteins, nucleic acids, lipids and vitamins.

**Nuclear Chemistry:** Discovery of radioactivity and nature of radiation from radio active substances; Chemical equations for nuclear changes, Radioactive series, Rate of radioactive decay, Artificial transmutation radioactivity, Synthetic elements, Nuclear fission, Nuclear fusion. Applications of radioactivity and radio-isotopes.

**Chemistry in Everyday life:** Dyes, Chemicals in medicines, Chemistry of rocket propellants, Chemicals in food, Soaps and Detergents.

## SECTION-C

### Mathematics 60 marks

(For PCM/PCMB Students seeking admission to Diploma Module in Engineering & Technology).

#### (A) Algebra :

**Sets:** Sets and their representations, finite and infinite sets, subsets, empty or null sets, universal set, equal sets, power set, complement of a set, union and intersection of sets and their algebraic properties, difference of sets, Venn diagrams, application of sets.

**Relations and functions:** ordered pairs, Cartesian product of sets, relations, domain, codomain and range, into and onto functions, one one into and one one onto functions, constant function, identity function, composition of functions, invertible functions, Binary operations.

**Complex Numbers:** Complex number in the form  $(a+ib)$ , representation of complex numbers by points in plane, Argand diagram, algebra of complex numbers, real and imaginary parts of a complex number, triangle inequality, modulus and argument (or amplitude) of a complex number, conjugate, square root of a complex number, cube root of unity, polar representation of a complex number.

**Theory of quadratic equation:** Solution of a quadratic equation in the complex number system by (i) factorization (ii) using formula, relation between roots & coefficients, the nature of roots, formation of quadratic equations with given roots, Symmetric functions of roots, Equations reducible to quadratic forms.

**Sequences and series:** Sequence and examples of finite and infinite sequences, Arithmetic progression (A.P.)- first term, common difference and nth term, sum to n terms of an A.P., Arithmetic mean (A.M.), insertion of A.M. between any two given numbers, Geometric

progression (G.P.)-first term, common ratio and nth term, Sum to n terms and infinite number of terms of a G.P., recurring decimal numbers as G.P., Geometric Mean (G.M.) insertion of G.M. between any two given numbers, Harmonic progression, Harmonic mean(H.M),relationship among A.M., G.M. and H.M, arithmetico-geometric series, special cases of  $\sum n, \sum n^2, \sum n^3$ , exponential series concept of e as the sum of an infinite series, proof of  $2 < e < 3$ , exponential function ( $e^x$ ) as the infinite series, logarithmic series- infinite series for  $\log_e(1+x)$ ,  $\log_e(1-x)$  and related problems.

**Permutations and combinations:** Fundamental principle of counting, the factorial notation, Permutation as an arrangement, meaning of P(n,r), combination, meaning of C(n,r), application of permutations & combinations.

**Mathematical Induction :** The principle of mathematical Induction, simple applications.

**Binomial theorems:** Statement of binomial theorem, proof of the binomial theorem for positive integral exponent using the principle of mathematical induction, general and middle terms in binomial expansions, Binomial theorem for any index (without proof), application of binomial theorem for approximation and properties of binomial coefficients.

**Mathematical logic:** Mathematical Logic statement, Venn diagrams in logic, negation, operation, basic logical connectives and compound statement including the negations, truth tables, duality algebra of statements and applications of logic in solving simple problems.

**Matrices and determinants:** Concept of a matrix, types of matrices, Equality of matrices, operations of addition, Scalar multiplication and multiplication of matrices, statements of important results on operations of matrices and their verification by numerical problems only, linear equations in matrix notation, determinants, determinant of a square matrix, properties of determinants, minors & cofactors of determinants, applications of determinants in (i) finding area of a triangle (ii) Solving a system of linear equations, Cramer's rule, transpose, adjoint and inverse of a matrix, consistency and inconsistency of system of linear equations, application of matrices in solving simultaneous linear equations in two or three variables.

**Boolean Algebra:** Boolean algebra as an algebraic structure, principle of duality, Boolean function, conditional and biconditional statements, valid arguments, switching circuits, application of Boolean algebra to switching circuits.

**(B) Trigonometry:**

Trigonometric functions of sum and difference of numbers, Trigonometric functions of multiples and submultiples of numbers, conditional identities for the angles of a triangle, Solution of trigonometric equations, solution of triangles, concept of inverse trigonometric functions and their use to reduce expression to simplest form.

**(C) Vectors :** Vectors & scalars, Magnitude and direction of a vector, types of vectors, position vector of a point dividing a line segment in a given ratio, components of a vector, addition of vectors, multiplication of a vector by a scalar, scalar (dot) product of vectors, projection of a vector on a line, Vector (cross) product of two vectors, application of dot & cross products in (i) finding area of a triangle and a parallelogram (ii) problems of plane geometry and trigonometry (iii) finding work done by a force (iv) vector moment of a vector about a point, scalar triple product and its applications, Moment of a vector about a line, co planarity of three vectors or four points using scalar triple product, vector triple product .

**(D) Coordinate Geometry :**

**Two Dimension:** (i) Area of a triangle, condition for the collinearity of three points, centroid and in-centre of a triangle, locus and its equation.

**The straight line and pair of straight lines** –Various forms of equations of a line, intersection of lines, angles between two lines, condition for concurrency of three lines, distance of a point from a line, coordinates of orthocentre and Circum centre of a triangle, equation of family of lines passing through the point of intersection of two lines, homogeneous equation of second degree in  $x$  &  $y$  , angle between pair of lines through the origin, combined equation of the bisectors of the angles between a pair of lines, condition for the general second degree equation to

represent a pair of lines, point of inter-section and angle between two lines represented by  $S=0$  and the factors of  $S$ .

**Circles-** Standard form of the equation of a circle, general form of the equation of a circle, its radius and center, equation of a circle in the parametric form, equation of a circle when the end points of a diameter are given, points of inter- section of a line and a circle in the center at the origin and condition of a line to be tangent to the circle, length of tangent, equation of the tangent, equation of a family of circles through the inter- section of two circles, condition for two inter- secting circles to be orthogonal.

**Conic sections-** Sections of cones, equations of conic sections (parabola, ellipse, hyperbola) in standard forms, conditions for  $y = mx+c$  to be a tangent and points of tangency.

**Geometry of Three Dimension (3D) :** Coordinate axes, planes in three dimensional space, coordinates of a point in space, distance between two points, section formula, d.c'.s. and d.r'.s. of a line joining two points, projection of the join of two points on a given line, angle between two lines whose d.r'.s. are given, Cartesian and vector equation of a line through (i) a point and parallel to a given vector (ii) through two points, co- linearity of three points, coplanar & skew line, shortest distance between two lines, condition for the intersection of two lines, Cartesian & vector equation of a plane (i) when the normal vector and the distance of the plane from the origin is given (ii) passing through a point and perpendicular to given vector (iii) passing through a point and parallel to two given lines through the intersection of two other planes (iv) Containing two lines(v) Passing through three points, Angle between two lines (ii) two planes (iii) a line and a plane. Condition of co-planarity of two lines in vector and Cartesian form, Length of perpendicular of a point from a plane by both vector and Cartesian methods, vector and Cartesian equation of a sphere, its center and radius, diameter form of the equation of a sphere.

**(E) CALCULUS:**

**Function, Limits and Continuity:** Concept of real function, its domain and range, types of functions, limit of a function, meaning and related notations, left and right hand limits, fundamental theorems on limits, limit at infinity and infinite limits, continuity of a function (i) at a point (ii) over an open/closed intervals, Sum, product and quotient of continuous functions,

continuity of special functions-polynomial, trigonometric, exponential, logarithmic, inverse trigonometric functions.

**Differentiation:** Derivative of a function, its geometrical and physical significance, Relationship between continuity and differentiability, derivative of some simple functions from first principle, derivative of sum, difference, product and quotient of functions, derivative of polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions, derivative of functions expressed in parametric form, chain rule and differentiation by substitution, Derivatives of second order.

**Application of Derivatives:** Rate of change of quantities, tangents and normals, increasing and decreasing functions and sign of the derivatives, maxima & minima, greatest and least values, Rolle's theorem and mean value theorem (without proof), curve sketching of simple curves.

**Indefinite integrals:** Integration as inverse of differentiation, properties of integrals, integration by substitution, by parts, partial fractions and their use in integration, integration of rational and irrational functions, integration of trigonometric functions of the type

$$\int \frac{dx}{a + b \cos x} \int \frac{dx}{a + b \sin x} \text{ and } \int \sin^m x \cos^n x dx.$$

**Definite Integrals:** Definite integral as limit of a sum, fundamental theorems of integral calculus (without proof), evaluation of definite integrals by (i) substitution (ii) using properties of definite integrals, application of definite integrals in finding the areas bounded by a curve, circle, parabola and ellipse in standard form between two ordinates and x-axis, area between two curves (line and circle, line & parabola, line & ellipse).

**Differential Equations:** Definition, order and degree, general and particular solution, formation of a differential equation whose general solution is given, solution of differential equation by the method of separation of variables, homogeneous differential equations,

linear differential equation of the type  $\frac{dy}{dx} + py = Q(x)$  whose  $p(x)$  &  $Q(x)$  are functions of  $x$ , Solution of second order differential equations.

**(F) Statics and Dynamics:**

**Elementary Statics-** Introduction, basic concepts, laws of mechanics, force, resultant of forces acting at point, parallelogram Law of forces, resolved parts of a force, equilibrium of a particle under three concurrent forces, triangle law of forces and its converse, Lami's theorem and its converse, two parallel forces, Like and unlike parallel forces, couple and its moment.

**Elementary Dynamics :** Basic concept. like displacement, speed, velocity, average speed, instantaneous speed, acceleration and retardation, resultant of two velocities, Motion of a particle along a line when moving with constant acceleration, motion of a particle under gravity, projectile motion, the path of a projectile, its horizontal range, velocity at any instant, greatest height and time of flight.

**(G) Probability:** Random experiment and associated sample space events as subsets of sample space, occurrence of an event, impossible events, sure events, combination of events through the operations "and", "or", "not" and their set representation, meaning of equally likely outcomes, definition of probability of an event as the ratio of the number of favorable equally likely outcomes to the total number of outcomes, equally likely events, addition rule for mutually exclusive events, Conditional probability, independent-events, independent experiments, Calculation of probability of events associated with the independent experiments  $P(A \text{ or } B)$ ,  $P(A \text{ and } B)$ , Baye's theorem and its application, recall of concept of random variables and its probability distribution, mean and variance of random variables, Binomial and Poisson's distributions, their mean, variance and application of these distributions in commerce and industry.

