

# SCHEME OF EXAMINATION

and

## SYLLABI

for

**Bachelor of Technology  
Power Engineering**

**Offered by**

**University School of Engineering and Technology**

**1<sup>st</sup> SEMESTER TO 8<sup>th</sup> SEMESTER**



**GURU GOBIND SINGH  
INDRAPRASTHA  
UNIVERSITY**

**Guru Gobind Singh Indraprastha University  
Dwarka, Delhi – 110078 [INDIA]**

**[www.ipu.ac.in](http://www.ipu.ac.in)**

**BACHELOR OF TECHNOLOGY  
(COMMON TO ALL BRANCHES)  
FIRST SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETMA-101		Applied Mathematics-I	3	1	4	M
ETPH-103		Applied Physics-I	2	1	3	M
ETME-105		Manufacturing Processes	3	0	3	M
ETEE-107		Electrical Technology	3	0	3	M
ETHS-109		Human Values and Professional Ethics-I#	1	1	1	--
ETCS-111		Fundamentals of Computing	2	0	2	--
ETCH-113		Applied Chemistry	2	1	3	M
<b>PRACTICAL/VIVA VOCE</b>						
ETPH-151		Applied Physics Lab-I	-----	2	1	
ETEE-153		Electrical Technology Lab	-----	2	1	M
ETME-155		Workshop Practice	-----	3	2	M
ETME-157		Engineering Graphics Lab	-----	3	2	
ETCS-157		Fundamentals of Computing Lab	-----	2	1	--
ETCH-161		Applied Chemistry Lab	-----	2	1	--
		NCC/NSS*#	-----	-----	-----	--
<b>TOTAL</b>			<b>16</b>	<b>18</b>	<b>27</b>	

M: Mandatory for award of degree

#NUES (Non University Examination System)

\*#NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards. The camps/classes will be held either during Weekends/Holidays or Winter/Summer Vacations.

**BACHELOR OF TECHNOLOGY  
(COMMON TO ALL BRANCHES)  
SECOND SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETMA-102		Applied Mathematics-II	3	1	4	M
ETPH-104		Applied Physics-II	2	1	3	
ETEC-106		Electronic Devices	3	0	3	M
ETCS-108		Introduction to Programming	3	0	3	M
ETME-110		Engineering Mechanics	2	1	3	--
ETHS-112		Communication Skills	2	1	3	--
ETEN-114		Environmental Studies	2	1	3	--
<b>PRACTICAL/VIVA VOCE</b>						
ETPH-152		Applied Physics Lab-II	-----	2	1	
ETCS-154		Programming Lab	-----	2	1	M
ETEC-156		Electronic Devices Lab	-----	2	1	M
ETME-158		Engineering Mechanics Lab	-----	2	1	--
ETEN-160		Environmental Studies Lab	-----	2	1	--
		NCC/NSS*#	-----	-----	-----	--
<b>TOTAL</b>			<b>17</b>	<b>15</b>	<b>27</b>	

M: Mandatory for award of degree

#NUES (Non University Examination System)

\*#NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards. The camps/classes will be held either during Weekends/Holidays or Winter/Summer Vacations.

**BACHELOR OF TECHNOLOGY  
(POWER ENGINEERING)  
THIRD SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETME207		Material Science and Metallurgy	3	0	3	
ETEE-207		Circuits and Systems	3	1	4	M
ETPE205		Thermodynamics for Power Engineers	3	1	4	M
ETPE207		Strength of Materials and Theory of Machines	3	1	4	
ETEL203		Analog Electronics	3	1	4	
ETPE-201		Electrical Machines	3	1	4	M
<b>PRACTICAL/VIVA VOCE</b>						
ETPE251		Thermodynamics for Power Engineers Lab	0	2	1	
ETPE253		Strength of Materials and Theory of Machines Lab.	0	3	1	
ETEL-251		Analog Electronics Lab <sup>@</sup>	0	2	1	
ETPE-255		Electrical Machines Lab <sup>@</sup>	0	2	1	
		NCC/NSS*#	-	-	-	
<b>TOTAL</b>			<b>18</b>	<b>14</b>	<b>27</b>	

M: Mandatory for award of degree

#NUES (Non University Examination System)

\*NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards.

@ A few lab experiments must be performed using any circuit simulation software e.g. PSPICE/MATLAB/ETAP/Scilab/LabVIEW

**BACHELOR OF TECHNOLOGY  
(POWER ENGINEERING)  
FOURTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETPE-202		Power Generation Engineering	3	1	4	M
ETPE-204		Energy Conversion	3	1	4	M
ETPE-206		Heat and Mass Transfer	3	1	4	
ETME-212		Fluid Mechanics	3	1	4	
ETEC-202		Switching Theory and Logic Design	3	1	4	
ETEE-212		Control Systems	3	1	4	M
<b>PRACTICAL/VIVA VOCE</b>						
ETPE-252		Heat and Mass Transfer Lab	0	3	1	
ETME-260		Fluid Mechanics Lab	0	3	1	
ETEC-252		Switching Theory and Logic Design Lab <sup>@</sup>	0	2	1	
ETEE-260		Control Systems Lab <sup>@</sup>	0	2	1	
ETSS-250		NCC/NSS*#	-	-	1	
<b>TOTAL</b>			<b>18</b>	<b>16</b>	<b>29</b>	

M: Mandatory for award of degree

#NUES (Non University Examination System)

\*NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards.

@ A few lab experiments must be performed using any circuit simulation software e.g. PSPICE/MATLAB/ETAP/Scilab/LabVIEW.

NOTE: 3-4 weeks In-house Power Plant Training will be held after fourth semester (Summer Vacations). However, Viva-Voce will be conducted in the fifth semester (ETPE 361).

**BACHELOR OF TECHNOLOGY  
(POWER ENGINEERING)  
FIFTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETHS301		Communication Skills for Professionals	2	0	1	
ETPE303		Steam Generator and Its Auxiliaries	3	1	4	M
ETPE305		Steam Turbine and Its Auxiliaries	3	1	4	M
ETPE307		Electrical Generator and Auxiliaries	3	1	4	M
ETPE309 OR ETPE313		Refrigeration and Air Conditioning OR Electrical and Electronic Measurements and Instrumentation	3	1	4	
ETMS311		Industrial Management	3	0	3	
<b>PRACTICAL/VIVA VOCE</b>						
ETHS351		Communication Skills for Professionals Lab	0	2	1	
ETPE 353		Thermal Power Plant Scheme Tracing Lab	0	3	1	
ETPE357 OR ETPE359		Refrigeration and Air Conditioning Lab OR Electrical and Electronic Measurements and Instrumentation Lab	0	2	1	
ETPE 361		Practical Training/In-house Training*	0	0	1	
<b>TOTAL</b>			<b>17</b>	<b>11</b>	<b>24</b>	

M: Mandatory for the award of degree.

\*Viva-Voce for evaluation of Industrial Training / In-house Workshop will be conducted in this semester.

**Note:** Minimum of 2 weeks of In-house training related to PE will be held after 5<sup>th</sup> semester; however, viva-voce will be conducted in 6<sup>th</sup> Semester (ETPE 350).

@ A few lab experiments must be performed using any circuit simulation software e.g. PSPICE/MATLAB/ETAP/Scilab/LabVIEW

**BACHELOR OF TECHNOLOGY  
(POWER ENGINEERING)  
SIXTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
<b>THEORY PAPERS</b>						
ETPE302		Load Dispatch and Electricity Regulations	2	1	3	
ETPE304		Power Plant Commissioning (Thermal and Hydro)	3	1	4	M
ETPE306		Power Plant Control and Instrumentation	3	1	4	M
ETPE308		Power System, Transmission and Distribution	2	1	3	M
ETPE310 OR ETPE312		I. C. Engines and Gas Dynamics OR Power Electronics and Electric Drives	3	1	4	
ETAT-302 OR ETPE316		Machine Design OR Electromagnetic Field Theory	3	1	4	
<b>PRACTICAL/VIVA VOCE</b>						
ETPE354		Rotational On-Job Training (Operation - Steam Generator and Its Auxiliaries)	0	3	1	
ETPE356		Rotational On-Job Training (Operation - Steam Turbine and Its Auxiliaries)	0	3	1	
ETPE358		Rotational On-Job Training (Operation - Power Plant Electrical Machines and Systems)	0	3	1	
ETPE350		Practical/In-House Training#	0	0	1	
ETPE360 OR ETPE362		I. C. Engines and Gas Dynamics Lab OR Power Electronics and Electric Drives Lab	0	2	1	
<b>TOTAL</b>			<b>16</b>	<b>17</b>	<b>27</b>	

M: Mandatory for award of degree

#NUES(Non University Examination System)

**Note:** Minimum of 4-6 weeks of industrial training related to PE will be held after 6<sup>th</sup> semester; however, viva-voce will be conducted in 7<sup>th</sup> Semester (ETPE 463).

**Imp:-** Elective Paper will be floated in 7<sup>th</sup> Semester, if one-third of the total students opt for the same. It is advised that the decision about the elective subject for 7<sup>th</sup> Semester is done before 15<sup>th</sup> April every year before end of 6<sup>th</sup> semester.

**BACHELOR OF TECHNOLOGY  
(POWER ENGINEERING)  
SEVENTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
<b>THEORY PAPERS</b>					
ETPE-401		Power Plant Operation	3	0	3
ETEE-419		Renewable Energy Resources	3	0	3
ETPE-405		Power Plant Performance and Efficiency	3	0	3
ETPE-403		Power System Protection and Switchgear	3	1	4
<b>ELECTIVE- SELECT ANY TWO (ONE FROM EACH GROUP)\$</b>					
<b>GROUP-A</b>					
ETPE-409		Theory of Machine	3	0	3
ETPE-407		Power Plant Maintenance (plant maintenance Planning and Cost control)	3	0	3
ETPE-413		Balance of Power Plant	3	0	3
ETPE-415		Preventive Maintenance & Condition Monitoring	3	0	3
ETME-413		Non-conventional manufacturing processes	3	0	3
ETCS-425		Database Management Systems	3	0	3
<b>GROUP-B</b>					
ETPE-421		Manufacturing and Industrial Engineering	3	0	3
ETPE-423		Communication Engineering	3	0	3
ETPE-425		Information Technology and its Applications	3	0	3
ETME-423		Finite Element Methods	3	0	3
ETME427		Rotor Dynamics	3	0	3
ETME-421		Management Information System and ERP	3	0	3
ETHS 419		Sociology and Elements of Indian History for Engineers	3	0	3
<b>PRACTICAL/VIVA VOCE</b>					
ETPE 451		Rotational On-Job Training (Maintenance – Steam Generator and Its Auxiliaries)	0	3	1
ETPE 453		Rotational On-Job Training (Maintenance – Steam Turbine and Its Auxiliaries)	0	3	1
ETPE-455		Rotational On-Job Training (Maintenance – Power Plant Electrical Machines and Systems)	0	3	1
ETPE-457		Power System Protection and Switchgear Lab.	0	2	1
ETPE 459		Lab based on Electives Group A or B	0	2	1
ETPE 461		Seminar (topic should be linked to industrial training/ Soft skills learnt) <sup>#</sup>	0	2	1
ETPE 463		Industrial Training	0	0	1
ETPE 465		Minor Projects*	0	6	3
<b>TOTAL</b>			<b>18</b>	<b>22</b>	<b>29</b>

\*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports. Seminar related to major project should be delivered one month after starting of Semester.

\$ Elective Paper will be float if one-third of the total students opt for the same. It is advice that the decision about the elective subject is done before 15<sup>th</sup> November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.



**BACHELOR OF TECHNOLOGY  
(POWER ENGINEERING)  
EIGHTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
<b>THEORY PAPERS</b>					
ETHS-402		Human Values and Professional Ethics-II	1	0	1
ETPE-404		Environmental Management	3	0	3
ETPE-406		Microprocessor and Microcontroller	3	0	3
<b>ELECTIVE- SELECT ANY TWO (ONE FROM EACH GROUP)\$</b>					
<b>GROUP-A</b>					
ETME-416		Mechanical Vibrations	2	1	3
ETPE-410		Design of Electrical Machine	2	1	3
ETPE-412		Project Management	2	1	3
ETPE-414		Smart Grid	2	1	3
ETEL-404		Power System Analysis and Stability	3	1	4
ETME-408		Nuclear Power Generation and Supply	2	1	3
ETMT-402		Robotics	2	1	3
<b>GROUP-B</b>					
ETEC-420		Data Communication and Networks	3	0	3
ETPE-426		Energy Management	3	0	3
ETPE-428		High Voltage AC and DC Technology	3	0	3
ETPE-430		Residual Life Assessment and Extension of TPP	3	0	3
ETME-424		Cryogenic Engineering	3	0	3
ETME-426		Total Quality Management	3	0	3
<b>PRACTICAL/VIVA VOCE</b>					
ETPE-452		Environmental and Energy Audit Lab	0	2	1
ETPE-454		Microprocessor and Microcontroller Lab	0	2	1
ETPE-458		Lab based on Elective Group A or B	0	2	1
ETPE-456		Major Project*	0	12	8
<b>TOTAL</b>			<b>12</b>	<b>19</b>	<b>24</b>

\*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports. Seminar related to major project should be delivered one month after starting of Semester.

\$ Elective Paper will be floated if one-third of the total students opt for the same. It is advised that the decision about the elective subject is done before 15<sup>th</sup> November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.

**NOTE:**

- The total number of the credits of the B.Tech. (Power Engineering) Programme = 214.
- Each student shall be required to appear for examinations in all courses. However, for the award of the degree a student shall be required to earn a minimum of 200 credits, including mandatory papers (M).

**FOR LATERAL ENTRY STUDENTS:**

- The total number of the credits of the B.Tech. (Power Engineering) Programme = 160.
- Each student shall be required to appear for examinations in all courses Third Semester onwards. However, for the award of the degree a student shall be required to earn a minimum of 150 credits, including mandatory papers (M).

**NOMENCLATURE OF CODES GIVEN IN THE SCHEME OF****B.TECH AND M.TECH**

1. **ET** stands for Engineering and Technology.
2. **PE** stands for Power Engineering.
3. **ME** stands for Mechanical Engineering.
4. **MT** stands for Mechatronics.
5. **AT** stands for Mechanical and Automation Engineering.
6. **EE** stands for Electrical and Electronics Engineering.
7. **EL** stands for Electrical Engineering.
8. **IT** stands for Information Technology
9. **CS** stands for Computer Science and Engineering
10. **CE** stands for Civil Engineering
11. **EC** stands for Electronics and Communications Engineering.
12. **EN** stands for Environmental Engineering
13. **TE** stands for Tool Engineering
14. **MA** stands for Mathematics
15. **HS** stands for Humanities and Social Sciences
16. **SS** stands for Social Services

**APPLIED MATHEMATICS-I**

**Paper Code : ETMA-101**  
**Paper : Applied Mathematics-I**

L	T	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student.*

**UNIT- I**

Successive differentiation: Leibnitz theorem for  $n^{\text{th}}$  derivative (without proof). Infinite series: Convergence and divergence of infinite series, positive terms infinite series, necessary condition, comparison test (Limit test), D'Alembert ratio test, Integral Test, Cauchy's root test, Raabe's test and Logarithmic test (without proof). Alternating series, Leibnitz test, conditional and absolutely convergence. Taylor's and Maclaurin's expansion (without proof) of function ( $e^x$ ,  $\log(1+x)$ ,  $\cos x$ ,  $\sin x$ ) with remainder terms, Taylor's and Maclaurin's series, Error and approximation.

[T1], [T2][No. of hrs. 12]

**UNIT- II**

Asymptotes to Cartesian curves. Radius of curvature and curve tracing for Cartesian, parametric and polar curves.