## SECTION-D Biology 60 Marks

(For PCB/PCMB Students seeking admission in Degree Module in Forestry).

**Origin and Evolution of life :**Theories and evidences of origin of life, Concept of species, speciation and isolation; Homeostasis; Scope of

biology; Classification-artificial, natural and phylogenetic; Binomial nomenclature; Status of bacteria and virus.

**Cell biology :** Ultra structure of cell; cell organelles and their function; Cell division; Karyotype analysis; Chromosomal basis and other patterns of inheritance; Linkages and crossing over; Mutation and chromosomal aberrations; Gene mapping; Human genetics; Structure of RNA and its role in protein synthesis; Gene expression and its regulation; Nuclear basis of differentiation and development; Oncogenes; DNA as a genetic material; Recombinant DNA technology; Gene bank; DNA fingerprinting; Genomics-principles and applications; Transgenic plants, animals and microbes.

**Physiology of plants and animals:** Plant water relations; Transpiration; Photosynthesis; Respiration- glycolysis, Krebs's cycle, compensation point, Respiratory Quotient; Food and Vitamins; Inter- and intra-cellular digestion; Role of hormones and enzymes in digestion; malnutrition; Respiration and circulation in animals; Blood, its composition and related disorder; Osmoregulation and excretion.

**Reproduction and growth in plants and animals:** Vegetative, micropropagation and sexual reproduction; Flowering-Photoperiodism, Vernalization; Pollination; Double fertilization; Parthenogenesis and Parthenocarpy; Reproduction in animal-embryonic development, growth, repair, aging and death; Movement and locomotion in plants and animals; Nervous coordination in animal; Phytochromes; seed germination; Role of growth regulators in seed dormancy.

**Ecology and Environment:** Organism and the environment; Population, community, ecosystem and biosphere; Major biomes; Ecological succession; Productivity; Energy flow in ecosystem; Nutrient cycling; Natural resources and its conservation; Biodiversity; Environmental pollution; Global environmental changes; Environmental ethics and legislation.

**Morphology of plants and animals :** Morphology and modification of root, stem and leaf; Inflorescence, flower, fruit, seed structure and types; Description of family poaceae, liliaceae, fabaceae, solanaceae and asteraceae; Meristematic and permanent tissues; Anatomy of root, stem and leaf; Secondary growth; Animal tissues-structure and function of epithelial, connective, muscular and nervous tissues; Salient features of earthworm, cockroach and rat.

**Application of biology :** Human population growth and factors; Common problem of drug, Alcohol and tobacco; Mental and addictive disorder; Common human diseases; Technology for medical application; Plant tissue culture and its application; Bioenergy; Biopesticide; Biopiracy; Bioethics; Domestication and improvement of plants and animals; Biomedical technologies such as radiography, angiography, sonography, ECG,EEG,ELISA test; Types, detection and diagnosis of cancer.

**II. For 10+2 vocational or NERIST Certificate (Engineering & Technology) candidates seeking admission to Diploma module in Technology.**

**Full Marks : 150 Time: 3 Hours**

**Section- A**

<b>A-1 Physics</b>	<b>20 marks</b>
<b>A-2 Chemistry</b>	<b>20 marks</b>
<b>A-3 Mathematics</b>	<b>30 marks</b>

**Section-B**

<b>B-1.Common Engineering Sciences</b>	<b>30 Marks</b>
<b>B-2 Vocational subject</b>	<b>50 Marks</b>

**Section A-1 Physics 20 Marks**

**Units and dimensions :** Units for measurements, systems of units, fundamental and derived units, SI units. Dimensional analysis and their applications.

**Motion in one and two dimensions :** Objects in motion in one dimension, motion in a straight line, uniform motion, its graphical representation and formulae, speed and velocity, instantaneous velocity, uniformly accelerated motion, its position-time graph, velocity-time graph and formulae.

Vectors and scalars, representations of vectors in two dimensions, unit vector, vector addition and multiplication, Resolution of vectors in plane, rectangular components, Scalar and vector

products, Motion in two dimensions, projectile motion, uniform circular motion.

**Laws of motion :** Force and inertia, first law of motion, Momentum, second law of motion, impulse, Third law of motion, examples of third law, linear momentum, conservation of linear momentum, Equilibrium of concurrent forces, Static and kinetic friction, laws of friction, rolling friction, lubrication.

**Work, Energy and Power :** Work done by a constant force, Kinetic and potential energy, power, Work-energy principle, Spring constant, Gravitational potential energy, Conservation of energy, Elastic collision in one dimension.

**Rotational motion :** Centre of mass of a two-particle system, centre of mass of a rigid body, general motion of a rigid body, motion of centre of mass, nature of rotational motion, rotational motion of a single particle in two dimensions, Uniform circular motion and their examples, Torque, angular momentum, conservation of angular momentum, Moment of inertia and its physical significance.

**Gravitation :** Newton's law of gravitation, universal gravitational constant 'G', acceleration due to gravity 'g', mass and density of the earth, inertial and gravitational mass, variations of 'g'. Gravitational potential energy near the earth's surface, gravitational potential, orbital velocity, escape velocity, geostationary satellite.

**Properties of matter :** Inter atomic and intermolecular forces, states of matter, Elastic properties of solids, Hooke's law, Young's modulus, bulk modulus and modulus of rigidity.

Fluid pressure, Pascal's law, buoyancy, flotation, Archimedes' principle, Atmospheric pressure. Surface Energy and Surface Tension, angle of contact, Capillary rise, Viscosity, Stokes law, streamline & Turbulent flow, Reynold's number, Bernoulli's Theorem & its applications.

**Heat and thermodynamics:**

Kinetic theory of gases, pressure exerted by a Gas, kinetic Energy & Temperature, Measurement of temperature, Absolute temperature scale, Gas Laws and Avogadro's number. Specific heat of solids

& liquids, Latent heats of fusion & vapourisation, Transfer of heat.

**Oscillations and waves:** Periodic motion, simple harmonic motion, equation of simple harmonic motion, kinetic and potential energy in simple harmonic motion, Oscillations due to a spring mass system, simple pendulum, time period of a simple pendulum. Wave motion, speed of a wave, principle of superposition, reflection of wave, Standing waves in string (graphical representation only), Sound wave and its propagation in different media, Effect of pressure and temperature on velocity of sound waves, characteristics of sound waves.

**Electrostatics:** Frictional Electricity, charges and their conservation, Coulomb's law, Electric field and potential due to a point charge, Dipole, its fields along the axis, Concept of dielectric and dielectric constant, Conductors and insulators.

Presence of free charges and bound charges inside a conductor, Capacitance, parallel plate capacitor with air and dielectric medium between the plates, series and parallel combination of capacitors, energy stored in a capacitor, Van de Graff generator.

**Current electricity:** Electric current, Ohm's law, resistivity, resistance of different materials, temperature dependence of resistance, resistances in series and parallel, Kirchhoff's law - illustrations by simple examples, Wheatstone's bridge and its applications for comparing emf of two cells and determination of internal resistance of a cell, Electric power and heating effects of current.

**Magnetic effect of current :** Oersted's experiment, Force on a moving charge in a uniform magnetic field, Force on a current carrying conductor and torque on current loop in a magnetic field, forces between two parallel current carrying conductors, definition of Ampere, Moving coil galvanometer and its conversion into ammeter and voltmeter.

**Magnetism :** Natural and man made magnets, properties of bar magnet, current loop as magnetic dipole, Lines of force in a magnetic field, Comparison of bar magnet and solenoid, Earth's magnetic field, Tangent galvanometer, vibration magnetometer, Electromagnets and permanent magnets.

**Electromagnetic induction and alternating current :** Induced emf, Faraday's laws, Lenz's law, electromagnetic induction, self and mutual inductance,

**Ray Optics and Optical Instruments :**

Sources of light, luminous intensity, luminous flux, Reflection of light at plane and spherical surfaces, Curved mirrors, mirror formula. Refraction of light, refractive index, total internal reflection, spherical lenses, thin lens formulae, lens maker's formula, magnification. Refraction and dispersion of light due to prism, spectrometer - its use for the determination of refractive index of material of a prism, Scattering of light in atmosphere, primary rainbow, Optical instruments - simple and compound microscopes, refracting and reflecting telescopes.

**Section A-2 Chemistry 20 Marks**

(For admission to Diploma Module in Engineering and Technology).

**Structure of Atom:** Discovery and properties of sub-atomic particles (electron, proton and neutron), Rutherford's atomic model, Bohr's model of hydrogen and hydrogen-like atoms, Spectrum of hydrogen, Heisenberg's uncertainty principle, Dual nature of electron, de-Broglie equation, Quantum numbers, Concept of atomic orbital, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle, Electronic configuration of elements up to atomic number 20.

**Chemical Bonding:** Ionic, Covalent, Coordinate covalent, Hydrogen and metallic bonds, Properties of compounds having these bonds. Hybridization and VSEPR theory for the molecular shape of simple molecules such as  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{CCl}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_4^+$ ,  $\text{H}_3\text{O}^+$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{C}_2\text{H}_4$  and  $\text{C}_2\text{H}_2$ .

**Periodic Properties of Elements:** Mendeleev's periodic table and long form of the periodic table (Main features, merits and demerits), Periodic properties (Metallic characters, ionization potential electron affinity and electronegativity), Classification of elements into s, p, d and f - blocks, General trends of periodic properties of s- and p-block elements.

**Gaseous State:** Physical properties of gases, Laws governing their behavior (Boyle's Law, Charles's Law, Gaylussac's

Law, Avogadro's law, Dalton's law of partial pressure, Graham's law of diffusion), Ideal gas equation, Kinetic molecular theory of ideal gases, Deviation from ideals behaviour, van der Waals equation of state; Continuity of states, Importance of critical constants, Liquefaction of gases.

**Chemical Equilibrium:** Reversible reaction, Law of mass action and its application to chemical equilibrium, Homogeneous and heterogeneous equilibrium, Le Chatelier's principle and its application, Ionic equilibria. Theory of electrolytic dissociation, Ostwald's dilution law; Arrhenius, Bronsted - lowry and Lewis concepts of acids and bases.

**Redox Reactions:** Oxidation and reduction processes (classical and modern concepts), Oxidation state, Calculation of equivalent mass of oxidizing and reducing agents, Balancing of redox reactions using oxidation number and ion-electron methods.

**Electrochemistry:** Faraday's laws of electrolysis (statement, explanation and application), Numerical problems; Electrical conductance, specific conductance, equivalent and molar conductances; General concept of Galvanic cell and its representation; Electrode potential, Standard hydrogen electrode and reference electrode, Electro-chemical series and its applications, EMF of a Galvanic cell, Nernst equation for electrode and cell potentials; Some commercial cells and batteries.

**Organic chemistry:** Classification of organic compounds, Nomenclature of hydrocarbons and compound containing one functional group, homologous series, Isomerism. General methods of preparation and properties of Alkanes, Alkenes and Alkynes. Aromatic hydrocarbons, Structure of benzene. Electrophilic substitution reactions in benzene.

**Organic compounds with one functional group:** Simple methods of preparation and properties of Halo-alkanes, Alcohols, Phenols, Ethers, Aldehydes, Ketones, Carboxylic acids, Derivatives of carboxylic acid, amino-, cyano-, isocyano-, azo-, and nitro- compounds.

**Section A-3 Mathematics 30 Marks**

(For admission to Diploma Module in Engineering and Technology).

**Trigonometry :** Trigonometric ratios of compound, multiple and sub-multiple angles,

General solution of trigonometric equations, Properties and solution of triangles, Inverse circular functions.

**Algebra:** (i) Complex Numbers : Complex number and its properties, Different forms of complex numbers, roots of complex numbers, cube roots of unity and their properties, De-Moivre's theorem.

(ii) Progressions : Arithmetic and Geometric progressions, Arithmetic and Geometric means, Harmonic Progression, sum of n-terms and nth terms of A.P. & G.P.

(iii) Permutation and combinations, Binomial theorem for positive integral index, Middle term, greatest term, Binomial coefficients.

(iv) Partial fractions of different forms

(v) Determinants of order two, three and their properties.

**Coordinate Geometry(2D)** Coordinates of a point in a plane, distance between two points, Division of a line segment in a given ratio (internal and external division), Different forms of equation of a straight line, Distance of a point from a line, Angle between two lines, Bisector of an angle between two lines, Pair of straight lines, Equation of a circle, tangent and normal to a circle, Equation of second degree representing a conic section, Basic ideas about parabola, ellipse and hyperbola.

**Coordinate Geometry (3D)** Coordinates of a point in three dimensions, Distance between two points, division of join of two points. Angle between two lines, Direction cosines and direction ratios of a line, Projection of a point on a line.

Equation of a plane, Different forms of equation to a plane, Angle between two planes, Plane through three given points, Angle between a plane and line, Equation of a straight line in space, Coplanar lines, shortest distance, centre and radius of sphere.

**Vector Algebra:** Vector and its components, Different kinds of vectors, Addition and subtraction of vectors, scalar and vector products of two and three vectors.

**Differential Calculus** : Functions and their representation limit, continuity and

differentiability of a function, Derivatives of elementary functions Derivatives of sum, product and quotient of functions, Derivatives of exponential, logarithmic and hyperbolic functions. Successive differentiation and Leibnitz theorem, Roll's theorem and Lagrange's mean value theorem, L'Hospital Rule, Curvature, Asymptotes, and concepts of curve tracing, Maxima & minima of functions of one variable.

**Integral Calculus** : Integration, Integral of elementary functions, Integration by parts and by substitution, Integral of rational functions and trigonometric functions, Integration of irrational functions Definite Integrals, Area under simple curves.

**Statistics** : Mean, median, mode and standard deviation of discrete and grouped data .

## **Section B-1**

**Common Engineering Science 30 marks**

**(Common for 10+2 Vocational and NERIST Certificate holders seeking admission to Diploma Module in Engineering & Technology.)**

**Engineering Drawing** : Lines, lettering and dimensioning, geometrical construction, scales, Engineering curves: conic sections, cycloid, Projection of points, straight lines, planes and solids: Sectional views: Isometric views; Auxiliary Projections.

**Workshop** : Hand tools for carpentry and fitting, forging, welding, specification and use, various operations : sawing, planning, chiseling, joining, filing, marking, chipping, gas cutting, maintenance and types of maintenance (preventive and corrective), materials for machine components.

**Mechanics** : Vector concept, force and force system, static equilibrium, Newton's laws of motions and derived concepts like fiction, centroid, area, moment of inertia, work energy principle and application of impulse.

**Electricity** : Concept of voltage, current, resistance, power and energy, relation between electrical, mechanical and thermal units, temperature weft of resistance. Ohm's law, series, parallel, circuits and Kirchoff's law, Capacitance and inductance.

## SECTION - B2

**Vocational Subject: 50 Marks**

( For 10+2 Vocational or NERIST Certificate holders in Technology seeking admission to Diploma Module in Engineering and Technology. A candidate is required to appear in only one of the following vocations /Trades).

### **Agricultural Engineering:**

#### **FARM EQUIPMENT TRADE:**

**Tractors and power tillers :** History of tractor and power tillers, technical specifications of various types and models of tractors and power tillers. Working principles of tractor and power tiller engines including fuel system, cooling system, lubrication, air intake and exhaust system. Working principles of clutch, gear box, final drive, steering, brake, hydraulic and electrical system. P.T.O. and belt pulley. Wheels and ballasting.

**Farm machinery :** Agricultural mechanization, scope, benefits and limitations. Land reclamation machinery . Equipment required for seedbed preparation, sowing, planting, interculture, irrigation, plant protection, harvesting and threshing. Implement hitching, safety in operation, Machinery management.

**Servicing and maintenance :** Selection of site for establishing centre for repair and overhaul of tractors. Selection of hand tools, workshop machines, materials, seals and packing. Repair and preventive maintenance of general purpose machine components like fasteners, bearing, coupling, spring and elements of rotary motion drive. Fault diagnosis of various systems of engine, tractor and power tiller, checking of wear and tear, repair of worn out components and maintenance. Routine and preventive maintenance of tractor, repair and maintenance of farm equipment and land reclamation machinery.

#### **FOOD PROCESSING TRADE:**

Food material characteristics and properties. Chemistry and microbiology of food, its processing and preservation. Food additives, Browning reaction. Adulteration and food laws. Nutritive value of foods.

Unit operation in food processing like washing, cleaning, sorting, grading, sizing, screening, heating, cooling, blanching, smoking and material handling etc. and related equipments. Food preservation principles and methods. Food processes such as drying, dehydration, heat treatment, refrigeration, freezing, fermentation, irradiation, evaporation and concentration etc. Food packaging materials and methods.

Processing and preservation methods of fruits and vegetables, milk, fish, meat and egg etc. and manufacture of their different products.

Instrumentation in food industry, Instruments for measurement of process parameters,

Steam generation, refrigeration and plant utilities in a food processing plant, Equipment servicing, repair and maintenance of common post harvest (including pulse and cereal milling), food and milk processing operations. Food grade engineering materials.

Cleaning, hygiene, sanitation and sterilization of food processing and handling equipment.

### **Civil Engineering:**

#### **Construction Technology (Draftsman/ Surveyor Trades):**

**Construction Material :** Rocks, bricks, tiles, sand, cement, lime and cement mortar, concrete, timber, steel, paints and varnishes, distemper, plastics, glasses, asphalt, sound and heat insulating materials.

**Construction and Maintenance :** Building Construction: Types of Brick and Stone masonry; Types and components of foundations, floors, doors and windows, arches and lintels, walls, stairs and roofs; Roads: Geometric features of road WBM and BBM pavements, Equipments used in road construction; Railway : Components, Construction and maintenance of tracks, Points and Crossings; Hydraulic Structure: Types and construction of Dams and Canals.

**Surveying :** Various surveying instruments; Methods of chain surveying, compass surveying,

plane table surveying, theodolite surveying, leveling and contouring.

**Water Supply and Sanitation :** Sources of water, pumps, types of distribution systems, appurtenances in distribution system, sanitary system, construction and maintenance of sewers. Different types of water supply and sanitary fittings, Septic tanks.

**Civil Engineering Drawings :** Signs and symbols used in Civil Engineering Drawings, Drawings related to : Different types of masonry bonds, Sub-structure details, Timber joints, Riveted, Bolted and welded joints, and Steel and Timber trusses.

**Estimation and Quantity Surveying :** Types and methods of estimates; Estimation of earthwork, masonry, RCC works, flooring, plastering, white washing and painting, sanitary fittings; Specifications of construction materials and various items of works.

## **Electronics Communication Engineering:**

### **ELECTRONICS TECHNOLOGY OR ELECTRONICS MAINTENANCE TRADE :**

**Circuits and Devices :** Semiconductors, type of semiconductors, doping, p-n junction diodes and their characteristics, Bipolar transistor, transistor, biasing, CE, CB and CC configurations and their characteristics, principles of class A, AB, B & C amplifier, gain, bandwidth, introduction to feedback amplifiers, Sinusoidal oscillator, clipping and clamping circuits, Mono-stable and Astable multivibrators.

**Fundamentals of Communication & Radio Engineering :** E.M. wave propagation - ground wave, space wave and sky wave, Antenna radiation, different types of Antenna, Analog communication, AM, FM, principles of multiplexing - FDM & TDM, Introduction to digital communication, Multi - channel telephony, Super heterodyne receiver, typical circuits of various stages of transistorized receivers, working principle, RF and IF alignment, AVC and AGC.

**T.V. and Audio System :** Monochrome T.V., Interlace scanning, synchronization, blanking pulses, bandwidth requirement, VSB, Picture resolution, typical circuits of the Video amplifier and EHT stages, function of keyed AGC, AFC, various controls in a T.V. receiver, Acoustics, high fidelity and high quality sound, sound recording - Disc and Tape, pool recording systems, equalization, Microphones and speakers, P.A. system, Record player, concept of Hi-Fi stereo.

**Instruments :** Resistors, capacitors and inductors, Printed circuit board. Ammeter and Voltmeter - different types and their working principle. Analog and digital multimeters, DC power supply, Cathode ray oscilloscope and signal/function generators.

## **Electrical Engineering:**

### **ELECTRICAL TECHNOLOGY OR ELECTRICAL MAINTENANCE TRADE:**

**Basic Electricity :** Primary, Secondary cell and charging of lead acid batteries, Capacitance and inductance their series, and parallel connection and energy storage, A.C. fundamental, wave shape, cycle, frequency, time period, peak, average and r.m.s. value, form factor, phase difference, peak factor, power factor, Series A.C. RLC circuit.