Integration: integration using reduction formula for  $\int_0^{\pi/2} \sin^n \theta d\theta$ ,  $\int_0^{\pi/2} \cos^n \theta d\theta$ ,  $\int_0^{\pi/2} \sin^n \theta \cos^m \theta d\theta$ .  
 Application of integration : Area under the curve, length of the curve, volumes and surface area of solids of revolution about axis only. Gamma and Beta functions.

[T1],[T2][No. of hrs. 12]

**UNIT- III**

Matrices: Orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix and Unitary matrix. Inverse of matrix by Gauss-Jordan Method (without proof). Rank of matrix by echelon and Normal (canonical) form. Linear dependence and linear independence of vectors. Consistency and inconsistency of linear system of homogeneous and non homogeneous equations. Eigen values and Eigen vectors. Properties of Eigen values (without proof). Cayley-Hamilton theorem (without proof). Diagonalization of matrix. Quadratic form, reduction of quadratic form to canonical form.

[T1], [T2][No. of hrs. 12]

**UNIT-IV**

Ordinary differential equations: First order linear differential equations, Leibnitz and Bernoulli's equation. Exact differential equations, Equations reducible to exact differential equations. Linear differential equation of higher order with constant coefficients, Homogeneous and non homogeneous differential equations reducible to linear differential equations with constant coefficients. Method of variation of parameters. Bessel's and Legendre's equations (without series solutions), Bessel's and Legendre's functions and their properties.

[T1],[T2][No. of hrs. 12]

**Text:**

[T1] B. S. Grewal, "Higher Engineering Mathematics" Khanna Publications.

[T2]. R. K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publications.

**References:**

[R1] E. kresyzig, "Advance Engineering Mathematics", Wiley publications

[R2] G.Hadley, "Linear Algebra" Narosa Publication

[R3] N.M. Kapoor, "A Text Book of Differential Equations", Pitambar publication.

[R4] Wylie R, "Advance Engineering mathematics", McGraw-Hill

[R5] Schaum's Outline on Linear Algebra, Tata McGraw-Hill

[R6] Polking and Arnold, "Ordinary Differential Equation using MatLab" Pearson.

**APPLIED PHYSICS – I**

**Paper Code: ETPH – 103**  
**Paper: Applied Physics – I**

<b>L</b>	<b>T</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Applied Physics aspects that are required for his understanding of basic physics.*

**UNIT I**

**Interference:** Introduction, Interference due to division of wave front: Fresnel's Biprism, Interference due to division of amplitude: wedge shaped film, Newton's rings.

**Diffraction:** Introduction, Difference between Fresnel and Fraunhofer diffraction, Single slit diffraction, Transmission diffraction grating, Absent spectra.

[T1], [T2](No. of Hrs. 8)

**UNIT II**

**Polarization:** Introduction, Uniaxial crystals, Double refraction, Nicol prism, Quarter and half wave plates, Theory of production of plane, circularly and elliptically polarized lights, Specific rotation, Laurents half shade polarimeter.

**Laser:** Spontaneous and stimulated emissions, Einstein's coefficients, Laser and its principle, He-Ne laser.

**Fibre optics:** Introduction, Single mode fibre, Step index and graded index multimode fibres, Acceptance angle and numerical aperture.

[T1], [T2](No. of Hrs. 8)

**UNIT III**

**Theory of Relativity:** Introduction, Frame of reference, Galilean transformation, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Mass energy relation

**Ultrasonics:** Introduction, Production of ultrasonics by magnetostriction and Piezoelectric methods, Applications.

[T1], [T2](No. of Hrs. 8)

**UNIT IV**

**Nuclear Physics:** Introduction, Radioactivity, Alpha decay, Beta decay, Gamma decay, Q value, Threshold energy, Nuclear reactions, Nuclear fission: Liquid drop model, Nuclear fusion, Particle accelerators: Linear accelerator, Cyclotron, Radiation detectors: Ionization chamber, Geiger Mueller Counter.

[T1](No. of Hrs. 8)

**Text Books:**

- [T1]. Arthur Beiser, 'Concepts of Modern Physics', [McGraw-Hill], 6<sup>th</sup> Edition 2009  
 [T2]. A. S. Vasudeva, 'Modern Engineering Physics', S. Chand, 6<sup>th</sup> Edition, 2013.

**Reference Books**

- [R1]. A. Ghatak 'Optics', TMH, 5<sup>th</sup> Edition, 2013  
 [R2]. G. Aruldas 'Engineering Physics' PHI 1<sup>st</sup> Edition, 2010.  
 [R3]. Fundamentals of Optics : Jenkins and White , Latest Edition  
 [R4]. C. Kittel, "Mechanics", Berkeley Physics Course, Vol.- I.  
 [R5]. Feynman " The Feynman lectures on Physics Pearson Volume 3 Millennium Edition, 2013  
 [R6]. Uma Mukhrji 'Engineering Physics' Narosa, 3<sup>rd</sup> Edition, 2010.  
 [R7]. H.K. Malik & A. K. Singh 'Engineering Physics' [McGraw-Hill], 1<sup>st</sup> Edition, 2009.

**MANUFACTURING PROCESSES**

**Paper Code: ETME-105**

**Paper: Manufacturing Processes**

<b>L</b>	<b>T</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The Objective of the paper is to facilitate the student with the basic Manufacturing processes.*

**Unit-I**

**Introduction:** Introduction of Manufacturing processes and their classification, Basic Metals & Alloys : Properties and Applications. Properties of Materials: Strength, elasticity, stiffness, malleability, ductility, brittleness, toughness and hardness. Ferrous Materials: Carbon steels, its classification based on % carbon as low, mild, medium & high carbon steel, its properties & applications. Wrought iron. Cast iron. Alloy steels: stainless steel, tool steel. Elementary introduction to Heat- treatment of carbon steels: annealing, normalizing, quenching & tempering and case- hardening.

Non-Ferrous metals & alloys: Properties and uses of various non-ferrous metals & alloys and its composition such as Cu-alloys: Brass, Bronze, Al-alloys such as Duralumin.

**Casting Processes:**

Principles of metal casting, Pattern materials, types and allowance, composition and properties of moulding sand, foundry tools, concept of cores and core print, elements of gating system, description and operation of cupola, special casting processes e.g. die-casting; permanent mould casting; centrifugal casting; investment casting; casting defects.

**(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>) [No. of Hrs.12]**

**UNIT-II**

**Smithy and Forging:**

Hot working and cold working, Forging tools and equipments, Forging operations, Forging types: Smith forging, Drop forging, Press forging, Machine forging; Forging defects; Extrusion, wire drawing, swaging.

**BENCH WORK AND FITTING:**

Fitting shop tools, operation: Fitting; sawing; chipping; thread cutting (with taps and dies);

Marking and marking tools.

**(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>) [No. of Hrs. 12]**

**Unit-III**

**Metal joining:** Welding principles, classification of welding techniques, Oxyacetylene Gas welding, equipment and field of application, Arc-welding, metal arc, Carbon arc welding, submerged arc welding and atomic hydrogen welding, TIG and MIG welding, Electric resistance welding: spot; seam; flash; butt and percussion welding, Flux: composition; properties and function, Electrodes, Types of joints and edge preparation, Brazing and soldering, welding defects.

**(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>)[No. of Hrs. 12]**

**Unit-IV**

**Sheet Metal Work:**

Tools and equipments used in sheet metal work, metals used for sheets, standard specification for sheets, Types of sheet metal operations: shearing, drawing, bending. Other operations like spinning, stretch forming, embossing and coining.

**Powder Metallurgy:** Introduction of powder metallurgy process: powder production, blending, compaction, sintering.

**(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>)[No. of Hrs. 12]**

**Text Books:**

[T1]. Manufacturing Process by Raghuvanshi.(Dhanpat Rai and Co.)

[T2]. Manufacturing Technology by P.N.Rao (TMH publications)

**Reference Books:**

[R1]. Workshop Technology by Hazra-Chowdhary (Media Promoters and Publishers Pvt. Ltd.)

[R2]. Production Engineering by R.K.Jain (Khanna Publishers)

[R3]. Workshop Technology by Chapman (Elsevier Butterworth-Heinemann)

[R4]. Fundamentals of Modern Manufacturing by Mikell P. Groover (Wiley India Edition)

[R5]. Manufacturing Processes for Engineering Materials by Kalpakjian and Schmid (Pearson)

**ELECTRICAL TECHNOLOGY****Paper Code: ETEE-107****Paper : Electrical Technology**

<b>L</b>	<b>T</b>	<b>C</b>
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. This is first introductory course in electrical technology to the students of all the branches of engineering in first year.
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
3. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To provide exposure to the students in respects of the basics of different aspects of electrical engineering with emphasis on constructional, measurement and applications of various types of instruments and equipments.*

**UNIT – I: DC Circuits**

Introduction of Circuit parameters and energy sources (Dependent and Independent), Mesh and Nodal Analysis, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer and Millman's Theorems, Star-Delta Transformation and their Applications to the Analysis of DC circuits.

**[T1],[T2][No. of Hrs. 11]****UNIT – II: A.C.Circuits**

A.C. Fundamentals, Phasor representation, Steady State Response of Series and Parallel R-L, R-C and R-L-C circuits using j-notation, Series and Parallel resonance of RLC Circuits, Quality factor, Bandwidth, Complex Power, Introduction to balanced 3-phase circuits with Star- Delta Connections.

**[T1],[T2][No. of Hrs. 14]****UNIT – III: Measuring Instruments**

Basics of measuring instruments and their types, Working principles and applications of moving coil, moving iron (ammeter & voltmeter) and Extension of their ranges, dynamometer- type Wattmeter, induction-type Energy Meter, Two-wattmeter method for the measurement of power in three phase circuits, Introduction to digital voltmeter, digital Multimeter and Electronic Energy Meter.

**[T1],[T2],[R2][No. of Hrs. 11]****UNIT – IV: Transformer and Rotating Machines**

Fundamentals of Magnetic Circuits, Hysteresis and Eddy current losses, working principle, equivalent circuit, efficiency and voltage regulation of single phase transformer and its applications. Introduction to DC and Induction motors (both three phase and single phase), Stepper Motor and Permanent Magnet Brushless DC Motor.

**[T1],[T2],[R2][No. of Hrs. 12]****Text Books:**

[T1] S.N Singh, "Basic Electrical Engineering" PHI India Ed 2012

[T2] Chakrabarti, Chanda, Nath "Basic Electrical Engineering" TMH India", Ed 2012.

**Reference Books:**

[R1] William Hayt "Engineering Circuit Analysis" TMH India Ed 2012

[R2] Giorgio Rizzoni "Principles and Application of Electrical Engineering" Fifth Edition TMH India.

**HUMAN VALUES & PROFESSIONAL ETHICS**

**Paper Code: ETHS-109**

**Paper : Human Values & Professional Ethics**

L	T	C
1	1	1

Non-University Examination Scheme (NUES)

Note: There will be no End-Term External University Examination. Marks are to be given on the basis of two internal sessional test of 30 marks each and one final Viva-voce project report Examination of 40 marks.

**Objectives:**

This introductory course input is intended

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a holistic perspective among students towards life, profession and happiness, based on the correct understanding of the Human reality and the rest of the Existence. Such a Holistic perspective forms the basis of value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.

**UNIT-1: Introduction to Value Education**

**No. of lectures: 03+1**

- Understanding the need, basic guidelines, content and process for value education.
- Basic Human Aspirations: Prosperity and happiness
- Methods to fulfil the human aspirations – understanding and living in harmony at various levels.
- Practice Session – 1. [T1], [R1], [R4]

**UNIT-2: Harmony in the Human Being**

**No. of lectures: 05+1**

- Co-existence of the sentient "I" and the material body – understanding their needs – Happiness & Conveniences.
- Understanding the Harmony of "I" with the body – Correct appraisal of physical needs and the meaning of prosperity.
- Programme to ensure harmony of "I" and Body-Mental and Physical health and happiness.
- Harmony in family and society: Understanding Human-human relationship in terms of mutual trust and respect.
- Understanding society and nation as extensions of family and society respectively.
- Practice Session – 02 [T2], [R1], [R2]

**UNIT-3: Basics of Professional Ethics**

**No. of lectures: 04+1**

- Ethical Human Conduct** – based on acceptance of basic human values.
- Humanistic Constitution and universal human order** – skills, sincerity and fidelity.
- To identify the scope and characteristics of people** – friendly and eco-friendly production system, Technologies and management systems.
- Practice Session – 03. [T1],[R4]

**UNIT-4: Professional Ethics in practice**

**No. of lectures: 04+1**

- Profession and Professionalism** – Professional Accountability, Roles of a professional, Ethics and image of profession.
- Engineering Profession and Ethics** - Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world.
- Professional Responsibilities** – Collegiality, Loyalty, Confidentiality, Conflict of Interest, Whistle Blowing
- Practice Session – 04 [T1], [T2], [T3], [R3]

**Text Books:**

- [T1] Professional Ethics, R. Subramanian, Oxford University Press.  
 [T2] Professional Ethics & Human Values: S.B. Srivastha, SciTech Publications (India) Pvt. Ltd. New Delhi.  
 [T3] Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.

**References:**

- [R1] Success Secrets for Engineering Students: Prof. K.V. SubbaRaju, Ph.D., Published by SMARTstudent.  
 [R2] Ethics in Engineering Mike W. Martin, Department of Philosophy, Chapman University and Roland Schinzingler, School of Engineering, University of California, Irvine.  
 [R3] Human Values: A. N. Tripathy (2003, New Age International Publishers)  
 [R4] Value Education website, <http://www.universalhumanvalues.info>[16]

Modified Scheme and Syllabus of B. Tech-POWER Engg. (1<sup>st</sup> Semester to 8<sup>th</sup> Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23<sup>rd</sup> BOS and 40<sup>th</sup> AC meeting of USET.

- [R5] Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press.  
 [R6] Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Eecel Books (2010, New Delhi). Also, the Teachers' Manual by the same author.

**\*PRACTICAL SESSIONS OF 14 HOME ASSIGNMENTS** will be followed by the students pursuing this paper. (Ref: Professional Ethics & Human Values: S.B. Srivastava, SciTech Publications (India) Pvt. Ltd. New Delhi. )

### CONTENT OF PRACTICE SESSION

#### **Module 1: Course Introduction – Needs, Basic Guidelines, Content and Process of Value Education**

**PS-1:** Imagine yourself in detail. What are the goals of your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcoming in your life? Observe and analyze them.

**Expected Outcome:**

The students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

**PS-2:** Now a days there is lot of voice about techno-genie maladies such as energy and natural resource depletion, environmental Pollution, Global Warming, Ozone depletion, Deforestation, etc. – all these scenes are man-made problems threatening the survival of life on the earth – what is root cause of these maladies and what is the way out in your opinion?

On the other hand there is rapidly growing danger because of nuclear proliferation, arm race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression and suicidal attempts, etc - what do you think the root cause of these threats to human happiness and peace – what could be the way out in your opinion?

**Expected Outcome:**

The students start finding out that technical education with study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all the problems and the sustained solution could emerge only through understanding of human values and value based living. Any solutions brought out through fear, temptation or dogma will not be sustainable.

**PS-3:** 1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of following:

- a) What is naturally acceptable to you in relationship – feeling of respect or disrespect?
- b) What is naturally acceptable to you - to nurture or to exploit others? Is your living the same as your natural acceptance or different?

2. Out of three basic requirements for fulfillment of your aspirations, right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time and efforts you devote for each in your daily routine.

**Expected Outcome:**

1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify the right or wrong, and referring to any external source life text or instrument or any other person cannot enable them to verify with authenticity, it will only develop assumptions.
2. The students are able to see that their practice in living is not in harmony with their natural acceptance at most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of the problems in their family and the lack of physical facilities in most of the cases; while they have given higher priority to earning of physical facilities in their life ignoring relationship and not being aware that right understanding is the most important requirement for any human being.