**Electrical Machine :** Magnetic effect of current, Faraday's law of electro-magnetic induction, force acting on a current carrying conductor in a magnetic field and torque production, D.C. machine-working principle of D.C. motor and D.C. generator, D.C. motor starting and speed control, common faults, causes, testing and applications, Single phase transformer - working principle. Turns ratio, voltage, current, power relation and applications, Single phase A.C. motor - commonly used single phase A.C. motors, starting, speed control, installation, testing, common faults and their causes and testing, Universal motor.

**Instruments :** Permanent magnet moving coil and moving iron, voltmeter and ammeter, Dynamometer type wattmeter, ohm meter, megger, induction type energy meter, their connection and application for measurement.

**Electrical Appliances :** Construction, principles, connection, common faults their causes and testing of the following equipments, Electric room heater, electric iron, electric stove, geyser,

electric kettle, electric fans, (ceiling and table fan).

**House Wiring :** Cleat wiring, casing and capping wiring, batton wiring, conduit wiring and PVC wiring, controlling of lamps from two of three places. Schematic diagram of service connection.

Testing and connection of domestic wiring installation, Wiring faults and rectification, Installation of plate and pipe earthing, Procedure for measurement of earth resistance.

**Electrical Drawing :** Symbols used for common electrical equipments/appliances, Simple schematic and wiring - diagrams.

## **Mechanical Engineering :**

### **MECHANICAL CRAFTSMANSHIP TRADE:**

Sheet metal operations, Tools and their specifications, carpentry (selection and wood working), pattern making; Various fitting tools and their specifications; Limits, fits and tolerances; Engineering and geometrical drawing; projections; isometric drawing; Reading engineering drawings;

Basic manufacturing processes like casting, forming welding and metal cutting, various casting processes, sand casting, die casting, centrifugal casting. Gating and riser, casting defects, melting furnaces.

Forging hammers and presses and various forging operations like upsetting, drawing, stamping etc. stock calculations.

Various welding processes and equipments, Arc welding, gas welding, electrode specification and IS codes, Arc characteristics, TIG, MTG welding, soldering and brazing.

Various machine tools like lathe, milling, shaping, drilling machines, simple calculations, Various operations like turning, facing, threading, knurling, groove cutting etc., Taper thread cutting calculations, key way cutting on milling machine; different Grinding methods;

Materials for machine tool components and cutting tools, coolants, lubricants

Measuring Tools (i.e. vernier, micrometer, gauges, comparators etc.).

### **AUTOMOBILE TECHNOLOGY TRADE :**

Different types of automobiles, types of IC engine and their components, auto cycle and diesel cycle, IHP, BHP and FHP and their calculations, cooling system, lubrication system, differential, transmission system, braking system, and lighting system, Two stroke/four stroke engines, valve timing diagrams, carburetor and injector repairing of trouble shooting and remedial measures, servicing of a vehicle, repairs, cost estimation, functions of gear box of scooter, car or truck, working of dynamo, fuel pumps, function of clutches used in Indian cars, motor cycles or scooters, Bleeding of fuel system of diesel engines, engine tuning, steering mechanism, wheels and tyres and their repairs.

### **REFRIGERATION & AIR CONDITIONING TRADE:**

Refrigeration systems, Air cycle refrigeration, vapor compression cycle, deviation of actual cycle from the theoretical cycle, study of charts and tables for refrigerants. Refrigeration of refrigeration processes on temperature - entropy and pressure - enthalpy diagrams. Absorption - compressor, evaporator, pumps, valves. Object of air conditioning, humidification and dehumidification, drying, evaporative cooling, comfort charts, year round air conditioning, air conditioning of cold storage, auditorium, aircrafts, locomotives. Sensible and latent heat, head load calculation, Psychrometry, use of psychrometric chart, air distribution and Ventilation systems, Types of fans and their ratings and mountings.

### **STRUCTURE AND FABRICATION TECHNOLOGY TRADE:**

**Strain stress Analysis : Simple stresses and strains :** Normal and shear stresses, hook's law, Elastic limits, Ultimate strength, Breaking stress, factor of safety, lateral strain, Poisson's ratio.

**Bending moment and shear force (Simple Treatment) :** Introduction to types of loading, Concept of bending moment and shearing force, Concept of B.M. and SF diagrams, Examples of

simple types of loadings on simply supported and cantilever beams.

**Bending Stresses :** Concept of bending stresses, neutral axis, moment of inertia of sections, strength of sections (only standard sections).

**Tool Materials and Heat Treatment of Steel :** Introduction to plain carbon tool steels and Alloyed tool steels, Applications, Concept of critical temperatures, Heat treatment processes - Annealing, Hardening, Tempering, Normalizing, Case Hardening, Types of furnaces (Introductory), Quenching media.

**Metal Sawing and Cutting Equipment :** Description of metal sawing machines, Power saw blades, Description of punching and shearing machines and their applications, nibbling machine etc.

**Mechanical Working of Metals :** Introduction to cold working and hot working. Introduction to spinning, drawing, stamping, beading, embossing, pressing, punching, rolling Extrusion processes.

**Metal Joining Processes :** Introduction of Riveting, Types of Rivets, Methods of Rivetting, Types of Rivetted Joints, Introduction to soldering brazing, Types of Joints for welding, Shielded Metal arc welding, Tig, Mig welding, Resistance welding process, Inert Gas arc welding, Submerged arc welding - Applications, Inspection of welded joints, Gas cutting, welding of cast iron by gas welding and arc welding, welding of Aluminum, Aluminum alloys, stainless steel. Cost estimation of welded work.

**Pipes and Pipe Joints :** Classification of pipes according to materials used and field of application, Types of pipe fittings, Cutting, threading and jointing of pipes, Laying of pipelines.

**Metal Cutting Processes :** Introduction to different metal cutting processes, Comparative study of following machine tools for machining operations (only specifications, relative advantages and suitability of each machine tools for different manufacturing processes).Lathe, Shaper, Planer, Slotter, Milling machine, Broaching machine, Forging machine, Grinding machines.Introduction to different types of cutting tools (Types of

chips, speed, feeds and depth of cut, cutting fluids).

**Surface Finish :** Primary texture, secondary texture, Errors of forms, Designation of surface roughness as per BIS specifications.

**Fits and Tolerance :** Concept of interchangeability, limits of size, basic size, Tolerance, Tolerance Zone, System of Tolerances, Introduction to fits, Types of fits, BIS specifications.

**Jigs and Fixtures :** Function of Jig and Fixture, Types of Jigs, Types of Fixtures, Example of simple jigs and fixtures and their use in structural fabrication.

**Measuring Instruments :** Standard of measurement, Study of Vernier calliper, outside and inside micrometers, Vernier Depth Gauge, Combination set, Dial Indicator, Limit Gauges, Screw Pitch Gauges, feeler gauges.

**Quality Control :** Concept of Probability, sampling inspections and inspection by attributes. Introduction to statistical quality control, normal distribution, standard deviation, Process capability.

**Costing and Estimation :** Difference between estimating and costing. Importance of estimation and costing, Importance of realistic estimates, Elements of cost, Fixed cost and variable cost, Depreciation, Calculation of machine time for turning, screw cutting, shaping, Standard time and its computation.

### **III. For 10+2 Vocational or NERIST certificate (Forestry) seeking admission to Degree Module in Forestry.**

**Full Marks : 150                      Time:3 Hours**

#### **Section-A**

<b>A-1 Physics</b>	<b>20 marks</b>
<b>A-2 Chemistry</b>	<b>20 marks</b>
<b>A-3 Biology</b>	<b>30 marks</b>

#### **Section-B**

**B-1 Common Biological Science** **30 marks**

**B-2 Vocational (Forestry/Horticulture)** **50 marks**

**Section-A-1 Physics** **20 marks**

**Section-A-2 Chemistry** **20 marks**

**(Syllabi for Section A-1, Physics & Section A-2, Chemistry are same as given above for 10+2 vocational/NERIST certificate (Engineering and Technology))**

## **SECTION - A3**

**Biology** **30 marks**  
(For admission to Degree Module in Forestry ).

**PLANT SCIENCES** :Classification of plant kingdom-artificial, natural and phylogenetic systems; Morphology-root, stem, leaf and their modifications; Flower and fruits, seed and seed dispersal; Anatomy-tissue system, secondary growth in root and stem; Physiology-water relations, ascent of sap, transpiration, photosynthesis, and respiration; Plant nutrition-micro and macro-elements; Movement in plants; Embryology-double fertilization and triple fusion; Development of dicot and monocot embryos; Plant pathology-Important plant diseases and their control measures; Insectivorous plants-Pitcher, Drosera, Bladderwort, etc.

**ANIMAL SCIENCES** :Classification of Animal Kingdom: Invertebrates-nematodes and arthropods (insects); Vertebrate-Amphibia, Aves, Reptiles and Mammals; Economically important animals; Wildlife-exploration, management and conservation, threatened animal species – in situ and ex-situ conservation techniques. Conservation projects-Tiger, Lion, Elephant, Crocodile projects, etc.

**ECOLOGY AND ENVIRONMENT** :Levels of organization: species, population, community, ecosystem and biosphere; Ecosystem-structure and function; Productivity; energy flow; nutrient cycling; major biomes; Natural Resources and their Conservation; Environmental pollutions; Global environmental changes; biotic resources; biodiversity; environmental ethics; Botanical garden and Herbaria, Zoological parks and Museum.

## **SECTION - B1**

**Common Biological Science 30 marks**

(Common for 10 + 2 Vocational and NERIST Certificate holders in Forestry/ Horticulture seeking admission to Degree Module in Forestry).

**PRINCIPLES OF LIFE SCIENCE** : Introduction, theories of origin of life, origin of life in relation to geological clock, evolution on living earth crust and its maintenance; Biological diversity: Diversity of prokaryotes and eukaryotes, the five kingdoms of life, biological classification, salient features of each group with example, study of representative genera of each group, binomial nomenclature, biodiversity and conservation of plants, animals and microbes, protected areas and conservation; Cell biology: cell theory, different cell organelles, their structure and functions, biochemistry of cell; Cell division: mitosis and meiosis; Genetics: Mendelian inheritance and deviations, Linkage and crossing over, Sex link inheritance, chromosomes and genes, their structure and functions, genetic recombination; Biotechnology: Biotechnology: concept and scope, role of biotechnology in genetic improvement and disease resistance; Environmental ecology: man and biosphere, public health and communicable diseases.

## **SECTION - B2 Vocational Subject**

**Forestry/ Horticulture 50 Marks**

(For 10+2 Vocational and NERIST Certificate holders in Forestry seeking admission to Degree Module in Forestry )

**Forest and Trees** : Classification of forest vegetation, forest components, structure and function of trees.

**Habitat Factors** : Climatic, Topographic, Edaphic and biotic factors.

**Forest and Tree Regeneration** : Types of regeneration – natural and artificial, tending operations.

**Plant Nutrition** : Essential elements for plant growth, manures and fertilizers.

**Management of Ornamental and Forest Crops** : Asexual and sexual propagation of crops, nursery management, Layering, grafting and budding.

**Concepts of Agroforestry and Social Forestry** : Scope and objectives, types of agroforestry systems, people's participation in social forestry.

**Forest Products and their utilization** : Definition and scope of Forest utilization, softwood and hardwoods, wood seasoning and

wood preservation, composite woods, utilization of NTFPs.

**Forest Mensuration** : Measurement of diameter, girth, height and volume of individual trees and crops.

**Wildlife** : Laws and Acts, conservation and management, threatened species, conservation measures and importance of wild life.

**Tree Biomass and Its Estimation** : Tree growth and development, Estimation of biomass and productivity. Forest measurement-different devices.

## **.SYLLABI FOR NEE-III**

### **SECTION-‘A’**

#### **PHYSICS**

**25 MARKS**

**Units:** Fundamental & derived units with particular reference to S.I. units-illustrations. Explanation of dimensions with examples.

**Mechanics:** Explanation of vector and scalar quantities with examples. Displacement as vector quantity. Concepts of instantaneous velocity, acceleration. Equations of motion. Definition and explanation of Laws of motion, force, mass and weight with mathematical expressions, Universal Laws of gravitation and Projectile motion. Explanation of circular motion, Satellite motion in an orbit : Kepler’s Laws, escape velocity. Rigid body motion, moment of inertia, angular momentum, torque, Centre of mass, conservation of angular momentum. Simple harmonic motion and its geometric representation. Derivation of its equation. Concepts of amplitude, Oscillation, time period, frequency and phase with their mathematical expressions. Definition and explanation of work, power and energy with mathematical relation. Problems involving potential and kinetic energies and conservation of energy. Conservative and non-conservative forces. Static and Dynamic friction.

**Properties of Solids:** Definition and explanation of strain, stress, elastic limit, ultimate strength, Hooke’s Law and Young’s modulus. Compression bending,

twisting and shear. Elastic moduli and their relations, Poisson’s ratio. Concepts and examples of properties e.g. hardness, malleability, ductility, brittleness, toughness abrasion resistance, fatigue.

**Properties of Liquids** : Thrust of a liquid and pressure. Pressure at different depths. Pascal’s Law and Hydraulic press. Buoyancy. Archimedes’s Principle: definition and explanation with illustration surface tension, viscosity, fluidity and volatility.

**Heat & Thermodynamics** : Heat and temperature, Construction of mercury thermometers. Measurement, measuring scales and devices.

Definition and explanation of linear expansion. Area and volume expansion with mathematical relation.

Expansion of gas at constant temperature and at constant pressure. Ideal gas equation.

Measurement of specific heat capacity, relation between  $C_p$  and  $C_v$ , Isothermal and adiabatic process. Explanation of change of state of matter with change of temperature. Definition of latent heat of fusion and vaporization and numerical examples.

Transfer of heat, Explanation and examples of conduction, Convection and radiation processes. Thermal conductivity. Idea of black body radiation. Stefan - Boltzman Law.

Explanation of first and second laws of Thermodynamics with examples.

**SOUND** : Wave motion, Concept of longitudinal and transverse waves; Definition of period, frequency, wave length, amplitude and phase; Speed of sound wave; wave propagation in a medium; Doppler effect.

Properties of sound waves, Reflection, Refraction and Superposition of waves, stationary waves, beats, Vibration of Strings and Air columns, concept of resonance; Echo, Reverberation.

**LIGHT** : Explanation of light wave, wave front, ray, velocity of light.

Laws of reflection, reflection in different types of mirrors(plane, spherical, cylindrical, parabolic) with their geometrical drawing. Definition of image, focal length, radius of curvature, magnification with formula, numerical examples and application.

Laws of refraction, refractive index, total internal reflection, concave and convex lenses and image formation through them, formula connecting object and image distances, application in telescopes, microscopes, theodolite etc., refraction through prism.

Elementary ideas of electromagnetic waves. Wave nature of light. Young's double slit experiment and Fringe width. Single slit diffraction, polarisation.

**ELECTROSTATICS :** Explanation of charge on the basis of electron theory, charging by friction, force between electric charges, concept of unit charge, electric field and electric potential, p.d. and its measurement, definition of capacitance of parallel plate capacitor, capacitors in series and parallel. Dielectric constant.

**CURRENT ELECTRICITY:** Definition of emf, potential difference and current with illustrations. Basic direct current circuits: Units of current, resistance and conductance, Ohm's Law and solution of simple problems, effect of temperature on resistance. Series and parallel connections of resistors. Kirchoff's rules, their applications and examples.

#### **MAGNETIC PROPERTIES OF MATERIALS**

Type of magnetic substances, magnetic flux, flux density, relative permeability, magnetic properties of soft iron and steel.

**ELECTROMAGNETISM:** Nature of magnetic field due to a straight conductor, a circular conductor and a solenoid, Fleming's left hand and right hand rule, Effect of current flowing through two parallel conductors, Biot - Savart Law.

Electromagnetic induction: e. m. f. induced in a coil by magnet, Faradays's law of induction, Calculation of e.m.f., Direction of induced e .m .f. Lenz's Law, Explanation of eddy current and explanation of self and

Mutual induction, Calculation of self and mutual inductance.

Generation of alternating e.m.f. Concept of reactance : Capacitive and inductive, Impedance. Simple a.c. circuits analysis.

**MODERN PHYSICS:** Photoelectric effect, structure of atom, atoms and molecules, intermolecular forces, chemical bonding. Crystal structure with simple examples.

Radio-activity. Explanation of fission and fusion processes.

**SEMICONDUCTORS:** Properties and basic principles, p and n types, Action of transistors.

## **SECTION-'B'**

### **CHEMISTRY**

**25 MARKS**

#### **(A) PHYSICAL CHEMISTRY**

**States of Matter:** Gaseous State: Postulates of kinetic theory of ideal gases; Derivation of kinetic equation; Derivation of Ideal gas equation. Continuity of states, Liquefaction of gases. **Solid State:** Structure of solid unit cell, fcc, bcc, ccp structure of solids.

**Solution and Colloidal solution:** Concentration of solutions: Mass percent, Mass fraction, Mole fraction, Molality, Normality, Molarity. Dilute solutions: Raoult's law, its statement and explanation; Ideal and non-ideal solutions; Colligative properties: Relative lowering of vapour pressure, Elevation in boiling point, Depression in freezing point, Osmotic pressure and its determination. Determination of molecular masses based on colligative properties; Van't Hoff theory of dilute solutions, Van't Hoff factor.

**Colloidal solutions:** Definition, Classification, and Preparation of colloidal solutions; Properties of colloidal state: Tyndall effect, Electrophoresis, Brownian movement; Protective colloids.

**Thermodynamics and Thermochemistry:** First law of thermodynamics, mathematical formulation of the law, Isothermal and adiabatic changes; Relation between heat capacities at constant pressure and constant volume; Second law of thermodynamics: Carnot's cycle and derivation of an expression for efficiency of a reversible engine. Concept and physical significance of Entropy, Gibbs energy and work-function relation; Gibbs energy change and chemical spontaneity. Thermochemistry: Heats of reaction, Hess's Law of constant heat summation.

**Kinetics and Chemical Equilibrium:** Rate of reaction, law of mass action, velocity constant. Reversible reactions and chemical equilibrium, Equilibrium constant. Le Chatelier's principle (statement, explanation and its industrial applications). Molecularity and Order of reaction, First and Second order of reactions, Rate law equation and mechanism of reactions.

**Ionic Equilibria:** Modern Ionic theory; Modern concepts on acids and bases; Strength of acids and bases, Ionic product for water, pH

scale. Common-ion effect and Solubility product, Their applications in qualitative inorganic analysis and indicators.

## **(B) INORGANIC CHEMISTRY:**

**Atomic Structure and Chemical Bonding:** Electrons, protons and neutrons, their charges and relative masses. The early models of the atom. Rutherford's model, Hydrogen spectra; Failure of Rutherford's model. Bohr's model of hydrogen and hydrogen like atoms; Dual nature of electron, de-Broglie equation, Uncertainty principle. Quantum numbers (i.e., quantum numbers and their application to electronic structure of atoms), Concept of atomic orbital, Pauli's exclusion principle, and Hund's rule, Aufbau principle.

**Ionic Bonds:** Definition, factors influencing the formation of ionic compounds, Lattice energy of ionic compounds. **Covalent Bonds:** Nature of covalent bond (Lewis concept), Concept of orbital overlap in bond formation, Sigma and pi bonds, Hybridization of atomic orbital ( $sp$ ,  $sp^2$ ,  $sp^3$  hybridization), Properties of covalent compounds, Structure of simple molecules such as  $H_2O$ ,  $NH_3$ ,  $CH_4$ ,  $C_2H_4$ ,  $C_2H_2$ ,  $PCl_5$  and  $SF_6$ . **Co-ordinate covalent bonds:** Lewis concept, structure of  $H_3O^+$  and  $NH_4^+$  ions on the basis of hybridization, Properties of co-ordinate covalent compounds.

**Metallic bonds:** Bonding in metals (elementary treatment only), Insulators, Conductors and Semi-conductor, Extrinsic semi-conductors (n-type and p-type). **Hydrogen bond:** Types of hydrogen bond, Consequences of hydrogen bonding.

**Periodic Properties of Elements:** Mendeleef's periodic table and periodic law; Long form of periodic table, its merits and demerits. General characteristics, Properties of s-block, p-block and d-block elements. Trend of periodic properties of elements such as atomic volume, atomic radii, ionization potential, electron affinity and electronegativity in periodic table (qualitative treatment only).

**Metallurgy:** General principles of extraction of metals, Occurrence of

metals, sources of different metals. General method of extraction of metals by pyrometallurgical process and by electrolysis (different principles only).

**Ferrous metallurgy:** Ores of iron, Metallurgy of iron and manufacture of steel. Properties of Cast iron, Wrought iron, Steel; Effects of carbon, silicon, phosphorous, sulphur, manganese on cast iron and steel.