#### **Module 2: Understanding harmony in human being – Harmony in myself!**



**PS-4:** Prepare the list of your desires. Observe whether the desires are related with self “I” or body. If it appears to be related with the both, see which part of it is related to self “I” and which part is related to body.

**Expected Outcome:**

The students are able to see that they can enlist their desires and the desires are not vague, also they are able to relate their desires to “I” and “body” distinctly. If, any desire appears to be related with both, they are able to see that feeling is related to “I” while the physical facility is related to the body. They are also able to see that “I” and “body” are two realities, and most of their desires are related to “I” and not with the “Body”; while their efforts are mostly connected on the fulfillment of the need of the body assuming that it will meet the needs of “I” too.

**PS-5:**

1. {A}. Observe that any physical facilities you use, follows the given sequence with time; Necessary and tasteful – unnecessary & tasteful – unnecessary & tasteless.  
 {B}. In contrast, observe that any feelings in you are either naturally acceptable or not acceptable at all. If, naturally acceptable, you want it continuously and if not acceptable, you do not want it at any moment.
2. List Down all your activities. Observe whether the activity is of “I” or of “body” or with the participation both “I” and “body”.
3. Observe the activities with “I”. Identify the object of your attention for different moments (over a period say 5 to 10 minute) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

**Expected Outcome:**

1. The students are able to see that all physical facilities they use are required for limited time in a limited quantity. Also they are able to see that cause of feeling, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable eve for a single moment.
2. The students are able to see that activities like understanding, desires, thoughts and selection are the activities of “I” only; the activities like breathing, palpitation of different parts of the body are fully the activities of the body. With the acceptance of “I”, while activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs, etc. are such activities that require the participation of both “I” and “body”
3. The students become aware of their activities of “I” and start finding their focus of attention at different moments. Also they are able see that most of their desires are coming from outsides (through preconditioning or sensation) and are not based on their natural acceptance.

- PS-6:**
1. Chalk out the program to ensure that you are responsible to your body – for the nurturing, protection and right utilization of the body.
  2. Find out the plants and shrubs growing in and your campus. Find out their use for curing different diseases.

**Expected Outcome:**

The students are able to list down activities related to a proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing the different diseases.

**Module 3: Understanding harmony in the family and society - Harmony in Human – Human relationship**

**PS-7:** Form small groups in the class and in that group initiate the dialogue and ask the eight questions related to trust. The eight questions are-

S.No.	Intention (Natural Acceptance)	S.No.	Competence
1.a.	Do I want to make myself happy?	1.b.	Am I liable to make myself always Happy?
2.a.	Do I want to make the other happy?	2.b.	Am I liable to make the other always happy?
3.a.	Does the other want to make him happy?	3.b.	Is the other able to make him always happy?
4.a.	Does the other want to make me happy? What is answer?	4.b.	Is the other able to make me always happy? What is answer?

Let each student answer the question for himself and everyone else. Discuss the difference between intention and competence.

**Expected Outcome:**

The students are able to see that the first four questions are related to our natural acceptance i.e. intention and the next four to our competence. They are able to note that the intention is always correct, only competence is lacking. We generally evaluate ourselves on the basis of our intention and other on the basis of their competence. We seldom look at our competence and other's intention as a result we conclude that I am a good person and other is a bad person.

**PS-8:**

1. Observe that on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasion you are disrespecting by way of under evaluation, over evaluation or otherwise evaluation.
2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

**Expected Outcome:**

The students are able to see that respect is right evaluation and only right evaluation leads to fulfilment of relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect) like gender biasness, generation gap, caste conflicts, class struggle, and domination through poor play, communal violence, and clash of isms and so on so forth.

All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

**PS-9:**

1. Write a note in the form of a story, poem, skit, essay, narration, dialogue, to educate a child.  
Evaluate it in a group.
2. Develop three chapters to introduce "social science", its needs, scope and content in the primary education of children.

**Expected Outcome:**

The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

**Module 4: Understanding harmony in the nature and existence – Whole existence as Co – existence -**

**PS-10:** Prepare the list of units (things) around you. Classify them into four orders. Observe and explain the mutual fulfilment of each unit with other orders.

**Expected Outcome:**

The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human beings are not fulfilling to their orders today and need to take appropriate steps to ensure right participation (in term of nurturing, protection and right utilization) in the nature.

**PS-11:**

1. Make a chart for the whole existence. List down different courses of studies and relate them to different or levels in the existence.
2. Choose any one subject being taught today. Evaluate and suggest suitable modifications to make it appropriate and holistic.

**Expected Outcome:**

The students are confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are liable to make out how these courses can be made appropriate and holistic.

**Module 5: Implication of the above Holistic Understanding of Harmony at all Levels of Existence.**

**PS-12:** Choose any two current problem of different kind in the society and suggest how they can be solved on the basis of the natural acceptance of human values. Suggest the steps you will take in present conditions.

**Expected Outcome:**

The students are liable to present sustainable solutions to the problem in society and nature. They are also able to see that these solutions are practicable and draw road maps to achieve them.

**PS-13:**

1. Suggest ways in which you can use your knowledge of engineering / technology / management for universal human order from your family to world family.
2. Suggest one format of humanistic constitution at the level of nation from your side.

**Expected Outcome:**

The students are able to grasp the right utilization of their knowledge in their streams of technology / engineering / management to ensure mutually enriching and recyclable production systems.

**PS-14:** The course is going to be over now. Evaluate your state before and after the course in terms of-

- Thoughts
- Behavior
- Work and
- Realization

Do you have any plan to participate in the transition of the society after graduating from the institute?

Write a brief note on it.

**Expected Outcome:**

The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for happy and prosperous society.

**FUNDAMENTALS OF COMPUTING****Paper Code: ETCS-111****Paper: Fundamentals of Computing**

<b>L</b>	<b>T</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>2</b>

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks : 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

*Objective: The objective of the paper is to facilitate the student with applied working knowledge of computers. This is the first course of computing and does not assume any pre-requisite.*

**UNIT-I**

Five Component Model of a Computer, System and Application software ( introduction ) storage devices , primary (RAM, ROM, PROM, EPROM, cache ) Memory and secondary (magnetic tape, hard disk, Compact disks) memory , peripheral devices , printers.

**[T1], [T2][8 Hours]****UNIT-II**

Operating Systems: DOS Internal, External commands, Windows ( 2000 and NT ) , Overview of architecture of Windows, tools and system utilities including registry , partitioning of hard disk , Overview of Linux architecture , File system , file and permissions , concept of user and group , installation of rpm and deb based packages.

**[T1], [T2][8 Hours]****UNIT-III**

Basics of programming through flow chart , Networking Basics - Uses of a network and Common types of networks , Network topologies and protocols , Network media and hardware , Overview of Database Management System.

**[T1],[T2],[R1][8 Hours]****UNIT-IV**

Libre / Open Office Writer : Editing and Reviewing, Drawing, Tables, Graphs, Templates

Libre / Open Office Calc : Worksheet Management , Formulas, Functions, Charts

Libre / Open Office Impress: designing powerful power-point presentation

**[R2][R3] [8 Hours]****Text:**

[T1] Peter Norton, Introduction to computers, Sixth Edition Tata McGraw Hill (2007).

[T2] Andrews Jean, A+Guide to Managing & Maintaining Your PC, Cengage Publication 6/e

**References:**

[R1] Anita Goel, Computer Fundamentals, Pearson Education.

[R2] Joiner Associates Staff, Flowcharts: Plain & Simple: Learning & Application Guide , Oriel Inc

[R3] <http://www.openoffice.org/why/>

[R4] <http://www.libreoffice.org/get-help/documentation/>

**APPLIED CHEMISTRY**

**Paper Code: ETCH – 113**  
**Paper : Applied Chemistry**

<b>L</b>	<b>T</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTER:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Each unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Applied Chemistry aspects that are required for his understanding of basic chemistry*

**UNIT I: FUELS**

Definition, Classification & Calorific value of fuels (gross and net), Dulong's formula (**Numericals**), Determination of calorific value of fuels using bomb's calorimeter (**Numericals**), Determination of calorific value of fuels using Boy's Gas Calorimeter (**Numericals**), Cracking – Thermal & catalytic cracking, Octane & Cetane numbers with their significance. High & Low temperature carbonization, Manufacture of coke (Otto – Hoffmann oven) Proximate and ultimate analysis of Coal (**Numericals**) Combustion of fuels (**Numericals**).

[T1,T2][No. of hrs. 08]

**UNIT II: THE PHASE RULE & CATALYSIS**

Definition of various terms, Gibb's Phase rule & its derivation, Application of phase rule to One component system- The water system, Application of phase rule to Two component system- The Lead-Silver system (Pattinson's process).

Catalyst and its characteristics, Types of catalysts, Concept of promoters, inhibitors and poisons. Theories of catalysis: Intermediate compound formation theory, adsorption or contact theory. Application of catalysts for industrially important processes Enzyme catalysis: Characteristics, Kinetics & Mechanism of enzyme catalysed reaction ( Michaelis-Menten equation), Acid-Base catalysis: Types, Kinetics & Mechanism, Catalysis by metals salts (Wilkinson's Catalyst), Auto-catalysis, Heterogeneous catalysis (Langmuir-Hinshelwood mechanism).

[T1,T2][No. of hrs. 08]

**UNIT III: WATER**

Introduction and specifications of water , Hardness and its determination by EDTA method (**Numericals**), Alkalinity and its determination (**Numericals**), Reverse Osmosis, Electrodialysis, Disinfection by break-point chlorination. Boiler feed water, boiler problems– scale, sludge, priming & foaming: causes & prevention, Boiler problems– caustic embrittlement & corrosion: causes & prevention, Water Softening by Internal Treatment: carbonate & phosphate conditioning, colloidal conditioning & calgon treatment Water Softening by External Treatment: Lime-Soda Process (**Numericals**) Zeolite & Ion-Exchange Process.

[T1,T2][No. of hrs. 08]

**UNIT IV: CORROSION & ITS CONTROL**

Causes, effects & consequences; Chemical or Dry corrosion & its mechanism (Pilling-Bedworth Rule) Electrochemical or Wet Corrosion & Its mechanism, Rusting of Iron Passivity, Galvanic series, Galvanic Corrosion, Soil Corrosion Pitting Corrosion, Concentration Cell or Differential Aeration Corrosion, Stress Corrosion. Factors Influencing Corrosion: Nature of metal and nature of corroding environment; Protective measures: Galvanization, Tinning Cathodic Protection, Sacrificial Anodic protection, Electroplating, Electroless plating, Prevention of Corrosion by Material selection & Design.

[T1,T2][No. of hrs. 08]

**Text Books:**

- [T1] P. C. Jain & Monika Jain, *Engineering Chemistry*, Latest edition, Dhanpat Rai Publishing Co., 2002.  
 [T2] P. Mathew, *Advance Chemistry*, 1 & 2 Combined Editions, Cambridge University Press, 2003.

**Reference Books:**

- [R1] P. W. Atkins and J. De Paula, *Atkins' Physical Chemistry*, Oxford, 2010.  
 [R2] T. Engel and P. Reid, *Physical Chemistry*, Pearson Education, 2013.  
 [R3] K. Qanungo, *Engineering Chemistry*, PHI Learning Private Limited, New Delhi, 2009.  
 [R4] O. G. Palanna, *Engineering Chemistry*, Tata McGraw Hill Education Private Limited, 2012.  
 [R5] D. A. Jones, *Principles and Prevention of Corrosion*, Prentice Hall, 2<sup>nd</sup> Edition, 1996.  
 [R6] H. K. Chopra and A. Parmar, *Engineering Chemistry- A Text Book*, Narosa Publishing House, 2012.  
 [R7] S. Chawla, *Engineering Chemistry-All India Edition*, Dhanpat Rai & Co., 2003.  
 [R8] R. Gadi, S. Rattan and S. Mohapatra, *Environmental Studies*, S.K. Kataria & Sons, 2<sup>nd</sup> Edition 2009.

**APPLIED PHYSICS LAB – I****Paper Code: ETPH-151****Paper : Applied Physics Lab – I****P****2****C****1****LIST OF EXPERIMENTS**

1. To determine the wavelength of sodium light by Newton's Rings.
2. To determine the wavelength of sodium light by Fresnel's biprism.
3. To determine the wavelength of sodium light using diffraction grating.
4. To determine the refractive index of a prism using spectrometer.
5. To determine the dispersive power of prism using spectrometer and mercury source.
6. To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
7. To find the wavelength of He-Ne laser using transmission diffraction grating.
8. To determine the numeral aperture (NA) of an optical fibre.
9. To plot a graph between the distance of the knife-edge from the center of the gravity and the time period of bar pendulum. From the graph, find
  - (a) The acceleration due to gravity
  - (b) The radius of gyration and the moment of inertia of the bar about an axis.
10. To determine the velocity of ultrasound waves using an ultrasonic spectrometer in a given liquid (Kerosene Oil).
11. To verify inverse square law.
12. To determine Planck's constant.

**Text Books:**

[T1] C. L. Arora 'B. Sc. Practical Physics' S. Chand

**Note:** Any 8-10 experiments out of the list may be chosen. Proper error – analysis must be carried out with all the experiments.

**ELECTRICAL TECHNOLOGY LAB**

**Paper Code: ETEE 153**  
**Paper: Electrical Technology Lab**

<b>L</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**LIST OF EXPERIMENTS**

1. To Design the circuit for a given load and selection of its various Components and instruments from the safety point of view
2. Study and applications of CRO for measurement of voltage, frequency and phase of signals.
3. Connection of lamp by  
 (1)Single Switch Method.(2) Two-way Switch Method.  
 OR  
 Performance comparison of of fluorescent Tube & CFL Lamp.
4. To Verify Thevenin's & Norton's Theorem  
 OR  
 To Verify Superposition &Reciprocity Theorem.  
 OR  
 To Verify Maximum Power Transfer Theorem.
5. To Measure Power & Power Factor in a Single-Phase A.C Circuit using Three Ammeters or three Voltmeters.
6. To Measure Power & Power Factor in a Balanced Three Phase Circuit using Two Single Phase Wattmeters.
7. To study of Resonance in a series R-L-C or Parallel R-L-C Circuits.
8. To perform open circuit and short circuit test on 1-phase transformer.
9. Starting, Reversing and speed control of DC shunt Motor
10. Starting, Reversing and speed control of 3-phase Induction Motor
11. To Study different types of Storage Batteries & its charging system.
12. .To Study different types of earthing methods including earth leakage circuit breaker (GFCI)

**Note:- Any 8-10 Experiments out of the list may be chosen.**

**WORKSHOP PRACTICE**

**Paper Code: ETME-155**  
**Paper: Workshop Practice**

<b>L</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>2</b>

**LIST OF EXPERIMENTS*****Sheet Metal Shop***

1. To study the tools and machineries used in sheet metal shop.
2. To make a tray using sheet metal tools.
3. To make a Funnel using sheet metal tools.
4. To make a cylindrical mug in sheet metal shop.

***Foundry Shop***

5. To make a mould in Foundry Shop.

***Carpentry Shop***

6. To make a half lap T-joint in Carpentry Shop.
7. To make a half cross lap joint in Carpentry Shop.
8. To make a pattern using Carpentry Tools.

***Welding Shop***

9. To study arc and gas welding equipments and tools.
10. To make Lap Joint, T-Joint and Butt Joint in Welding shop.

***Fitting Shop***

11. To make V-Section and T-Slot in fitting shop.

***Machine Shop***

12. To study basic operations on lathe, shaper, milling, drilling and grinding machines..
13. To perform step turning, knurling and threading operations on lathe.
14. To prepare a simple job on shaper.

**Note:- Any 8-10 Experiments out of the list may be chosen.**



**ENGINEERING GRAPHICS**

**Paper Code: ETME-157**  
**Paper: Engineering Graphics Lab**

<b>L</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>2</b>

**LIST OF EXPERIMENTS****UNIT - I**

**General:** Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications,

**Projections of Point and Lines:** Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>)

**Unit - II**

**Planes other than the Reference Planes:** Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

**Projections of Plane Figures:** Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>)

**Unit - III**

**Projection of Solids:** Simple cases when solid are placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>)

**Unit-IV**

**Isometric Projection of plain surface and bodies.**

(T<sub>1</sub>, T<sub>2</sub>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>)

**Text Books:**

[T1] Engineering drawing by N.D.Bhatt (Charotar Publications).

[T2] Engineering Drawing by S.C.Sharma & Navin Kumar (Galgotia Publications)

**Reference Books:**

[R1] Engineering Drawing by Venugopalan, (New Age International).

[R2] **Engineering Drawing by P.S.Gill (S.K. Kataria & Sons)**

[R3] Engineering Graphics by K.C.John (PHI)

**Note:- Any 8-10 Experiments out of the list may be chosen.**

**FUNDAMENTAL OF COMPUTING LAB**

**Paper Code: ETCS 157**

**Paper: Fundamental of Computing Lab**

<b>L</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**LIST OF EXPERIMENTS**

For program development an IDE e.g. CodeBlock<sup>[a]</sup>, Eclipse CDT<sup>[b]</sup>, Netbeans<sup>[c]</sup> is recommended

1. Dismantling a PC Part -1
2. Dismantling a PC Part -2
3. Internal and External commands of DOS
4. System utilities of windows including regedit
5. Installation of any rpm or debianlinux distribution with emphasis on drive partitioning
6. Installation of rpm and deb based packages
7. Understanding of File system of Linux
8. Creating user and group ( through CLI)
9. Understanding and working knowledge of .Libre / Open Office Writer  
: Editing and Reviewing, Drawing, Tables, Graphs, Templates
10. Understanding and working knowledge of Libre / Open Office Calc
11. Understanding and working knowledge Libre / Open Office Impress
12. Understanding of flow chart development through Dia \*
13. Two Mini Projects based on the skills learned in experiments 1-12
  - [ Dia ] <http://projects.gnome.org/dia/>

**Note:- Any 8-10 Experiments out of the list may be chosen.**

**APPLIED CHEMISTRY LAB**

Paper Code –ETCH-161

Paper : Applied Chemistry Lab

P

2

C

1

**LIST OF EXPERIMENTS**

1. Determination of alkalinity of water sample.
2. Determination of hardness of water sample by EDTA method.
3. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
4. Determine the amount of oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
5. Determine the amount of copper in the copper ore solution, provided hypo-solution (Iodometric Titration).
6. Determine the amount of chloride ions present in water using silver nitrate (Mohr's Precipitation Method).
7. Determine the strength of  $MgSO_4$  solution by Complexometric titration.
8. Determine the surface tension of a liquid using drop number method.
9. Determine the viscosity of a given liquid (density to be determined).
10. Determine the cell constant of conductivity cell and titration of strong acid/strong base conductometrically.
11. To determine (a)  $\lambda_{max}$  of the solution of  $KMnO_4$ . (b) Verify Beer's law and find out the concentration of unknown solution by spectrophotometer.
12. Determination of the concentration of iron in water sample by using spectrophotometer.
13. Determination of the concentration of Iron (III) by complexometric titration.
14. Proximate analysis of coal.
15. Determination of eutectic point and congruent melting point for a two component system by method of cooling curve.  
(At least 8 to 10 experiments are to be performed)

**Suggested Books:**

1. [A. I. Vogel](#), [G. H. Jeffery](#), *Vogel's Text Book of Quantitative Chemical Analysis*, Published by Longman Scientific & Technical, 5<sup>th</sup> Edition, 1989.
2. S. Chawla, *Essentials of Experimental Engineering Chemistry*, Dhanpat Rai & Co., 3<sup>rd</sup> Edition, 2008.
3. S. Rattan, *Experiments in Applied Chemistry*, Published by S.K.Kataria & Sons, 2<sup>nd</sup> Edition, 2003.
4. O. P. Pandey, D. N. Bajpai and S. Giri, *Practical Chemistry*, Published by S. Chand, 2005.
5. M. S. Kaurav, *Engineering Chemistry with Laboratory Experiments*, Published by PHI Learning Private Limited, 2011.
6. S. K. Bhasin and Sudha Rani, *Laboratory Manual on Engineering Chemistry*, Published by Dhanpat Rai Publishing Company, 2006.

**Note:- Any 8-10 Experiments out of the list may be chosen.**

**APPLIED MATHEMATICS-II****Paper Code : ETMA-102****Paper: APPLIED MATHEMATICS-II**

<b>L</b>	<b>T</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student.*

**Unit –I**

Partial differentiation and its Applications: Partial derivatives of first and second order. Euler's theorem for homogeneous functions (without proof). Derivatives of Implicit Functions, total derivatives. Change of variables. Jacobian. Taylor's theorem for function of two variables (without proof). Error and approximation. Extreme values of function of several variables (maxima, minima, saddle points). Lagrange method of undetermined multipliers. Partial differential equations: Formulation, solution of first order equations, Lagrange's equations, Charpit's method.

**[T2][No. of 12hrs.]****Unit-II**

Laplace Transformation: Definition, Laplace transformation of basic functions, existence condition for Laplace transformation, Properties of Laplace transformation (Linearity, scaling and shifting). Unit step function, Impulse Function, Periodic Functions. Laplace transformation of derivatives, Laplace transformation of integrals, differentiation of transforms, Integration of transforms, Convolution theorem, inverse Laplace transformation. Solution of ordinary Differential equations.

**[T1, T2][No. of 12hrs.]****Unit-III**

Complex Function: Definition, Derivatives, Analytic function, Cauchy's Riemann equation (without proof). Conformal and bilinear mappings, Complex Integration: Complex Line integration, Cauchy's integral theorem and integral formula (without proof). Zeros and Singularities, Taylor's and Laurent's series (without proof). Residues, Residue theorem (without proof). Evaluation of real definite integrals: Integration around the unit circle, Integration around a small semi circle and integration around rectangular contours.

**[T1, T2][No. of 12hrs.]****Unit-IV**

Multiple integrals: Double integrals, Change of order of integration, Triple integrals. Vector Calculus: Scalar and vector functions, Gradient, Divergence and curl. Directional derivatives, Line Integrals. Surface integrals, volume integrals. Green's theorem, Stoke's theorem and Gauss divergence theorem (without proof).

**[T1, T2][No. of 12hrs.]****Text:**

[T1]. E. Kresyzig, "Advance Engineering Mathematics", Wiley publications

[T2] Michael Greenberg, "Advance Engineering mathematics", Pearson.

**References:**

- [R1] R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publications
- [R2] B. S. Grewal, "Higher Engineering Mathematics" Khanna Publications.
- [R3] S. Ponnusamy, "Foundation of Complex Analysis" Narosa Publication
- [R4] G.B. Thomas and R. N. Finny "Calculus and Analytic Geometry" Addison Wesley/ Narosa
- [R5] Wylie R, "Advance Engineering mathematics", McGraw-Hill
- [R6] M. Spiegel, "Schaum's Outline on Laplace Transform, Tata McGraw-Hill

**APPLIED PHYSICS – II****Paper Code: ETPH-104****Paper : APPLIED PHYSICS – II**

<b>L</b>	<b>T</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Applied Physics aspects that are required for his understanding of basic physics.*

**UNIT I**

**Electromagnetic Theory** : Gradient, Divergence, Curl, Gauss' law, Ampere's Law, Continuity equation, Maxwell's equations (differential and integral forms), Significance of Maxwell's equations, Poynting Theorem, Electromagnetic wave propagation in dielectrics and conductors.

**[T1], [T2][No. of Hrs. 8]****UNIT II**

**Statistical Physics**: Black body radiation, Planck's radiation formula, Wien's and Rayleigh-Jeans Laws, Distribution laws: Qualitative features of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics & their comparison (without derivation).

**Quantum Mechanics**: Postulates of Quantum mechanics, de-Broglie hypothesis, Davisson Germer experiment, Wave function and its physical significance, Wave Packet, Phase and group velocities, Uncertainty principle, Schrodinger equation for free particle, Time dependent Schrodinger equation, Particle in a box (1-D).

**[T1][T2][No. of Hrs. 8]****UNIT III**

**Crystal Structure**: Types of solids, Unit cell, Types of crystals, Translation vectors, Lattice planes, Miller indices, Simple crystal structures, Interplaner spacing, Crystal structure analysis: Bragg's law, Laue method, Point defects: Schottky and Frankel defects.

**[T1], [T2][No. of Hrs. 8]****UNIT IV**

**Band Theory of Solids**: Introduction, Kronig-Penney model: E-k diagram, Effective mass of an electron, Intrinsic semiconductors: Electron concentration in conduction band, Hole concentration in valence band, Extrinsic semiconductor: p-type and n-type semiconductors, Fermi level, Hall Effect: Hall voltage and Hall coefficient.

**[T1][T2][No. of Hrs. 8]****Text Books:**

- [T1]. Arthur Beiser 'Concepts of Modern Physics', [McGraw-Hill], 6<sup>th</sup> Edition 2009.  
 [T2]. A. S.Vasudeva, 'Modern Engineering Physics', S. Chand, 6<sup>th</sup> Edition, 2013.

**Reference Books**

- [R1]. Richard Wolfson 'Essential University Physics' Pearson, 1st edition, 2009.  
 [R2]. H.K. Malik & A. K. Singh 'Engineering Physics' [McGraw-Hill], 1<sup>st</sup> Edition, 2009.  
 [R3]. C. Kittle, 'Mechanics', Berkeley Physics Course, Vol.- I. Latest Edition.  
 [R4]. Irving Kaplan 'Nuclear Physics' Latest Edition.  
 [R5]. John R. Taylor, Chris D. Zafirator and Michael A. Dubson, 'Modern Physics For Scientists and Engineers', PHI, 2<sup>nd</sup> Edition.  
 [R6]. D.J. Griffith, 'Introduction to Electrodynamics', Prentice Hall, Latest Edition.

**ELECTRONIC DEVICES**

**Paper Code: ETEC-106**  
**Paper : Electronic Devices**

L	T	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. This is the first introductory course in Electronics Engineering to the students of all the branches of engineering during the first year.
2. Question No.1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions from each unit. It should be of 25 marks.
3. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: Objective of the paper is to facilitate the student with the basics of electronic aspects that are required for his understanding and applications in their respective field of study. The pre-requisites are, to have a basic understanding of Applied Physics and Mathematics.*

**Unit-I**

Evaluation Of Electronics: Introduction & Application Of Electronics, Energy Band Theory Of Crystals, Energy Band Structures In Metals, Semiconductors And Insulators, Theory Of Semiconductors: Classification Of Semiconductors, Conductivity Of Semiconductors, Carrier Concentration In Intrinsic & Extrinsic Semiconductors, Properties Of Intrinsic And Extrinsic Semiconductors, Variation In Semiconductors Parameters With Temperature, Fermi-Dirac Function, Fermi Level In A Semiconductor Having Impurities, Band Structure Of Open-Circuited P-N Junction, Drift And Diffusion Currents, Carrier Life Time, Continuity Equation (Elementary Treatment Only)

**[T1][T2][T3][No. Of Hours: 12]****Unit – II**

**Theory of p-n junction Diode:** Diode Current Equation, Diode Resistance, Transition Capacitance, Diffusion Capacitance, (Elementary treatment only), Effect of Temperature on p-n Junction Diode, Switching Characteristics, Piecewise Linear Model, **Special Diodes:** Zener Diode, Varactor Diode, Tunnel Diode, Photodiode, Light Emitting Diodes, Schottky Barrier Diode, **Applications of Diodes:** Half-Wave Diode Rectifier, Full-Wave Rectifier, Clippers and Clampers (Elementary treatment only).

**[T1][T2][T3][No. of Hours: 11]****Unit – III**

**Bipolar junction transistor:** Introduction of transistor, construction, transistor operations, BJT characteristics, load line, operating point, leakage currents, saturation and cut off mode of operations, Eber-moll's model.

**[T1][T2][T3][No. of Hours: 11]****Unit – IV**

**Application of BJT:** CB, CE, CC configurations, hybrid model for transistor at low frequencies, Introduction to FETs and MOSFETs.

**Fundamentals of digital electronics:** Digital and analog signals, number systems, Boolean algebra, logic gates with simple applications, logic gates, karnaugh maps.

**[T1][T2][T3][No. of Hours: 11]****Text Books**

- [T1] S. Salivahanan, N. Suresh Kr. & A. Vallavaraj, "Electronic Devices & Circuit", Tata McGraw Hill, 2008  
 [T2] Millman, Halkias and Jit, "Electronic devices and circuits" McGraw Hill  
 [T3] Boylestad & Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10<sup>TH</sup> Edition.

**Reference Books**

- [R1] Sedra & Smith, "Micro Electronic Circuits" Oxford University Press, VI Edition  
 [R2] Robert T. Paynter, "Introducing Electronic Devices & Circuits", Pearson Education, VII Edition, 2006

## INTRODUCTION TO PROGRAMMING

**Paper Code: ETCS-108**

**Paper: Introduction to Programming**

<b>L</b>	<b>T</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks : 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of programming aspects, using C as the primary language. This course focuses on the programming constructs which are used in other languages as well. This is the first course on programming and does not assume any prerequisite.*

### UNIT I

Concept of algorithms, Flow Charts, Overview of the compiler ( preferably GCC ), Assembler, linker and loader , Structure of a simple Hello World Program in C ,Overview of compilation and execution process in an IDE ( preferably Code Block)

[T1],[T2], [R4][R5][No. of hrs 8]

### UNIT II

Programming using C: Preprocessor Directive, C primitive input output using get char and put char , simple I/O Function calls from library , data type in C including enumeration , arithmetic, relational and logical operations, conditional executing using if, else, switch and break .Concept of loops , for, while and do-while , Storage Classes: Auto, Register, Static and Extern

[T1], [T2], [R7][No. of hrs 8]

### UNIT III

Arrays (one and two dimensional), 2-d arrays used in matrix computation. Concept of Sub-programming, functions. Parameter transmission schemes i.e. call by value and call by reference, Pointers, relationship between array and pointer, Argument passing using pointers, Array of pointer, passing arrays as arguments

[T2], [R1], [R7][No. of hrs 8]

### UNIT IV

Structure and unions , Strings and C string library, File Handling in C Using File Pointers, fopen( ), fclose( ), Input and Output using file pointers, Character Input and Output with Files , String Input / Output Functions , Formatted Input / Output Functions,Block Input / Output Functions, Sequential Vs Random Access Files , Positioning the File Pointer

[T1], [T2],[R2][R7][No. of hrs 8]

### Text Books:

[T1] Herbert Schildt, "C: The Complete Reference", OsbourneMcgraw Hill, 4th Edition, 2002.

[T2] Forouzan Behrouz A. "Computer Science: A Structured Programming Approach Using C, Cengage Learning 2/e

### Reference Books:

[R1] Kernighan & Ritchie, "C Programming Language", The (Ansi C version), PHI, 2/e

[R2] K.R Venugopal, "Mastering C ", TMH

[R3] R.S. Salaria "Application Programming in C " Khanna Publishers4/e

[R4] Yashwant Kanetkar " Test your C Skills " , BPB Publications

[R5] <http://www.codeblocks.org/>

[R6] <http://gcc.gnu.org/>

[R7] Programming in ANSI C, E. Balagurusamy; Mc Graw Hill, 6<sup>th</sup> Edition.

**ENGINEERING MECHANICS**

**Paper Code: ETME 110**  
**Paper: Engineering Mechanics**

<b>L</b>	<b>T</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**OBJECTIVE: THE OBJECTIVE OF THE PAPER IS TO GIVE THE BASIC PRINCIPLES OF MECHANIC APPLIED IN DIFFERENT DISCIPLINES OF ENGINEERING.**

**UNIT- I**

**Force system:** Free body diagram, Parallel force system, concurrent force system, Equilibrium equations and applications in different force systems.