**Non-ferrous metallurgy:** Ores of aluminium and copper, Metallurgy of aluminium and copper; Properties and uses of Lead, Zinc, Tin and Chromium.

**Alloys:** Effects of carbon and other alloying elements on the properties of steel. Composition and uses of the following alloys: Brass, Bronze, German silver, Bell metal, Gun metal, Duralumin, Nanganin, Type metal, Nichrome and Solder.

**The chemistry of some chemicals:** Ammonia, Nitric acid, Sulphuric acid, Hydrochloric acid, Hydrogen and Oxygen.

## **(C) ORGANIC CHEMISTRY:**

**Introduction:** Classification and nomenclature of organic compounds. Qualitative detection of Nitrogen, Sulphur and Halogens.

**Hydrocarbons:** Saturated and unsaturated aliphatic hydrocarbons. Preparation and properties with special reference to methane, ethane, ethylene, acetylene. **Aromatic hydrocarbons:** Preparation and properties of benzene; Structure of benzene. **Haloalkanes and Haloarenes:** Preparation, properties and uses of haloalkanes and polyhalogen derivatives such as  $CHCl_3$ ,  $CHI_3$ , DDT.

**Compounds with functional groups containing oxygen:** General methods of preparation and properties of Alcohols and phenols, Aldehydes and ketones, Carboxylic acid and acid derivatives.

**Compounds with functional groups containing nitrogen:** Preparation and properties of Nitrocompounds, Amines and Azo-compounds.

## **(D) INDUSTRIAL CHEMISTRY**

**Plastics & Polymers:** Definition of a polymer; Polymerization (Addition and condensation);

Thermoplastic and thermosetting resins;  
Some commercially important plastics.  
Rubbers and their vulcanization.

**Fuels:** Definition of fuel, classification of fuels with examples; Calorific value (gross and net). Solid Fuels: Different types of solid fuels, ignition point, Carbonization of coal, Destructive distillation of wood (name of different products only). Liquid fuels: Fractional distillation of crude oil (only names of different fractions, boiling ranges and uses of different fractions); Properties of liquid fuels: Flash point, power point, viscosity, specific gravity carbon residue; Octane and cetane number. Gaseous fuels: Different commercial gaseous fuels with their composition and calorific value; Manufacture of Producer gas and Water gas (principles with physico-chemical reactions only).

**Water:** Hard and soft water, Boiler feed water, Scale formation, Priming and foaming, Caustic embrittlement, Water softening methods, Treatment of water for town supply and sewage disposal.

**Corrosion and its protection:** Definition, Theories of corrosion, Factors affecting rate of corrosion, Rusting of ferrous metal, Demerits of corrosion, Prevention of corrosion by various methods.

**Environmental Pollution:** Air and water pollution: causes and remedy.

## SECTION-‘C’

### MATHEMATICS 25 MARKS

**Algebra :** Arithmetic, Geometric and Harmonic Progressions, Permutation and Combination, Binomial expansion for positive index, middle term, greatest term, binomial expansion for general index. Determinants up to third order, their properties and application to solve linear algebraic equations (Cramer’s rule), concept of a matrix, types of matrices, equality of matrices, operations of addition, scalar multiplication and

multiplication of matrices, determinant of a square matrix, transpose, adjoint and inverse of a matrix, consistency and inconsistency of a system of linear equations, solving a system of linear equations in two or three variables using inverse of a matrix.

**Trigonometry :** Inverse trigonometric functions, solution of inverse trigonometric equations.

**Coordinate Geometry(2D) :** Points and their coordinates in a plane, distance formula, area of a triangle, condition for the collinearity of three points and section formula, various forms of equations of a line, intersection of lines, angles between two lines, condition of concurrency of three lines distance of a point from a line, pair of lines, circle, tangents and normal to a circle, simple problems on parabola, ellipse and hyperbola.

**Differential Calculus :** Partial derivatives, maxima & minima of single & two variables, tangent and normal, curvature and derivative of arc.

**Integral Calculus :** Integration of rational and irrational functions, integration of transcendental functions, definite integration, area bounded by curves, length of arc and volume of surface revolution.

**Differential equation :** Differential eqs. Of first and second order of degree first & their applications.

**Vector Calculus :** Idea of gradient, divergence & curl, line integral, surface integral & volume integral.

**Coordinate Geometry (3D) :** Points and coordinates on 3-dimensional space, Distance between points, direction cosines, direction ratios, projections, equation to a plane, angle between planes, distance of a point from a plane, angle between lines & planes, condition of co planarity of two lines, shortest distance between two lines, condition for the intersection of two lines.

**Probability :** Problems on probabilities, conditional probability, Baye’s Theorem, Binomial & Poisson distributions.

## SECTION- D

### 2.1 AGRICULTURAL ENGINEERING

:

75 MARKS

**General Engineering Science:** Laws of thermodynamics Zeroth law, first law, second law. Concept of enthalpy, internal energy, entropy and absolute temperature. Properties of pure substances and mixtures, reversibility and irreversibility. Thermodynamic cycles, Carnot cycle and steam power cycles, otto, diesel and dual cycles.

Equivalent forces at a point, simplest resultants in two and three dimensions, equations of equilibrium, free body diagrams and reactions. Two dimensional frames and trusses. Principle of virtual work, friction forces. Belt, rope and chain drive and power screws. Centroids, mass centers, second moment and product of inertia of plane area. Velocity, acceleration, rectilinear, curvilinear coordinate system and relative motion, particle dynamics, equation of motion.

Concept of stress and strain, normal and shearing stresses and strains. Stress-strain diagrams for uniaxial loading. Deformation of axially loaded members, torsion of circular shafts. Stress and deflections in closed coiled helical springs subjected to flexural loads. Reactions for statically determinate beams, relationships between load, shearing force and bending moment, shear force and bending moment diagrams. Theory of simple bending stresses, shearing stresses in beams, principal stresses and principal planes, principal strains, principal stresses in 3 D, relation between elastic constants, combined torsion and bending, pressure vessels, biaxial stresses, yield theories, deflection of beams.

Properties of fluids. Pressure and its measurement. Hydrostatic forces on surface. Kinematics and dynamics of fluid flow. Dimensional analysis and similitude. Laminar and turbulent flow in pipes, general equation for head loss, energy loss through pipe fittings.

Measurement of distance and areas. Principle and methods of chain surveying, prismatic compass and chain traversing. Theodolite traversing. Plane table

surveying including two point and three point problems. Leveling and contouring, measurement of areas and volumes.

Engineering properties of granular materials, soil classifications, fundamental definitions and relationships. Determination of index properties of soil. Permeability and seepage analysis. Stress distribution. Shear strength. Mohr's circle of stresses. Compaction. Active and passive earth pressures. Stability analysis of earthen slopes.

**Farm Power and Machinery:** Salient features of various sources of farm power used in India, Farm engine, tractors and power tillers, their selection, operation and adjustment. Principles of working and construction of I.C. engine. Engine valves and operating mechanism, fuel and combustion. Different systems of I.C. engine such as fuel, lubrication, cooling, intake, exhaust etc. Study of clutch, brake, gearbox, differential, final drive hydraulic and electrical system of farm tractors. Use of electrical motors as a source of farm power.

Scope, need and constraints of mechanization. Types of implements, field capacities, constructional details, design criteria and principles of operations of different types of hand tools. Animal, power tiller and tractor operated primary and secondary tillage implements such as indigenous plough, mould board plough, disk plough, rototillers, harrow, cultivator, subsoiler, leveler etc. Types, principles and constructional details of weeder, seed and fertilizer drill, planters, transplanters, sprayer, duster, mower, vertical conveyor reaper, threshers and combine harvesters.

**Soil and Water Conservation Engineering:** Water resources utilization in India. Ground water resources development and utilization, Hydraulics of wells, open well and tube well design and construction. Water lifts and irrigation pumps. Measurement of irrigation water. Water conveyance and its control. Irrigation efficiencies, irrigation scheduling. Design of irrigation channel and seepage analysis. Design of underground pipelines. Soil-plant-water relationships. Land grading and field layout for efficient irrigation. Introductory concept of farm irrigation methods: border, check basin, furrow, sprinkler and drip. Drainage: importance, problems, types and requirements in agriculture, drainage coefficient, dynamics of soil-water,

measurement of soil permeability, field drainage layout patterns.

Hydrology: Hydrologic cycle, precipitation, infiltration, evaporation, runoff and its estimation and measurement. Types and mechanics of wind and water erosions, biological and engineering measures of controlling erosion, gully control and gully control structures. Vegetative waterways and their design, stream bank erosion and its control, design, construction and maintenance of farm ponds. Introduction to watershed management.

**Post Harvest/Process, Food Engineering and Farm Structures:** Engineering properties of biological materials: rheology of agricultural products. Mixing and mixers. Psychrometry; theory of grain drying, different types of grain dryers and dryer efficiency. Size-reduction and energy requirement, Kick's law and Rittingers, law, roller mill, burr mill and hammer mill. Storage of grains, lateral and vertical pressure relationship.

Importance of agricultural processing: process of cleaning, grading and sorting, and related equipments. Material handling equipments. Processing of cereals, pulses, oil seeds. Layout, maintenance and testing of related machinery and plant. By-products utilization; combustion, gasification and other chemical and bio chemical transformations.

Properties and classification of building material like bricks, lime, cement, sand, coarse aggregates, timber, asbestos, glass etc. Animal shelters and storage structures in fans.

## **2.2. CIVIL ENGINEERING:**

**75 MARKS**

### **STRENGTH OF MATERIALS & THEORY OF STRUCTURES:**

Normal stress, shearing stress, Normal strain, Hooke's Law, Stress-strain behaviour of mild steel, Poisson's Ratio, Shearing strain, Torsion of Circular Shaft, Relations among load, Shear and Bending Moment, Shear and Bending-Moment Diagrams, Pure Bending, Bending of Members Made of several Materials, Shearing Stresses in a Beam, Mohr's Circle for Plane Stress, Principal Stresses,

Maximum Shearing Stress, Euler's Formula for Pin-Ended Columns and columns with other End conditions.

Equation of the Elastic Curve by Double Integration Method, Slope and Deflection of Determinate Beams by Moment-Area Theorems, Deflections and Slope by Energy Methods, Castigliano's Theorem, Stability and Degree of Indeterminacy, Rolling loads and Influence lines for Determinate Beams, Trusses, and Floor Girders, Cables and Three-Hinged Arch.