**Friction:** Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, Belt drive- derivation of equation  $T_1/T_2 = e^{\mu\theta}$  and its application, M.A, V.R and Efficiency of Screw Jack, Application of friction in pivot and collar bearing..

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

**UNIT- II**

**Structure:** Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section, graphical method.

**Distributed Force:** Determination of center of gravity, center of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, Pappus theorems, polar moment of inertia.

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

**Unit-III**

**Kinematics of Particles:** Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component.

**Kinetics of Particles:** Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

**Unit-IV**

**Kinematics of Rigid Bodies:** Concept of rigid body, type of rigid body motion, absolute motion, introduction to relative velocity, instantaneous center of velocity, Velocity polygons for four bar mechanism and single slider mechanism.

**Kinetics of Rigid Bodies:** Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy.

Shear force and bending Moment Diagram.

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

**Text Books:**

- [T1] Engg Mechanics by A.K.Tayal (Umesh Publications).  
 [T2] Engg Mechanics by Basudeb Bhattacharya (Oxford university Press)

**Reference Books:**

- [R1] Engg Mechanics by Irving H. Shames (Pearson publications).  
 [R2] Engg Mechanics by U.C.Jindal (Galgotia Publications).  
 [R3] Engg Mechanics by Beer & Johnston( TMH).  
 [R4] Engg Mechanics by K.L.Kumar (TMH).  
 [R5] Engg Mechanics by Sadhu Singh (Khanna Publishers).



**COMMUNICATION SKILLS****Paper Code: ETHS – 112****Paper: Communication Skills**

L	T	C
2	1	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To enhance the language and communication competence of professional students with emphasis on English for Specific Purposes (ESP) through communication skills related activities.*

**UNIT-I**

**I. Basic Remedial Grammar** (Errors in Parts of Speech, Tenses, Verbs and Modal; Reported Speech; Active and Passive Voice; Conditional clauses; Question Tags and Short Responses)

[T1],[R2],[R3][No. of hrs 06]

**UNIT-II**

**II. Vocabulary and usage** (Synonyms and Antonyms; Suffixes and Prefixes; Homophones and Homonyms; One-word substitution; Prepositions; Phrasal verbs and Idioms, Indianism)

[T1],[R2],[R3][No. of hrs 06]

**UNIT-III****(A)**

- I. Types of writing (Expository, Descriptive, Narrative, Analytical and Argumentative)
- II. Definition, description and explanation of scientific objects, instruments and processes etc.
- III. Interpretation and use of charts, graphs and tables in technical writing.[T1],[R1]

**(B)**

- I. Paragraph writing
- II. Precis writing
- III. Comprehension [T1],[R2],[R3]

**[No. of hrs 10]****UNIT-IV**

- I. Reading different types of texts (speed and purpose)[T1]
- II. Reading five essays [T2]
- III. E.M. FORSTER, *What I Believe* (Pg-123)
- IV. JAMES BRYCE, *Some Hints on Public Speaking* (Pg-135)
- V. L.A. HILL, *Principles of Good Writing* (Pg-150)
- VI. A.P.J. ABDUL KALAM, *Work Brings Solace* (Pg-207)
- VII. SALIM ALI, *Man and Nature in India: The Ecological Balance* (Pg-213)

**[No. of hrs 10]****TEXT BOOKS**

- [T1] Technical Communication: Principles and practice (OUP), (Meenakshi Raman and Sangeeta Sharma)  
OXFORD UNIVERSITY PRESS
- [T2] Communication Skills for Engineers, Murli Krishna, Pearson.
- [T3] Wren and Martin: High School English Grammar and Composition; S. Chand
- [T4] Exploration of Ideas; An Anthology of Prose: Orient Blackswan.

**REFERENCE BOOKS:**

- [R1] Professional Communication: Aruna Koneru, MCGRAW HILLS EDUCATION PVT. LTD
- [R2] Wren and Martin: High School English Grammar and Composition; S. Chand
- [R3] Advanced English Grammar and Composition: Gurudas Mukherjee & Inidbar Mukherjee; (ANE BOOKS PVT. LTD.)

**ENVIRONMENTAL STUDIES****Paper Code: ETEN-114****Paper : Environmental Studies**

<b>L</b>	<b>T</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTER:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Each unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each

*Objective: The objective of this course is to make students environment conscious. They will be exposed through the fundamental concepts of environment and ecosystem so that they can appreciate the importance of individual and collective efforts to preserve and protect our environment. This course must raise various questions in student's mind that how our environment is inter dependent on various factors and how human being must care for their natural surroundings.*

**UNIT I: Environmental Studies: Ecosystems, Bio-diversity and its Conservation****(i) The Multidisciplinary Nature of Environmental Studies-**

Definition, scope and importance of Environmental Studies. Biotic and a biotic component of environment, need for environmental awareness.

**(ii) Ecosystems**

Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structures and function of the following ecosystem:

- (a) Forest ecosystem
- (b) Grassland ecosystem
- (c) Desert ecosystem
- (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

**(iii) Bio-diversity and its Conservation**

Introduction to biodiversity —definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity : Habitat loss, Poaching of wildlife, man-wildlife conflicts, rare endangered and threatened species(RET) endemic species of India, method of biodiversity conservation: *In-situ* and *ex-situ* conservation.

**[T1], [R3][No. of hrs. 08]****UNITII: Natural Resources: problems and prospects****(i) Renewable and Non-renewable Natural Resources**

Concept and definition of Natural Resources and need for their management

- *Forest resources:* Use and over-exploitation, deforestation, case studies, timber extraction, mining, dams and their effects on forests and tribal people.
- *Water resources:* Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, Water conservation, rain water harvesting, watershed management.
- *Mineral resources:* Uses are exploitation, environmental effects of extracting and using mineral resources, case studies.
- *Food resources:* World food problems, changes causes by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- *Energy resources:* Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Urban problems related to energy, case studies.
- *Land resources:* Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

**[T1], [R3][No. of hrs. 08]**

**UNIT III: Environmental Chemistry and Pollution Control****(i) Chemistry of Environment****(a) Green Technology**

Principles of Green technology, Zero Waste Technology, Green Chemistry & Its basic principles, Atom Economy, Green Methodologies. clean development mechanisms (CDM), concept of environmental impact assessment,

**(b) Eco-Friendly polymers**

Environmental degradation of polymers, Biodegradable, Photo-biodegradable polymers, Hydrolysis & Hydrobiodegradable, Biopolymers & Bioplastics: polylactic acid, polyhydroxybutyrate, polycaprolactone,. Concept of bioremediation.

**(ii) Environmental Pollution**

Definition, types, causes, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Pollution case studies. Solid waste and its management: causes, effects and control measures of urban and industrial waste.

**Chemical toxicology**-Terms related to toxicity, impact of chemicals (Hg, As, Cd, Cr, Pb) on environment.

[T1], [R3][No. of hrs. 08]

**UNIT IV: Disaster Management, Social Issues, Human Population and the Environment****(i) Disaster Management**

Disaster management: floods, earthquake, cyclone and land-slides, nuclear accidents and holocaust, *case studies*.

**(ii) Social Issues, Human Population and the Environment**

Sustainable development, Climate change, global warming, acid rain, ozone layer depletion, Environmental ethics: Issues and possible solutions, Consumerism and waste products, , Wasteland reclamation. Population growth, problems of urbanisation.

Environment Protection Act, 1986; Air (Prevention and Control of Pollution) Act, 1981; Water (Prevention and Control of Pollution) Act, 1974; Wildlife Protection Act, 1972; Forest Conservation Act, 1980; Environmental management system standards-ISO 14000 series.

[T1][No. of hrs. 08]

**Text Books:**

[T1] E. Barucha, *Textbook of Environmental Studies for Undergraduate Courses*, Universities Press (India) Pvt. Ltd., 2005.

[T2] S. Chawla, *A Textbook of Environmental Studies*, McGraw Hill Education Private Limited, 2012

**References Books:**

[R1] G. T. Miller, *Environmental Science*, Thomas Learning, 2012

[R2] W. Cunningham and M. A. Cunningham, *Principles of Environment Science: Enquiry and Applications*, Tata McGraw Hill Publication, N. Delhi, 2003.

[R3] R. Rajagopalan, *Environmental Studies: From Crisis to Cure*, 2<sup>nd</sup> Edition, Oxford University Press, 2011.

[R4] A.K. De, *Environmental Chemistry*, New Age Int. Publ. 2012,.,

[R5] A. Kaushik and C.P. Kaushik, *Perspectives in Environment Studies*, 4<sup>th</sup> Edition, New Age International Publishers, 2013

[R6] *Environmental Engineering* by Gerard Kiely, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.

**APPLIED PHYSICS LAB – II****Paper Code: ETPH-152****Paper: Applied Physics Lab – II****P****2****C****1****LIST OF EXPERIMENTS**

1. To determine the  $e/m$  ratio of an electron by J.J. Thomson method.
2. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain lissajous pattern on the CRO screen by feeding two sine wave signals from two signal generators.
3. To determine the frequency of A.C. mains by using Sonometer .
4. To determine the frequency of electrically maintained tuning fork by Melde's method.
5. Computer simulation (simple application of Monte Carlo): Brownian motion, charging & discharging of a capacitor.
6. To study the charging and discharging of a capacitor and to find out the time constant.
7. To study the Hall effect.
8. To verify Stefan's law.
9. To determine the energy band gap of a semiconductor by four probe method/or by measuring the variation of reverse saturation current with temperature.
10. To study the I-V characteristics of Zener diode.
11. To find the thermal conductivity of a poor conductor by Lee's disk method.
12. To study the thermo emf using thermocouple and resistance using Pt. Resistance thermometer.

**Suggested Books:**

[T1] C. L. Arora 'B. Sc. Practical Physics' S. Chand, Latest edition.

**Note:** Any 8-10 experiments out of the list may be chosen. Proper error – analysis must be carried out with all the experiments.

Electronic Devices

**Paper Code: ETEC-156**  
**Paper: Electronic Devices Lab**

**P C**  
**2 1**

LIST OF EXPERIMENTS

1. Introduction to C.R.O, Function Generator & Bread Board Kit & to generate different types of waveform with the help of Function Generator & to calculate their frequency, amplitude AC & DC voltage.
2. Identification & testing of Active & passive components
3. To plot V-I characteristics of a semiconductor diode & Calculate Static & Dynamic Resistance
4. To Study the Reverse characteristics of Zener diode
5. To Study the Rectifier circuit.
  - a) Half Wave Rectifier
  - b) Centre Tapped Rectifier.
  - c) Bridge Rectifier.
6. To Study the output waveforms of different Filter Ckts of Rectifier.
7. To Plot Input & Output characteristics CB transistor.
8. To Plot Input & Output characteristics of CE transistor.
9. Realization of basic gates.
10. Implementation of Boolean functions (two or three variables).
11. Few experiments mentioned above to be performed on P-spice.
12. To develop a working model of any electronic circuit.

**Note:- Any 8-10 Experiments out of the list may be chosen.**

**ENGINEERING MECHANICS LAB**

**Paper Code: ETME-158**  
**Paper: Engineering Mechanics Lab**

**P**      **C**  
**2**      **1**

**LIST OF EXPERIMENTS:**

1. To verify the law of Force Polygon
2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
4. To find the forces in the members of Jib Crane.
5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
7. To determine the MA, VR,  $\eta$  of Worm Wheel ( 2-start)
8. Verification of force transmitted by members of given truss.
9. To verify the law of moments using Bell crank lever
10. To find CG and moment of Inertia of an irregular body using Computation method.

**Note:- Any 8-10 Experiments out of the list may be chosen.**

**PROGRAMMING LAB**

<b>Paper Code</b>	<b>:</b>	<b>ETCS 154</b>	<b>P</b>	<b>C</b>
<b>Paper</b>	<b>:</b>	<b>Programming Lab</b>	<b>2</b>	<b>1</b>

**LIST OF EXPERIMENTS**

For program development an IDE e.g. CodeBlock<sup>[a]</sup>, Eclipse CDT<sup>[b]</sup>, Netbeans<sup>[c]</sup> is recommended

1. Write a program to find divisor or factorial of a given number.
  2. Write a program to find sum of a geometric series
  3. Write a recursive program for tower of Hanoi problem
  4. Write a recursive program to print the first m Fibonacci number
  5. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices
    - Addition of two matrices
    - Subtraction of two matrices
    - Finding upper and lower triangular matrices
    - Transpose of a matrix
    - Product of two matrices.
  6. Write a program to copy one file to other, use command line arguments.
  7. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.
  8. Write a program to perform the following operators on Strings without using String functions
    - To find the Length of String.
    - To concatenate two string.
    - To find Reverse of a string.
    - To Copy one sting to another string.
  9. Write a Program to store records of an student in student file. The data must be stored using Binary File. Read the record stored in "Student.txt" file in Binary code. Edit the record stored in Binary File. Append a record in the Student file.
  10. Write a programmed to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of File.
  11. Two Mini Projects based on the skills learned in experiments 1-10 [ These mini projects may be done in a group not exceeding group size of 4 ]
    - [a] <http://www.codeblocks.org/>
    - [b] <http://www.eclipse.org/cdt/>
    - [c] <https://netbeans.org/features/cpp/>
- Note:- Any 8-10 Experiments out of the list may be chosen.**

**ENVIRONMENTAL STUDIES LAB****Paper Code –ETEN-160****Paper : Environmental Studies Lab****P      C**  
**2      1****LIST OF EXPERIMENTS**

1. Determination of pH, conductivity and turbidity in drinking water sample.
2. Determination of pH and conductivity of soil/sludge samples.
3. Determination of moisture content of soil sample.
4. Determination of Total Dissolved Solids (TDS) of water sample.
5. Determination of dissolved oxygen (DO) in the water sample.
6. Determination of Biological oxygen demand (BOD) in the water sample.
7. Determination of Chemical oxygen demand (COD) in the water sample.
8. Determination of Residual Chlorine in the water sample.
9. Determination of ammonia in the water sample.
10. Determination of carbon dioxide in the water sample.
11. Determination of nitrate ions or sulphate ions in water using spectrophotometer.
12. Determination of the molecular weight of polystyrene sample using viscometer method.
13. Base catalyzed aldol condensation by Green Methodology.
14. Acetylation of primary amines using eco-friendly method.
15. To determine the concentration of particulate matter in the ambient air using High Volume Sampler.

**P.S.:** For better understanding of various aspects of environment visits to local areas, depending upon easy access and importance may be planned to any nearby river, forest, grassland, hills and students should write a report based on their observations.

**Suggested Books:**

1. [A. I. Vogel](#), [G. H. Jeffery](#), *Vogel's Text Book of Quantitative Chemical Analysis*, Published by Longman Scientific & Technical, 5<sup>th</sup> Edition, 1989.
2. [dst.gov.in/green-chem.pdf](http://dst.gov.in/green-chem.pdf) (monograph of green chemistry laboratory experiments).
3. S. Chawla, *Essentials of Experimental Engineering Chemistry*, Dhanpat Rai & Co., 3<sup>rd</sup> Edition, 2008.
4. S. Rattan, *Experiments in Applied Chemistry*, Published by S.K.Kataria & Sons, 2<sup>nd</sup> Edition, 2003.
5. W. Cunningham and M. A. Cunningham, *Principles of Environment Science: Enquiry and Applications*, Tata McGraw Hill Publication, N. Delhi, 2003.
6. A. Kaushik and C. P. Kaushik, *Perspectives in Environment Studies*, 4<sup>th</sup> Edition, New Age International Publishers, 2013.

**Note:- Any 8-10 Experiments out of the list may be chosen.**



**MATERIAL SCIENCE & METALLURGY**

**Paper Code: ETME-207**  
**Paper: Material Science & Metallurgy**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to introduce the student about knowledge of structure of materials and effect of deformation. This paper also provides understanding of heat treatment on materials and applications of different types of alloys and composite materials.*

**UNIT – I**

**Structure of metal:** Crystal structure (BCC, FCC and HCP, Packing factor and density calculation), X-ray diffraction, miller indices, lattices, imperfections, elementary treatment of point and line defects and their relation to mechanical properties.

**Diffusion:** Diffusion mechanisms, steady state and non steady state diffusion, factors affecting diffusion

**Deformation:** Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and grain growth.

[T1,T2] [No. of Hrs. 11]

**UNIT – II**

**Fracture:** Types of fracture ductile and brittle, fatigue

**Creep:** Basic consideration in the selection of material for high and low temperature service, creep curve, effect of material variables on creep properties, brittle failure at low temperature.

**Solidification:** Phases in metal system, lever rule, solidification of metal and alloys, solid solution, eutectic, eutectoid and inter-metallic compounds, Iron carbon equilibrium diagram, TTT-diagram. Effect of alloying elements on TTT diagram, S-N curve.

[T1,T2][No. of Hrs. 13]

**UNIT - III**

**Heat Treatment:** Principles and purpose of heat treatment of plain carbon steels, annealing, normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys. Hardenability: determination of hardenability Jominy end quench test.

**Materials:** Plain Carbon steels, effect of alloying elements, properties, uses, springs, and wear resisting steels, IS standards codes for steels.

[T1,T3][No. of Hrs: 10]

**UNIT - IV**

**Corrosion:** Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.

**Fiber Reinforced Composites:** General characteristics, Applications, Introduction to Fibers – glass, carbon, Kevlar 49 fibers. Matrix – Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.

[T1,T3][No. of Hrs: 10]

**Text Books:**

- [T1] Callister “Materials Science and Engineering”: An Introduction, 6th Edition  
 [T2] Parashivamurthy K.I “Material Science and Metallurgy”, Pearson,  
 [T3] Sidney H Avner,” Introduction to Physical Metallurgy”, Tata McGraw-Hill,New Delhi-1997.

**Reference Books:**

- [R1] Degarmo E. Paul et.al, “Materials & Processes in Manufacture”, Prentice Hall India, New Delhi, 2001.  
 [R2] L. Krishna Reddi, “Principles of Engineering Metallurgy”, New Age Publication, New Delhi, 2001.  
 [R3] Buduisky et al, “Engineering Materials & Properties”, Prentice Hall India, New Delhi, 2004.  
 [R4] Peter Haasten, “Physical Metallurgy”, Cambridge Univ. Press, 1996.  
 [R5] Raymond A Higgin., “Engineering Metallurgy Part 1”, Prentice Hall India, New Delhi, 1998

**CIRCUITS & SYSTEMS**

**Paper Code: ETEE-207**  
**Paper: Circuits & Systems**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No.1 rest of the paper shall consist of four units as per the syllabus, every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

**Objective:** *The purpose of this course is for each student to learn and further explore the techniques of advanced circuit analysis. The concepts and analytical techniques gained in this course (e.g., signals, Laplace transformation, frequency response) will enable students to build an essential foundation of many fields within electrical engineering, such as control theory, analog electronic circuits, signal processing.*

**UNIT-I**

Introduction to signals, their classification and properties, different types of systems, LTI systems and their properties, periodic waveforms and signal synthesis, properties and applications of Laplace transform of complex waveform.

**[T1,T2][No. of Hrs: 10]****UNIT-II**

System modeling in terms of differential equations and transient response of R, L, C, series and parallel circuits for impulse, step, ramp, sinusoidal and exponential signals by classical method and using Laplace transform.

**[T1,T2][No. of Hrs: 12]****UNIT-III**

Graph theory: concept of tree, tie set matrix, cut set matrix and application to solve electric networks.

Two port networks – Introduction of two port parameters and their interconversion, interconnection of two 2-port networks, open circuit and short circuit impedances and ABCD constants, relation between image impedances and short circuit and open circuit impedances. Network functions, their properties and concept of transform impedance, Hurwitz polynomial.

**[T1,T2][No. of Hrs: 10]****UNIT IV**

Positive real function and synthesis of LC, RC, RL Networks in Foster's I and II, Cauer's I & II forms, Introduction of passive filter and their classification, frequency response, characteristic impedance of low pass, high pass, Band Pass and Band reject prototype section.

**[T1,T2][No. of Hrs: 10]****TEXT BOOKS:**

- [T1] W H Hayt "Engineering Circuit Analysis" TMH Eighth Edition  
 [T2] Kuo, "Network analysis and synthesis" John Wiley and Sons, 2<sup>nd</sup> Edition.

**REFERENCE BOOKS**

- [R1] S Salivahanan "Circuit Theory" Vikas Publishing House 1<sup>st</sup> Edition 2014  
 [R2] Van Valkenburg, "Network analysis" PHI, 2000.  
 [R3] Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design" Umesh publication, 2000.  
 [R4] D. R. Choudhary, "Networks and Systems" New Age International, 1999  
 [R5] Allan H Robbins, W.C. Miller "Circuit Analysis theory and Practice" Cengage Learning Pub 5<sup>th</sup> Edition 2013  
 [R6] Bell "Electric Circuit" Oxford Publications 7<sup>th</sup> Edition.

**THERMODYNAMICS FOR POWER ENGINEERS**

**Paper Code: ETPE-205**

**Paper: Thermodynamics for Power Engineers**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No.1 rest of the paper shall consist of four units as per the syllabus, every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Thermodynamics that are required for an engineering student.*

**UNIT-I**

Fundamentals and Definitions System, Control Volume, properties, state change, and diagram, Dimensions and units.

Work Mechanics and Thermodynamics, definitions, Displacement work at part of a system boundary, Engine Indicator, Displacement work in various quasi-static processes, shaft work, electrical work.

Heat Temperature, thermal equilibrium, zeroth law of thermodynamics, sign convention for heat transfer.

[T1][T2][R1][No. of Hrs. 11]

**UNIT-II**

First Law of Thermodynamics. Statement, Application to non-cyclic process, Energy, modes of energy, Pure substance, Specific heats, First Law for Control Volumes., Second Law of Thermodynamics ,Direct and reversed heat engines, Kelvin-Planck and Clausius Statements and their equality, reversible and irreversible processes, Carnot cycle, thermodynamic temperature scale.

[T1][T2][No. of Hrs. 11]

**UNIT-III**

**Entropy**

Definition, calculation through Tds relations, T-S diagrams, entropy as a measure of irreversibility Properties of pure substances-Use of steam Tables and Mollier Diagram.

**Ideal gas**

Properties of ideal gas and ideal gas mixtures with and without a condensable vapour-psychrometry.

[T1][R2][No. of Hrs. 11]

**UNIT-IV**

**Second Law Analysis of Engineering Processes**

Availability and irreversibility and their application in Thermal Engineering, Analysis of vapour power cycles, Carnot cycle; Simple Rankine Cycle, Cycle with superheating, reheating and regeneration.

**Analysis of cycles**

Analysis of Air standard, Carnot, Otto, diesel, dual and Joule cycles; Gas turbine cycles with heat exchange and regeneration; Stirling and Ericson cycles Natural Gas, CNG, LPG, their properties.

[T1][R2][No. of Hrs. 11]

**Text:**

[T1] Nag, P.K., "Engineering Thermodynamics", Tata McGraw Hill, 2<sup>nd</sup> edition, 1998.

[T2] Spalding, D.B. and Cole, E.H., "Engineering Thermodynamics", Edward Arnold, 1959. Hawkins, G.A., "Engineering Thermodynamics", John Wiley and Sons, 1955.

**References:**

[R1] Van Wylen, G.J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", John Wiley and Sons, 4<sup>th</sup> edition, 1997.

[R2] Jones Dugan Engineering Thermodynamics Prentice Hall

**STRENGTH OF MATERIALS & THEORY OF MACHINES****Paper Code: ETPE-207****Paper: Strength of Materials & Theory of Machines**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No.1 rest of the paper shall consist of four units as per the syllabus, every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Strength of Materials that are required for an engineering student.*

**UNIT-I**

**Simple Stress & Strain:** Mechanical properties of solids, concept of stress and strain, normal and shear stresses, Hook's law, principle of St. Venant, stress-strain diagrams, principle of superposition, stress and strain in bars subjected to tension and compression, elongation due to self weight, composite sections, thermal stresses, poisson's ratio, relation between elastic constants.

**Torsion of circular shafts:** Torque and horse-power, angle of twist, shear stresses in hollow and solids shafts within elastic limit, derivation of torsion equation, assumptions, stepped and composite shafts, closed coil helical springs subjected to axial loads and couple.

**Thin walled vessels:** Thin cylinders subjected to internal pressure, circumferential and longitudinal stresses and strains, maximum shear stress, increase in diameter and volume of vessel, thin spherical shells subjected to internal pressure, thin cylinders with hemispherical ends, wire winding of thin cylinders.

**[T1][T2][R1 & R2][No. of Hrs. 12]****UNIT-II**

**Shearing force and bending moment in beams:** Types of loads and supports, various types of beams, inter relation between SF & BM diagrams, shearing force and bending moment diagrams for various types of loading and supports, maximum bending moment and point of contraflexure.

**Theory of simple bending:** Stresses due to bending of initially straight beams, theory and assumptions, geometrical characteristics of sections, application of bending formula to simply supported beams of circular, rectangular and I sections, flitched beams.

**[T1][T2][R1 & R2][No. of Hrs. 11]****UNIT-III**

**Gears:** Types of gears, gear terminology, condition for correct gearing, cycloidal and involutes profiles of gear teeth, pressure angle, path of contact, arc of contact, interference, undercutting, minimum number of teeth, number of pairs of teeth in contact, helical, spiral, worm and worm gear, bevel gear.

**Gear trains:** Gear trains, simple, compound, reverted, and epicyclic, solution of gear trains, sun and planet gear, bevel epicyclic gear, compound epicyclic gear, pre-selective gear box, differential of automobile, torque in gear trains.

**[T3][R3][R4 & R5][No. of Hrs. 11]****UNIT-IV**

**Governors:** Types of governors: watt, porter, proell, spring loaded centrifugal, inertia, sensitiveness, stability, isochronism's, hunting, effort and power of governor, controlling force.

**Balancing:** Static and dynamic balancing of rotating parts, balancing of IC engines, balancing of multi-cylinder engine, V-engines and radial engines, balancing of machines

**Cam, Belt & Rope Drive:** Basic Concepts, Introduction to Applications.

**[T3][R3][R4 & R5][No. of Hrs. 11]****Text Books:**

[T1] Strength of Materials, SS Rattan, TMH

[T2] Strength of Materials, Ramamrutham, Dhanpat Rai Pubs.

[T3] Theory of Machines, SS Rattan, TMH

**Reference Books:**

[R1] Strength of Material , R K Bansal, Luxmi Punlications

[R2] Strength of Materials, Sadhu Singh, Khana Pubs.

[R2] Engineering Mechanics of Solids, Popov, PHI

[R3]Theory of Mechanics &amp; Machines, Jagdish Lal, Metropolitan Book Co.

[R4] Mechanism, J S Beggs, TMH

[R5] Theory of Mechanics, R K Bansal, Luxmi Publications

**Modified Scheme and Syllabus of B. Tech-POWER Engg. (1<sup>st</sup> Semester to 8<sup>th</sup> Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23<sup>rd</sup> BOS and 40<sup>th</sup> AC meeting of USET.**

**ANALOG ELECTRONICS**

**Paper Code: ETEL-203**  
**Paper: Analog Electronics**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**OBJECTIVE:-**

*The objective of teaching this subject is to impart in depth understanding of the concepts of biasing in active circuits and employing simple models to represent nonlinear and active elements in circuits. It also includes the operation of the circuits at high frequencies and effects of feedback. The analysis and applications operational amplifiers is also dealt with.*

**UNIT – I**

**Review of diode and BJT, Bias stabilization:** Need for stabilization, fixed Bias, emitter bias, self-bias, bias stability with respect to variations in  $I_{co}$ ,  $V_{BE}$  &  $\beta$ , Stabilization factors, thermal stability. Bias Compensation techniques.

**Small signal amplifiers:** CB, CE, CC configurations, hybrid model for transistor at low frequencies, RC coupled amplifiers, mid band model, gain & impedance, comparisons of different configurations, Emitter follower, Darlington pair(derive voltage gain, current gain, input and output impedance.)Hybrid -model at high frequencies ( $\pi$  model)

[T1, T2][No. of Hours: 11]

**UNIT – II**

**Multistage Amplifiers:** Cascaded and cascoded amplifiers, Calculation of gain Impedance and bandwidth, Design of multistage amplifiers.

**Feedback Amplifiers:** Feedback concept, Classification of Feedback amplifiers, Properties of negative Feedback amplifiers, Impedance considerations in different Configurations, Examples of analysis of feedback Amplifiers.

[T1 ,T2][No. of Hours: 11]

**UNIT – III**

**Field Effect Transistor:** Introduction, Classification, FET characteristics, Operating point, Biasing, FET small signal Model, enhancement & Depletion type MOSFETS.

**Power Amplifiers:** Power dissipations in transistors, Amplifiers Classification, (Class-A, Class-B, Class-C, Class-AB) Efficiency analysis, Push-pull and complementary Push-pull amplifiers, crossover distortion and harmonic distortion in push pull amplifier. Tuned amplifiers.

[T1, T2][No. of Hours: 11]

**UNIT – IV**

Op-Amp and its applications: Inverting and Non-inverting amplifiers, adder, sub-tractor, integrators, differentiator, instrumentation amplifiers, oscillators, and multi vibrators

[T1, T2, R5][No. of Hours: 11]

**Text Books:**

[T1] B.Kumar ,Shail Bala Jain, “Electronic Devices and Circuits” PHI.

[T2] Salivahanan , Suresh Kumar, Vallavaraj, “Electronic Devices and Circuits” TMH, 1999

**Reference Book**

[R1] J. Millman and Halkias, “Integrated Electronics, Analog &amp; Digital Circuits &amp; Systems” TMH – 2000.

[R2] Boylestad &amp; Nashelsky, “Electronic Devices &amp; Circuit Theory” Pearson Publication.

[R3] Electronic devices and circuits, DAVID A BELL, Oxford University Press, 2000.

[R4] Problems and solutions in basic electronic ,Albert Malvino, David J.Bates, TMH.

[R5] Sedra &amp; Smith, “Micro Electronic Circuits” Oxford University Press, 2000

**ELECTRICAL MACHINES****Paper Code: ETPE-201****L T/P C****Paper: Electrical Machines****3 1 4****INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of this paper is to make students understand principle of electromechanical energy conversion and electrical machines.*

**UNIT- I** : Principles of Electromechanical Energy Conversion.

**DC machines:** construction, armature windings, induced EMF equation, torque production, magnetization curve. Types of generators and motors, characteristics, commutation and interpoles, armature reaction, Speed control of dc motor and starting.

PMDC machine: Introduction and need of brushless motors.

[T1, T2][No. of Hrs. 11]

**UNIT- II: Transformers:** construction, ideal and practical transformer, equivalent circuits, voltage regulation, maximum efficiency criterion. Open circuit and short circuit tests. Phasor diagrams on no load, full load, lagging and leading power factor loads. Three phase transformer.

Introduction to polyphase induction machines, production of rotating magnetic flux vector, principle of operation, importance of air gap, comparison with transformer, types of rotor.

[T1, T2][No. of Hrs. 10]

**UNIT- III: Induction motors:** Development of an equivalent circuit, estimation of parameters, no load and block rotor tests. Torque slip characteristics, starting of induction motors methods, deep bar and double cage rotor, power relations, speed control of induction motors.

Single phase induction motor, double field revolving theory, starting methods of single phase induction motors, universal motor and introduction to switched reluctance motor.