### **WATER RESOURCES ENGINEERING:**

Hydrology: rainfall, stream flow measurements, runoff, hydrographs, flood studies, reservoir and channel routing flood forecasting, flood protection measures, river training works, well hydraulics. Irrigation:

Command area, duty and delta, canal outlets, crop-water requirement.

### **FLUID MECHANICS.**

Properties of Fluid, Manometry, Forces on Plane and Curved surfaces, Flow classification, Continuity Equation, Momentum Equation, and Energy Equation and their Applications, Orifices, Venturimeter, Weirs and Notches, Laminar and Turbulent Flow through Pipes, Darcy Weisbach Equation, Moody Diagram, Steady Uniform Flow in Open Channels, Mannings's Formula.

### **GEOTECHNICAL ENGINEERING:**

Preliminary definitions & relationship, Determination of index properties, classification of soils, soil structure and clay mineralogy, permeability, Darcy's law, seepage analysis, compaction, one dimensional consolidation, Terzaghi's theory, shear strength, theoretical consideration and tests, shallow and deep foundations, soil exploration.

### **HIGHWAY AND RAILWAY ENGINEERING:**

Highway Geometric Design: Cross sectional elements, Sight distances, horizontal and vertical alignments; Types and components of Pavement structures, Design of Flexible Pavements; Traffic Characteristics: Road user and vehicular characteristics, traffic volume studies, O-D studies and traffic capacity studies;

Railways: Components, construction and maintenance of rail tracks, points and crossings.

### **SURVEYING:**

Contouring, Theodolite and its adjustment, measurement of angles and setting out lines, Trigonometrical leveling, Tacheometry, Curves and different methods of setting out curves,

Introduction to electronic Theodolites and Total Stations.

**STRUCTURAL DESIGN :**

Working stress methods of design, singly and doubly reinforced sections, rectangular and Tee beams, shear, torsion and development length, one and two way slabs, short and long column, Design of isolated footings, Introduction of limit state design, Design for flexure, shear and compression, Design of riveted and welded connections, tension and compression members, splicing and lacing, Beam column connection, roof trusses.

**ENVIRONMENTAL ENGINEERING:**

Estimation of quantity of water, per capita demand, population forecasting, water quality parameters, treatment of water, distribution system, Estimation of quantity of sewage, dry weather flow and storm run off, sewer appurtenances, characteristics of sewage, treatment and disposal of sewage, sludge digestion.

**2.3.COMPUTER SCIENCE AND ENGINEERING**

**75 MARKS**

**Operating System & System Software:**

Overview of Operating Systems, Operating Systems Structures, Uses, Types and Functions of Operating Systems. File Systems, File System Implementation. Concept of Process-Process Management, Process Synchronization and Deadlocks, Inter-process Communications, CPU Scheduling. Memory Management – Allocation Schemes, Paging Segmentation, Virtual Memory, Demand Paging, Paging Replacement Algorithms. Disk Management – Disk Scheduling Algorithms. System Softwares- Functions and Uses of System Software, Assemblers, Loaders, Linkers, Pass Structure of an Assembler, Loading Schemes, Macro and Co-Routines, Macro Processing and Macro Calls, Sub-Routines and Sub-Routine Calls.

**Digital Electronics & Elements of Logic Design:** Various Number Systems and their Implementation, Binary Arithmetic, 1's Complement, 2's Complement, 9's Complements & 10's Complements of a

number. Floating Point Numbers, Boolean Algebra and Logic Functions. Different Methods of Minimizing Boolean Functions. Design of Combinatorial Circuits – Adders, Multiplexer, Demultiplexer, Decoder, Parity Generator and Checker, Comparator Etc. Switching Algebra, Function Decomposition, Symmetric Function, Contact Networks, Design of Sequential Circuits (Synchronous & Asynchronous) Flip-Flops, Register, Counter Fault Tolerant, Hazard, Stuck-At-Fault, Bridging Fault, Stuck-Open-Fault.

**Microprocessor, Computer Architecture & Organization :** 8085 Microprocessor Architecture, Instruction Set, Assembly Language Program, Counters and Delays, Interrupts, Interfacing Data Converters, Programmable Interface Devices : 8155 Multipurpose Programmable Device, 8279 Keyboard/Display Interface, 8254 Interval Timer, 8259 Interrupt Controller, 8237 DMA Controller.

CPU Structure and Function, Basic Idea of Hardware And Software, Instruction Sets : Characteristics, Functions and Formats, Addressing Modes; Computer Arithmetic, Control Unit : Microprogram Control, Hardwired Control; Memory : Internal Memory Organization, External Memory (Magnetic Disk, RAID, Optical Memory, Magnetic Disk), Cache Memory and Mapping Procedures; I/O Organization : Interrupts, Programmed I/O, Interrupt-Driven I/O, DMA, I/O Channels, Standard I/O Interfaces; RISC and CISC Processor, Basics of Parallel Processing, Pipelining.

**Programming Language Concepts :** Programming in C And C++, Syntax, Preprocessor Directives, Built-In Data Types, User-Defined Data Types, Operators and Precedence, Loops and Conditional Flow of Control, Enumerated Types, Arrays, Variable Types and Scope of Variables, Global, File and Namespace, Functions, Pass By Value, Pass By Reference, Input and Output Handling, File Handling. Operator and Function Overloading, Single Inheritance, Polymorphism, Virtual Member Functions, Constructor and Destructor, Information Hiding, Encapsulation, Data Members, Member Functions, Public and Private Access.

**Data Structures :** Arrays, Link Lists, Stacks, Queues, Trees, Graphs : Representations, Implementations and their Applications –

Arithmetic Expression Evaluation, Recursion, Priority Queues, Etc., Graph and Tree Traversals, Basic Search Techniques : Tree Searching: Binary Search Trees, Avl Trees, Etc., Hashing Techniques.

Basic Sorting Techniques : Bubble Sort, Insert Sort, Selection Sort, Radix Sort, Tree Indexes : M-Way Search Trees, B-Trees, B+Trees

## **2.4. ELECTRONICS & COMMUNICATION ENGG. MARKS :75**

### **ELECTRONIC DEVICES AND CIRCUITS:**

#### **Analog Devices & circuits:**

Physics of Semiconductor Materials & Components, Energy band diagram, Fermilevel, Hall effects.

**Devices:** Diodes, BJT,s FET,s, Thristors, Tunnel diodes, Basics of IC,s and operational amplifiers.

**Circuits:** Biasing circuits of transistors, Design of power supplies using Diodes and transistors-voltage Regulator Circuits Transistor Amplifier (BJT & FET), Power amplifiers, feedback amplifiers, oscillators (qualitative analysis only). Multivibrators, Time base circuits. Regulated Power supply.

Time base circuit-Saw-tooth voltage and current generators, transistor switches, wave shaping circuit

( diode & transistors)Electro-static and magnetic deflection methods, low frequency h-parameter transistor & FET models, Pi models.

### **DIGITAL DEVICES AND CIRCUITS:**

**Number systems:** logic gates-Boolean Algebra-Transistor as a switch-logic families-Arithmetic and logic circuits-Counters and shift registers-A/D and D/A converters, Multiplexer, Demultiplexer, Encoder, Decoder.

**Microprocessors:** Architecture-Assembly language programming of 8085-peripheral devices-Interfacing of memory and devices.

Semi Conductor Memories: RAM, ROM, Storage devices , printer, Connectors,

floppy drives, Organization of computer, simple programme.

### **ELECTRONIC INSTRUMENTATION AND MEASUREMENTS:**

Systems, units and standards of Measurement, AC and DC indicating instruments, AC and DC bridge circuits, Error Analysis of a generalized measurement systems, transducers (Strain gauge, LVDT. Thermistor, Thermocouple etc.) Electronic Measuring Instruments, CRO, Digital Ammeter, Millimeter, Voltmeter, Time and Frequency measurements, Signal Generators, Q-meter, Wattmeter, Energy meter.

### **NETEORKS-FILTERS AND MICROWAVE ENGINEERING.**

Network theorems, Single and Two port networks, T-type, II-type ladder type networks. Transmission lines: Characteristics impedances, Attenuators, Equalizers, Basics of wave guides-Transmission line charts.

**Filters:** type, simple design problems, Basics of Electromagnetic theory , Maxwell's equations. Basics principles of wave propagation. Fundamentals of Antennas and Radar, Basics of Microwaves, EM Spectrum Principles of microwaves devices and circuits.

### **COMMUNICATION ENGINEERING:**

Introduction to signal analysis-Fourier series and Fourier transform. Sampling theorem, Parsevals theorem, convolution, Transmission through linear systems: AM,FM PM, Pulse modulation; PCM: Amplitude limiting in FM, Pre-emphasis, Deemphasis; Noise in AM and FM: Multiplexing-FDM, TDM; ASK, FSK, Block schematic of different transmitters for AM, FM,SSB, ISB systems; Superheterodyne receivers, Mixers, AGC, AFC, spectrum of EM waves; Propagation of EM waves-sky waves- sky wave, ground wave, space wave, skip distance, maximum usable frequency; Antenna fundamentals and Radiation; Communication systems;; Principles of telegraphy, telephony and television broadcasting , Basics of satellite and optical fibre communications: Fundamentals of telematics.

## **2.5. ELECTRICAL ENGINEERING**

### **75 MARKS**

#### **ELECTRICAL CIRCUITS :**

Phasors and phasor algebra, balanced and unbalanced poly-phase circuit, Test signals, Star-Delta transformation, Network theorems, Parameters of electromagnetic circuits, resonance in R-L-C Series and Parallel circuits, Network analysis by mesh and node methods.

#### **ELECTRICAL ENGINEERING MATERIALS :**

Conducting and Insulating materials, Magnetic materials, Properties and applications

#### **ELECTRICAL INSTRUMENTS AND MEASUREMENTS :**

Principles of measurements : Classification, accuracy and sensitivity, damping and control forces, shunt and multiplier, Measurement of resistance: Low, medium and high Principles and use of DC potentiometers, AC Bridges, Indicating instruments: Multimeter, PF meters, synchroscope.

#### **ELECTRICAL MACHINES :**

Classification of D.C. machines: Constructional features, e.m.f., torque, excitations, motor performance, speed, power, size considerations, speed control, efficiency.

Transformers: Induced e.m.f., equivalent circuits, regulation, different efficiencies.

Three phase induction machines: Torque characteristics, Starting, equivalent Circuits.

Three Phase Synchronous Machines: Generation, voltage regulation, parallel operation, synchronous motor, starting and V-curves, Single phase motors: type, starting characteristics.