[T1, T2][No. of Hrs. 11]

**UNIT- IV: Synchronous Machine:** construction, pitch factor and distribution factor, induced emf equation, equivalent circuits and phasor diagrams, power relations, OCC and SCC characteristics for voltage regulation of alternator, salient pole and cylindrical rotor machines and phasors. Effect of excitation and V curves. Power factor correction and parallel operation of synchronous generator.

[T1, T2][No. of Hrs. 10]

**Text books:**

[T1] I.J Nagrath and D.P.Kothari, "Electrical Machines", Tata Mc Graw Hill, 2010, Fourth Edition

[T2] Bhag S. Guru, Huseyin R. Hiziroglu, "Electric Machinery and Transformers", Oxford Pub., Third Edition.

**Reference Books:**

[R1] "Electrical Machines" M. V. Deshpande PHI

[R2] "Principles of Electric Machinery and Power Electronics", PC Sen, Wiley and Sons, Third Edition.

[R3] "Electrical Machines", Ashfaq Hussain, Dhanpat Rai

[R4] "Electrical Machines", Fitzgerald, A.E. , C.Kingslay & Umans, Mc Graw Hill.

**THERMODYNAMICS FOR POWER ENGINEERS LAB****Paper Code: ETPE-251****Paper: Thermodynamics for Power Engineers Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Study of four stroke cycle Petrol Engine
2. Study of four stroke cycle Diesel Engine
3. Study of two stroke cycle Petrol Engine
4. Study of two stroke cycle Diesel Engine
5. Study of Cochran Boiler
6. Study of Wilcox and Babcock Boiler
7. Study of Locomotive Boiler
8. To conduct an Experiment on Baby Boiler and Plot pressure Vs Saturation temperature curve.
9. To determine the various psychrometric properties of air using sling psychrometer.
10. To study a gas Turbine model

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**STRENGTH OF MATERIALS & THEORY OF MACHINES LAB****Paper Code: ETPE-253****L T/P C****Paper: Strength of Materials & Theory of Machines Lab****0 3 1****List of Experiments**

1. To study the universal impact testing m/c and to find the impact strength of the given specimen.
2. To study the pendulum type impact testing m/c and to find the impact strength of given specimen.
3. To study the universal testing machine (UTM) and to perform tensile test on it.
4. To perform compression test on UTM for a given specimen.
5. To perform shear test on UTM for a given specimen.
6. To determine the value of modulus of elasticity of a given specimen using extensometer on UTM.
7. To perform bending test on UTM for a given specimen.
8. To study the torsion testing machine and to find the modulus of rigidity, torsional strength and modulus of rupture in torsion for a given specimen.
9. To study the spring testing machine and to find the stiffness of given spring.
  - (a) To determine experimentally, the moment of Intertia of a flywheel and axle and compare with theoretical values.
  - (b) To determine the frictional torque between flywheel axle and ball bearing.
10. To perform the experiment of balancing of rotating parts and find the unbalanced couples and forces.
11. To determine experimentally the unbalance forces and couples of reciprocating parts.
12. To study the different type of centrifugal and Inertia governors.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**



**ANALOG ELECTRONICS LAB****Paper Code: ETEL-251****Paper: Analog Electronics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**NOTE:- At least 8 Experiments out of the list must be done in the semester****List of Experiments:**

1. Plotting input and output characteristics and calculation of parameters of a transistor in common emitter configuration.
2. Transistor biasing circuit. Measurement of operating point ( $I_c$  and  $V_{ce}$ ) for a :-
  - a) fixed bias circuit
  - b) Potential divider biasing circuit.
3. Plot the FET characteristics & MOSFET characteristics.
4. Two Stage R.C. Coupled Amplifier.
  - a) To measure the overall gain of two stages at 1 KHz and compare it with gain of 1st stage,
  - b) To observe the loading effect of second stage on the first stage.
  - c) To plot the frequency response curve of two stage amplifier.
5. To study Emitter follower circuit & measurement of voltage gain and plotting of frequency response Curve.
6. Feedback in Amplifier. Single stage amplifier with and without bypass capacitor, measurement of voltage gain and plotting the frequency response in both cases.
7. To determine and plot firing characteristics of SCR by varying anode to cathode voltage, and varying gate current.
8. To note the wave shapes and voltages at various points of a UJT relaxation oscillator circuit.
9. Transistorized push pull amplifier & Measurement of optimum load, maximum undistorted power (by giving maximum allowable signal) Efficiency and percentage distortion factor.
10. To study the characteristics of single tuned & double tuned amplifier.
11. To study the opamp (IC 741) as inverting and non inverting amplifier and calculate its gain.
12. To study the opamp (IC 741) as adder, subtractor and voltage follower, calculate its output voltage.
13. Construct biased and unbiased series and shunt clipping circuits & combinational clipper circuit for positive and negative peak clipping of a sine wave.
14. To study RC phase shift/WIEN BRIDGE oscillator
15. To study the waveform of square wave generator using 741 OP-AMP IC.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**ELECTRICAL MACHINE LAB****Paper Code: ETPE-255****Paper: Electrical Machine Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List Of Experiments**

1. To obtain magnetization characteristics of DC shunt generator and determine critical field resistance and critical speed.
2. To perform load test on DC shunt generator and determine the characteristics.
3. To perform speed control of DC shunt motor by field and armature control.
4. To perform Open circuit and short circuit tests on single phase transformer for parameter estimation of the transformer.
5. To obtain star-star, star-delta and delta-delta connections for three phase transformers.
6. To perform parallel operation of two single phase transformers with non linear load.
7. To perform block rotor test and no load test on induction motor(three phase) for parameter estimation.
8. To perform SCC and OCC of an alternator and calculate voltage regulation at UPF, .8 leading and .8 lagging pf.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**POWER GENERATION ENGINEERING**

**Paper Code: ETPE-202**

**Paper: Power Generation Engineering**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of Power Generation Basics that are required for a Power Engineering student.*

**UNIT-I**

**Introduction:** Conventional & Non-Conventional Sources of Energy and their availability in India, Different Types of Power Plants, Choice of Type of Power Generation, Power Plants in India.

**Hydro Power Generation:** Hydrology – Hydrographs, Flow Duration Curve, Mass Curve; Principle of working, Classification, Site selection; Different components & their functions; Types of Dams; Types, Characteristics & Selection of Hydro-Turbines; Specific Speed of Hydro-Turbines; Power Output Equation; Turbine Governing; Draft Tube; Bearings; Water Hammer & Surge Tank, Cavitation, General arrangement and Operation of Hydro-electric Power Plant, Mini & Micro Hydro Power Plants, Pumped Storage Power Plants; Advantages of Hydro-electric Power Plants; Hydro Power in India & future trends.

[T1][T3][R1 &R2][No. of Hrs. 12]

**UNIT-II**

**Nuclear Power Generation:** Principle of Nuclear Energy, Nuclear Power Plant Components & their Functions; Nuclear Fuels, Radioactivity, Nuclear Reaction & Classification; Nuclear Reactors – Types & Classification, Main Parts; Problems in Reactor Operation; Radiation Hazards; Safety Measures; Nuclear Waste & its Disposal; Nuclear Power in India.

[T1][T3][R1 &R4] [No. of Hrs. 10]

**UNIT-III**

**Gas Power Generation:** Operating Principle; Classification – Open Cycle, Closed Cycle, Combined Cycle; Fuels for Gas Turbine Power Plants; Different Components and their functions; Gas Turbine Characteristics, Cycle Efficiency, Operational Aspects, Advantages and Limitations.

**Diesel Power Generation:** Working principle, Types of Diesel Engines, Different parts / systems and their functions, Performance of Diesel Engine, Plant Operation and Efficiency, Heat Balance, Advantages and Disadvantages, Applications.

[T1][T3][R2]No. of Hrs. 11]

**UNIT-IV**

**Thermal Power Generation:** Operating Principle, Site selection, Coal to Electricity, General Layout of Thermal Power Plant, Brief description of different parts/systems and their functions, Advantages and Limitations.

**Co-Generation:** Concept; Schemes; Brief Description; Benefits & Limitations; Applications.

**Non-Conventional Energy Sources:** Types, Brief Description, Advantages & Limitations.

[T1][T2][T3][R1&R3] [No. of Hrs. 10]

**Text Books:**

- [T1] P.K.Nag, “Power Plant Engineering”, Tata McGraw Hill Publications.  
 [T2] Morse F. T., “Power Plant Engineering”, Affiliated East-West Press Pvt. Ltd., New Delhi.  
 [T3] Arora & S. Domkundwar, “A Course in Power Plant Engineering”, Dhanpat Rai & Sons.

**References Books:**

- [R1] Verma Mahesh, “Power Plant Engineering”, Metropolitan Book Company Ltd., New Delhi.  
 [R2] S. Rao & Dr. B. B. Parulekar, “Energy Technology”, Khanna Publishers.  
 [R3] G.D.Rai, “Non-conventional Energy Sources”, Khanna Publishers.  
 [R4] Deshpande, M.V. “Elements of Electric Power Station Design”, A. H. Wheeler and Company, Allahabad, 1979.

**ENERGY CONVERSION**

**Paper Code: ETPE-204**  
**Paper: Energy Conversion**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of Energy conversion that are required for a Power engineering student.*

**UNIT-I**

Principle of Thermal Energy Release, Structure of Hydro carbons, Analysis of Fuel, Combustion Theory, Mass Balance, Energy Release, Flue Gas Analysis.

**[T1][T3][R1][No. of Hrs. 10]****UNIT-II**

Principle of Thermal Energy to Work, Phase change cycles, carnot, Renkine, Reheat, Regenerative and Binay Vapour Cycles, Non Phase Change Cycles-Stirling, Otto, Diesel, Dual, Atkinson, Joule or Brayton and Ericson Cycloe, Optimization of Reheat Pressure and Degree of Regeneration.  
 Steam Generators, Low & High Pressure boilers, Boilers, Accessories and Mountings, Feed water Treatment.

**[T1][T2][R1&R2][No. of Hrs. 11]****UNIT-III**

Steam Nozzles – Study flow energy equation, Nozzle efficiency Mass of discharge through Nozzles. Steam Turbine, Classification (Impulse Reaction), Compounding, Optimum velocity ratio, velocity diagram, introduction to hydel turbine.

Steam Condenser detail – types of condensers, vacuum efficiency, Condenser efficiency, air ejectors, cooling towers, numerical problems on design of equipments.

**[T1][T2][No. of Hrs. 11]****UNIT-IV**

Introduction to SI & CI engine, Introduction to Non-conventional source of Energy – solar, Tidal wind, Geo-thermal, Nuclear.

**[T1][T3][R1][No. of Hrs. 10]****Text Books:**

- [T1] Nag, P.K., “Engineering Thermodynamics”, Tata McGraw Hill, 2<sup>nd</sup> edition, 1998.  
 [T2] Spalding, D.B. and Cole, E.H., “Engineering Thermodynamics”, Edward Arnold, 1959.  
 . Hawkins, G.A., “Engineering Thermodynamics”, John Wiley and Sons, 1955.  
 [T3] R K Rajput, Thermal Engineering, Luxmi Publications 2010

**References Books:**

- [R1] Van Wylen, G.J. and Sonntag, R.E., “Fundamentals of Classical Thermodynamics”, John Wiley and Sons, 4<sup>th</sup> edition, 1997.  
 [R2]. Jones Dugan Engineering Thermodynamics Prentice Hall

HEAT & MASS TRANSFER

Paper Code: ETPE-206

Paper: Heat &amp; Mass Transfer

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of Heat & Mass Transfer that are required for an engineering student.*

**UNIT-I**

**Introduction: Definition of Heat:** Modes of Heat Transfer; Basic Laws of heat transfer; Electrical Analogy of heat conduction; Conduction through composite walls; Overall heat transfer coefficient.

**Conduction:** The general conduction equation in Cartesian, coordinates; steady one dimensional heat conduction without internal heat generation; the plane slab; the cylindrical shell; the spherical shell; critical thickness of insulation. Fins of uniform cross-section; Governing equation; Temperature distribution and heat dissipation rate; Efficiency and effectiveness of fins.

[T1] [T2][R1][No. of Hrs. 12]

**UNIT- II**

**Convection:** Free and forced convection; Newton's law of cooling; convective heat transfer Coefficient; Nusselt number; Dimensional analysis of free and forced convection; the concept of boundary layer; hydrodynamic and thermal boundary layer; Analysis of free convection; governing equations for velocity and temperature fields. Relation between fluid friction and heat transfer, Reynolds analogy, Dimensionless numbers; Reynolds, Prandtl, Nusselt, Grashoff and Stanton Numbers and their significance, Heat transfer with change of phase; Nusselt theory of laminar film condensation.

[T1][R2][No. of Hrs. 12]

**UNIT -III**

**Heat Exchangers:** Introduction; classification of heat exchangers; Logarithmic mean temperature Difference; Area calculation for parallel and counter flow heat exchangers; Effectiveness of heat exchangers; NTU method of heat exchanger design, Applications of heat exchangers.

[T1][R2][No. of Hrs. 10]

**UNIT-IV**

**Radiation:** Theories of thermal radiation; Absorption, reflection and transmission; Monochromatic and total emissive power; Black body concept; Planck's distribution law; Stefan Boltzman law; Wien's displacement law; Lambert's cosine law; Kirchoff's law;

**Diffusion in Fluids:** Molecular and eddy diffusion, Diffusivity, Diffusion through liquids and gases.

[T1][R2][No. of Hrs. 10]

**Text Books:**

[T1] D. S. Kumar, Heat and Mass Transfer, Katson Publishing House, Ludhiana.

[T2] R K Rajput, Heat and Mass Transfer, S Chand, 2007

**References Books:**

[R1] S.P. Sukhatme, A text book on heat transfer, University Press

[R2] Holman, Heat Transfer, McGraw-Hill

[R3] R. Yadav, Heat and Mass Transfer, Central Publishing House, Allahabad.

**FLUID MECHANICS**

**Paper Code: ETME-212**  
**Paper: Fluid Mechanics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objectives: The objective of this subject to provide an understanding of the fundamentals of fluid mechanics, an appreciation of the design principles in fluid systems, the ability to analyses existing fluid systems and contribute to new designs.*

**UNIT- I**

**Fundamental Concepts of Fluid Flow:** Fundamental definitions, Fluid properties, classification of fluids, Flow characteristics, Foundations of flow analysis, Incompressible and compressible fluids, one, two and three dimensional flows,

**Pressure and its measurements:** Pascal's law, pressure variation in a fluid at rest, Classification of different manometers.

**Fluid Statics:** Fluid pressure, Forces on solid surfaces, Buoyant forces, Metacentre and Metacentric height. Stability of floating bodies,

[T1, T2, R1, R2, R3][No. of Hrs. 11]

**UNIT- II**

**Kinematics of Fluid Flow:** Types of fluid flow, streamline, path line and streak line; continuity equation, Equations for acceleration, Irrotational and rotational flow, velocity potential and stream function, Vortex flow, Continuity equation.

**Dynamics of Fluid Flow:** Control volume analysis, Eulers equation of motion, Bernoulli's equation, Bernoulli's theorems from steady flow energy equation, Venturi meter; Pitot tube, Momentum equation.

**Laminar Flow:** Reynold's experiment, Critical velocity, Steady laminar flow through a circular tube, Measurement of viscosity.

[T1, T2, R1, R2, R3] [No. of Hrs. 11]

**UNIT- III**

**Turbulent Flow:** Shear stress in turbulent flow. Hydro dynamically smooth & rough boundaries. Velocity distribution for turbulent flow in smooth and rough pipes.

**Boundary Layer Flow:** Boundary Layer Theory and Applications: Boundary Layer thickness, displacement, momentum and energy thickness, Flow separation, Drag and lift on immersed bodies.