#### **GENERATION; TRANSMISSION AND DISTRIBUTION :**

Generation: Thermal, Hydel and Nuclear Power Stations, Prime movers and alternators.

Transmission: Voltage levels, line conductors, electrical line parameters of short lines, voltage regulation, corona.

Distribution : D.C. and A.C. systems, voltage level, types of distribution feeders and distributors voltage drop and effects, power factor improvement plant.

Substation: Different types, site selection, equipments, electrical earthing.

Switchgear : Switch, isolators, circuit breakers types.

Protection: Fault current and protective devices, fuses, relay functions, alternator,

Transformer protection, thermal relays, over voltage-causes, effect and protective devices.

#### **ELECTRICAL ESTIMATION AND COSTING :**

Estimation of materials for industrial and residential installations. UPS and small diesel generating-set and accessories. Cost estimation of materials and selection criteria, Design and calculation of the cost of 400V/230V three phase 4 wire, 100-500 KW overhead line, Tenders.

#### **ELECTRICAL POWER UTILIZATION:**

Design of lighting system.

Electrical Heating: Resistance heating, induction heating Arc heating and Dielectric heating

Electrochemical process: Principles, equipment and procedure .

Electrical Drives: Characteristics of various electric drives, speed control, mechanical consideration, selection of motors.

#### **POWER ELECTRONICS :**

Power diodes and Darlington Pair

Thyristor: Principle, thyristor family, firing circuits, applications, Selenium rectifiers, uncontrolled and controlled rectification, Power MOSFETS.

#### **DIGITAL ELECTRONICS :**

Digital signals, gates, Boolean algebra, logic families, multiplexures/demultiplexure, Encoders/decoders, flip-flops, registers, counters and applications of logic gates, application of logic gates and OPAMPS in timing circuits, A/D and D/A conversion.

#### **COMPUTER PROGRAMMING :**

Concept of low level and high level languages, Block-diagram, concept of flow chart, and algorithm, Assemblers, Macros, sub-routines, co-routines, loaders, linkers, editors and compilers, programming and file handling in C and C++.

## **2.6.MECHANICAL ENGINEERING**

**75 MARKS**

### **ENGINEERING MECHANICS & STRENGTH OF MATERIALS :**

Vector concepts, rest and motion, Introduction to force systems (Parallel, Concurrent & Coplanar); Free Body Diagram; Equilibrium principle; Static analysis of systems with friction; Friction and impending motion; rolling and sliding of cylinders; Newton's law of motion and derived concepts. Centroid; Area & mass moment of inertia. Work-Energy principle; Impulse; Collision of two bodies; Plane motion of particles and applications; Static analysis of simple structures; Method of joints and method of sections. Virtual work; combined motion of rotation and translation; Transmission of power by belt and gear drives.

Stress & strain in tension, Compression; Shear stresses, Principal stress and strain, Mohr's circle for stress and strain analysis, Beams & columns; Support reactions; Shear force and bending moment diagram. Theories of Failures; Columns, Struts; Stress & strain analysis of shafts under torsion, analysis of springs.

### **ENGINEERING MATERIALS :**

Mechanical, thermal, chemical and manufacturing properties, structure of materials, alloys. Iron and its alloys, Iron carbon phase diagrams, steel and their important alloys of iron, heat treatment processes, Elastic & plastic behaviors; Plastic deformation. Effect of various alloying elements on mechanical properties of Iron: Bearing alloys; Powder and non ferrous metallurgy; Ficks law. Commonly used engineering materials for tools, engineering components and household objects.

### **DESIGN OF MACHINE ELEMENT :**

Concept of FOS, material selection, engineering materials, Design of Rivets, Screws, Bolts with detail analysis. Cotter and Knuckle joints, shafts, keys and couplings, Springs – helical and leaf types.

## **HYDRAULICS AND HYDRAULIC MACHINES :**

Properties of liquid, hydraulic pressure and its measurement, Forces on immersed bodies; Center of pressure; Buoyancy stability of immersed and floating bodies;

Flow of liquids : 1-D, 2-D, & 3-D flows; steady, unsteady, laminar and turbulent flows; continuity equation, momentum equation, and energy equation and their applications, Euler equation and Bernoulli's equation; Orifice, mouth piece and nozzles, flow through pipes and piping systems, losses in piping systems; fundamentals of channel flow, hydraulic jump; flow measurements :

Dimensional analysis and associated theorems. Non dimensional numbers and their significances;

Stream function and velocity potential function; streamline, streakline and pathline; Rotational and irrotational flow, circulation and vorticity; Free and forced vortex; Basic flows like rectilinear, source, sink, doublet etc.

Different types of pump, reciprocating and rotary pumps, operation and maintenances of pumps, Cavitation and NPSH; Characteristic curves of pumps, losses and efficiencies of pumps. Compressors, blowers and fans. Different types of turbines, Francis, Kaplan and Pelton turbines, operation and maintenance of turbines; characteristic curves, work done and efficiency of turbine, specific speed and selection of pumps and turbines. Hydraulic machinery like hydraulic ram, hydraulic coupling and torque converter, hydraulic jack, screw pump, Gear pump, Vane pump etc.

### **THERMAL ENGINEERING :**

Basic thermodynamic concepts; System and surrounding; Thermodynamic Properties; Intensive and Extensive properties; Point and path functions; Zeroth law, first and second laws of thermodynamics and associated corollaries; Concepts of absolute temperature, internal energy, enthalpy & entropy; Clausius inequality, concept of availability, Maxwell's relations. Application of thermodynamic laws, reversibility & irreversibility , internal & external irreversibility; Pure substances and mixtures.

Thermodynamic cycles, Carnot cycle, Rankine cycle, Joule Brayton cycle ; Air standard cycles; Otto cycle and Diesel cycles.

Ideal gas compression and compressors, jet propulsion, gas compressors, steam generators,

Fuel and combustion, I.C. engine, calculation of efficiencies, testing of IC. Engines; Open and closed gas turbine cycles, introduction to heat and mass transfer; heat exchanger; LMTD and NTU methods.

Principles of refrigeration, air refrigeration system, Vapor compression refrigeration system, refrigeration cycles, use of T-s & p-h charts for refrigeration, refrigerants and their properties, vapor absorption system, psychometric properties and charts.

Types of power plants; components of steam power plant; hydro-electric power plant, nuclear power plants, diesel power plant. Elementary solar and geothermal power systems.

#### **THEORY OF MACHINES :**

Kinematics and kinetics; mechanisms and structure; inversions; kinematic chains; different types of mechanisms; degree of freedom & its determination; Grashoff's criteria; velocity analysis; acceleration

analysis; gear trains; balancing of rotating masses; brakes & dynamometer.

#### **PRODUCTION AND INDUSTRIAL ENGINEERING :**

Fundamentals of metal cutting, tool geometry, Calculations of cutting forces and tool life; General purpose machine tool and their operations, various welding techniques like arc, gas, resistance etc. Metal forming methods like rolling, drawing, extrusion, press working, powder metallurgy, heat treatment of metals, Introduction to NC and CNC machines, basics of measuring instruments, study of transducers, static and dynamic characteristic of instruments, Introduction to metrology: Limits, fits and tolerance, Mechanical and optical comparators; Measuring instruments of angles; measurements of surface roughness and thread profiles, calibration of various measuring instruments.

Production planning; Inventory control; material and wage calculation; elements of cost; network analysis; work study and estimating machining time; break even analysis; TQM & ISO 9000; Shop floor management; Machines & Industrial safety.

## APPENDIX

<u>Branch in which admission is admissible</u>	<u>Allied Branches</u>
<b>Agrilcultural Engineering</b>	Agriculture Engineering; Agriculture Engineering & Farm Machinery; Agriculture Farm Engineering
<b>Civil Engineering</b>	Civil Engineering; Civil Engineering (Draughtsmanship); Civil Engineering (Construction Technology); Construction Technology; Building Construction; Public Health Engineering; Civil Engineering (Public Health Engineering); Water Resource Engineering; Civil Engineering (Management of Water Resources); Transportation Engineering; Rural Technology; Civil & Rural Engineering; Rural Engineering; Civil & Rural Technology
<b>Computer Science &amp; Engineering</b>	Computer Technology; Computer Science; Computer Engineering ; Computer Sc. & Engineering; Computer Sc. & Technology; Computer Hardware Maintenance; Computer Science & Hardware Engineering; Special Diploma in Electronics (Computer); Information Technology
<b>Electronics &amp; Communication</b>	Applied Electronics; Industrial Electronics; Special Diploma in Electronics (Industrial Electronics); Electronics Engineering; Electronics (Consumer); Electronic Equipment & Trouble Shooting; Consumer Electronics; Electronics & Micro processors; Micro-processors; Microprocessors & Microbased System; Electronics Communication System; Electronics Fiber Optics; Electronics Communication; Electronics & Electrical Communication; Special Diploma in Electronics (Communication) Telecommunication; Electronics & Communication Engineering; Telecommunication (Electronics & Telecommunication); Telecommunication Engg.; Telecommunication (Sound & Television); Electronics & Radio Engineering; Electronics & Radio Technology; Electronics, Television & Sound Engineering; Sound & Television Engg; Television & Video Engineering System; Audio & Video Engg., Electronics & Instrumentation, Electrical and Electronics Engineering, Instrumentation Engineering, Electronics & Telecommunication Engineering, Control & Instrumentation
<b>Electrical Engineering</b>	Electrical Engineering; Electrical Engineering & Electronics Control; Electrical Engineering with Industrial Control; Electrical Power System, Electrical & Electronics Engineering, Electrical Power or Power Control, Electrical & Electronics Control Engg., Electrical Power Engg., Electrical Instrumentation, Control & Instrumentation, Power Electronics
<b>Mechanical Engineering</b>	Mechanical Engineering (Maintenance); Mechanical Engineering (SW); Fabrication Technology; Fabrication Engineering; Mechanical Engineering (Sheet Metal & Welding); Mechanical Engineering (Maintenance Engineering); Machine Tool Maintenance & Repair; Mechanical Engineering (Instrumentation), (Mechanical Engineering), (Tube Well Engineering); Thermal Engineering; Mechanical Engineering (Heat Power Engineering); Robotics; Mechanical Engineering (Design, Drawing & General); Mechanical Engineering (Machine Design & Drafting); Mechanical & Rural Engineering, Automobile Engg., Manufacturing Engg., Welding Technology, Foundry/Forging Technology, Maintenance & Plant Engg., Industrial & Production Engg.