**Pipe Flow Systems:** Darcy-Weisbach equation, Moody diagram, Energy losses in pipelines, concept of equivalent length, Flow between two reservoirs multiple pipe systems. Siphon.

[T1, T2, R1, R2, R3][No. of Hrs. 11]

**UNIT- IV**

**Dimensional Analysis and Principles of Similarity:** Buckingham's Theorem and its applications, Geometric, Kinematics and Dynamic similarity; Dimensionless numbers-Reynolds, Froude, Euler, Mach, Weber Number and their significance.

**Flow Measurements:** Measurement of flow using, orifice meter, nozzle, Measurement of flow in open channels – rectangular, triangular, trapezoidal weir, Cipoeletti weir. Hot-wire anemometer.

[T1, T2, R1, R2, R3] [No. of Hrs. 11]

**Text Books:**

[T1] R.K. Basal, "Fluid Mechanics &amp; Hydraulic Machines", Laxmi Publications(P) Ltd.,2002.

[T2] D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria &amp; Sons,2000.

**Reference Books:**

[R1] I.H. Shames, "Mechanics of Fluids", Tata McGraw Hill

[R2] V.L. Streeter and E.B. Wylie, "Fluid Mechanics", Tata McGraw Hill

[R3] Modi, P.N., and Seth, S.H., "Hydraulics and Fluid Machines", Standard Book House,

[R4] Vijay Gupta and S.K.Gupta, "Fluid Mechanics and its Applications", Wiley Eastern Ltd,

[R5] Som, S.K. &amp; Biswas G. : Introduction of fluid mechanics &amp; Fluid Machines, TMH, 2000,

**SWITCHING THEORY AND LOGIC DESIGN****Paper Code: ETEC-202****L T/P C****Paper: Switching Theory and Logic Design****3 1 4****INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the knowledge of Logic Systems and Circuits, thereby enabling the student to obtain the platform for studying Digital Systems and Computer Architecture.*

**UNIT- I**

**Number Systems and Codes:-** Decimal, Binary, Octal and Hexadecimal Number systems, Codes- BCD, Gray Code, Excess-3 Code, ASCII, EBCDIC, Conversion between various Codes.

**Switching Theory:-** Boolean Algebra- Postulates and Theorems, De' Morgan's Theorem, Switching Functions- Canonical Forms- Simplification of Switching Functions- Karnaugh Map and Quine Mc-Clusky Methods.

**Combinational Logic Circuits:-** Review of basic gates- Universal gates, Adder, Subtractor, Serial Adder, Parallel Adder- Carry Propagate Adder, Carry Look-ahead Adder, Carry Save Adder, Comparators, Parity Generators, Decoder and Encoder, Multiplexer and De-multiplexer, ALU, PLA and PAL.

**[T2,T3][No. of Hrs. 14]****UNIT- II**

**Integrated circuits:-** TTL and CMOS logic families and their characteristics. Brief introduction to RAM and ROM.

**Sequential Logic Circuits:-** Latches and Flip Flops- SR, D, T and MS-JK Flip Flops, Asynchronous Inputs.

**Counters and Shift Registers:-** Design of Synchronous and Asynchronous Counters:- Binary, BCD, Decade and Up/Down Counters, Shift Registers, Types of Shift Registers, Counters using Shift Registers- Ring Counter and Johnson Counter.

**[T2,T3][No. of hrs. 10]****UNIT- III**

**Synchronous Sequential Circuits:-** State Tables State Equations and State Diagrams, State Reduction and State Assignment, Design of Clocked Sequential Circuits using State Equations.

**Finite state machine-**capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and merger chart methods-concept of minimal cover table.

**[T1][No. of hrs. 10]****UNIT- IV**

**Algorithmic State Machine:** Representation of sequential circuits using ASM charts synthesis of output and next state functions, Data path control path partition-based design.

**Fault Detection and Location:** Fault models for combinational and sequential circuits, Fault detection in combinational circuits; Homing experiments, distinguishing experiments, machine identification and fault detection experiments in sequential circuits.

**[T1][No. of hrs. 10]****Text Book:**

[T1] Zyi Kohavi, "Switching & Finite Automata Theory", TMH, 2<sup>nd</sup> Edition

[T2] Morris Mano, "Digital Logic and Computer Design", Pearson

[T3] R.P. Jain, "Modern Digital Electronics", TMH, 2<sup>nd</sup> Ed,

**Reference Books:**

[R1] A Anand Kumar, "Fundamentals of Digital Logic Circuits", PHI

[R2] Taub, Helbert and Schilling, "Digital Integrated Electronics", TMH

**CONTROL SYSTEMS**

**Paper Code: ETEE-212**  
**Paper: Control Systems**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To teach the fundamental concepts of Control systems and mathematical modeling of the system. To study the concept of time response and frequency response of the system. To teach the basics of stability analysis of the system*

**UNIT I : Control Systems - - Basics & Components**

Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Control system components: Electrical/ Mechanical/Electronic/A.C./D.C. Servo Motors, Stepper Motors, Tacho Generators, Synchronos, Magnetic Amplifiers, Servo Amplifiers,

**[T1,T2][No. of Hrs. : 11]****UNIT II : Time – Domain Analysis**

Time domain performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

**[T1,T2][No. of Hrs. : 10]****UNIT III : Frequency Domain Analysis**

Polar and inverse polar plots, frequency domain specifications and performance of LTI systems, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain performance closes loop frequency responses from open loop response. Limitations of frequency domain analysis, minimum/non-minimum phase systems.

**[T1,T2][No. of Hrs. : 10]****UNIT IV : Stability & Compensation Techniques**

Concepts, absolute, asymptotic, conditional and marginal stability, Routh–Hurwitz and Nyquist stability criterion, Root locus technique and its application.

Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation, compensation using P, PI, PID controllers.

**[T1,T2][No. of Hrs. : 11]****Text Books:**

- [T1] B. C. Kuo, "Automatic control system", Prentice Hall of India, 7<sup>th</sup> edition 2001.  
 [T2] Nagraath Gopal "Control Systems Engineering -Principles and Design" New Age Publishers

**Reference Books:**

- [R1] Norman S. Nise, "Control systems engineering" John Wiley & Sons (Asia) Singapore.  
 [R2] Raymond T. Stefani, Design of Feedback Control System, Oxford University Press.  
 [R3] K. Ogata, "Modern control engineering", Pearson 2002.  
 [R4] S. P.Eugene Xavier, "Modern control systems", S. Chand & Company.  
 [R5] M. Gopal "Control Systems-Principles and Design" TMH 4<sup>th</sup> Edition 2012



**HEAT & MASS TRANSFER LAB****Paper Code: ETPE-252****Paper: Heat & Mass Transfer Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. To study Thermal conductivity of metal bar
2. To study Thermal conductivity of insulating powder
3. To study Heat Dissipation from pin fin
4. To study Heat transfer in forced convection
5. To study Heat transfer in natural convection
6. To study Double pipe heat exchanger
7. To study Parallel & Counter flow heat Exchanger

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**FLUID MECHANICS LAB**

**Paper Code: ETME-260**  
**Paper: Fluid Mechanics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**Fluid Mechanics Lab experiments based on syllabus (ETME-201).**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**SWITCHING THEORY AND LOGIC DESIGN LAB**

<b>Paper Code: ETEC-252</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper : Switching Theory and Logic Design Lab</b>	<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Realize all gates using NAND & NOR gates
2. Realize Half Adder, Full Adder, Half subtracter, Full subtracter
3. Realize a BCD adder
4. Realize a Serial Adder
5. Realize a four bit ALU
6. Realize Master-Slave J K Flip-Flop, using NAND/NOR gates
7. Realize Universal Shift Register
8. Realize Self-Starting, Self Correcting Ring Counter
9. Realize Multiplexer and De-Multiplexer
10. Realize Carry Look ahead Adder / Priority Encoder
11. Simulation of PAL and PLA
12. Simulation Mealy and Moore State machines

**NOTE: - At least 8 Experiments out of the list must be done in the semester**

**CONTROL SYSTEMS LAB****Paper Code: ETEE-260****Paper: Control Systems Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Comparison of open loop & closed loop control in speed control of D.C. motor & to find the transfer function.
2. To study the characteristics of positional error detector by angular displacement of two servo potentiometers
  - a. excited with dc
  - b. excited with ac
3. To study synchro transmitter in terms of position v/s phase and voltage magnitude with respect to rotor voltage magnitude /phase.
4. To study remote position indicator systems using synchro transmitter/receiver.
5. To plot speed- torque curves for ac servomotor for different voltages.
6. To study ac motor position control system & to plot the dynamic response & calculate peak time, settling time, peak overshoot, damping frequency, steady state error etc.
7. To study the time response of simulated linear systems.
8. To study the performance of PID Controller.
9. Plot impulse response, unit step response, unit ramp response of any 2<sup>nd</sup> order transfer function on same graph using MATLAB.
10. To draw the magnetization (Volt Amps) characteristics of the saturable core reactor used in the magnetic amplifier circuits.
11. Plot root locus for any 2<sup>nd</sup> order system (with complex poles). For Mp=30%, find the value of K using MATLAB.
12. To design lead-lag compensator for the given process using Bode plots in MATLAB.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**COMMUNICATION SKILLS FOR PROFESSIONALS**

**Paper Code: ETHS-301**

**Paper: Communication Skills for Professionals**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>1</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision. This course will also equip them with the basic skills required for a variety of practical applications of communication such as applying for a job, writing reports and proposals. Further, it will make them aware of the new developments in communication that have become part of business organisations today.*

**UNIT I**

**Organizational Communication:** Meaning, importance and function of communication, Process of communication, Communication Cycle - message, sender, encoding, channel, receiver, decoding, feedback, Characteristics, Media and Types of communication, Formal and informal channels of communication, 7 C's of communication, Barriers to communication, Ethics of communication (plagiarism, language sensitivity)

**Soft Skills:** Personality Development, Self Analysis through SWOT, Johari Window, Interpersonal skills -Time management, Team building, Leadership skills. Emotional Intelligence. Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, Career planning, Self esteem.

[T1,T2][No. of Hrs. 08]

**UNIT II**

**Introduction to Phonetics:** IPA system (as in Oxford Advanced Learner's Dictionary), Speech Mechanism, The Description of Speech Sounds, Phoneme, Diphthong, Syllable, Stress, Intonation, Prosodic Features; Pronunciation; Phonetic Transcription - Conversion of words to phonetic symbols and from phonetic symbols to words. British & American English (basic difference in vocabulary, spelling, pronunciation, structure)

**Non-Verbal Language:** Importance, characteristics, types – Paralanguage (voice, tone, volume, speed, pitch, effective pause), Body Language (posture, gesture, eye contact, facial expressions), Proxemics, Chronemics, Appearance, Symbols.

[T1,T2][No. of Hrs. 08]

**UNIT III**

**Letters at the Workplace** – letter writing (hard copy and soft copy): request, sales, enquiry, order, complaint.

Job Application -- resume and cover letter

**Meeting Documentation**-- notice, memo, circular, agenda and minutes of meeting.

**Report Writing** - Significance, purpose, characteristics, types of reports, planning, organizing and writing a report, structure of formal report. Writing an abstract, summary, Basics of formatting and style sheet (*IEEE Editorial Style Manual*), development of thesis argument, data collection, inside citations, bibliography; Preparing a written report for presentation and submission. Writing a paper for conference presentation/journal submission.

[T1,T2][No. of Hrs. 08]

**UNIT IV**

**Listening and Speaking Skills:** Importance, purpose and types of listening, process of listening, difference between hearing and listening, Barriers to effective listening, Traits of a good listener, Tips for effective listening. Analytical thinking; Speech, Rhetoric, Polemics; Audience analysis. Telephone Skills - making and receiving calls, leaving a message, asking and giving information, etiquettes.

**Presentations:** Mode, mean and purpose of presentation, organizing the contents, nuances of delivery, voice and body language in effective presentation, time dimension.

**Group Discussion:** Purpose, types of GDs, strategies for GDs, body language and guidelines for group discussion.

**Interview Skills:** Purpose, types of interviews, preparing for the interview, attending the interview, interview process, employers expectations, general etiquettes.

[T1,T2][No. of Hrs. 07]

**Text Books:**

- [T1] Anna Dept. Of English. Mindscapes: English for Technologists & Engineers PB. New Delhi: Orient Blackswan.
- [T2] Farhathullah, T. M. Communication Skills for Technical Students. Orient Blackswan, 2002.

**References Books:**

- [R1] Masters, Ann and Harold R. Wallace. Personal Development for Life and Work, 10th Edition. Cengage Learning India, 2012.
- [R2] Institute of Electrical and Electronics Engineers. IEEE Editorial Style Manual. IEEE, n.d. Web. 9 Sept. 2009.
- [R3] Sethi and Dhamija. A Course in Phonetics and Spoken English. PHI Learning, 1999.
- [R4] Khera, Shiv. You Can Win. New York: Macmillan, 2003.

**STEAM GENERATOR AND ITS AUXILIARIES**

**Paper Code: ETPE-303**

**Paper: Steam Generator and its Auxiliaries**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Steam Generator & its auxiliaries that are required for a Power engineering student.*

**UNIT-I**

Coal: Types of coal and their characteristics, their suitability for different kinds of Boilers, Alternations in firing methods due to change of coal composition.

Coal Handling System: Location and layout, main equipments and their functions, coal transportation, preparation, storage and reclamation, MGR systems, safety aspects, fire prevention and fire fighting in Coal Handling Plant.

Combustion Theory: Definition, combustion requirements, factor influencing combustion, composition of fuels, gross and net calorific value.

Fuel Oil Systems: Location and site selection, types of fuels oils used main equipments and their functions, transportation, handling, storage, fuel oil preparation before firing.

[T1,T2,R1][No. of Hrs. 12]

**UNIT-II**

Description of Main Boiler: Classification and types, arrangements of main boiler, fundamentals of boiler design, location of various pressure parts.

Boiler Circulation Theory: Water walls, boiling phenomena, nucleate / film boiling, natural / controlled / forced circulation.

Construction Details of Super Heaters, Re-heaters, Economizers, De-super heaters.

Steam Separation Theory: Boiler Drum & its internals.

[T1, T2, R1][No. of Hrs. 11]

**UNIT-III**

Draught System: Theory of natural, induced, balance and forced draught, draught loss, stack effect.

Various Fans and their salient features: Construction details / lubricating oil system for PA Fan, FD Fan, ID Fan.

Air Pre-heaters: Types and functions, constructional details, SCAPH, soot blowers.

Ventilation and Air Conditioning, Pulverisers and Feeders: Classification of mills, constructional features of bowl mill, pulverization of coal, factors affecting milling plant performance, coal feeders and its type.

Fuel Firing Arrangements and Burners: Corner, front and rear wall firing, Direct and indirect firing, details of coal and oil burners, burners tilting mechanism, atomization of fuel oil in oil burners and ignitors.

[T1,R2][No. of Hrs. 11]

**UNIT-IV**

Electrostatic Precipitator (ESP): Need of fly ash separation, working principle, corona effect, constructional details, rapping mechanism.

Ash Handling System: Fly ash handling system, bottom ash disposal system, ash handling plant operation, ash handling pump, disposal of ash slurry, utilization of ash.

Plant Visit: Milling plant, main boiler and fans, ash handling.

Furnace, Safeguard, Supervisory System (FSSS): Description of Field equipments (no C&I).FSSS

Water Supply System: Soft Water, Circulated Water, Cooling Water, and D.M. Water.

[T1,T2,R1,R2][No. of Hrs. 11]

**Text Books:**

[T1] "Power Plant Familiarization"– Vol. II', NPTI Publication.

[T2] P.K.Nag, "Power Plant Engineering", Tata McGraw Hill Publications.

**References Books:**

[R1] Arora & S. Domkundwar, "A Course in Power Plant Engineering", Dhanpat Rai & Sons.

[R2] "Modern Power Station Practice", Volume B, British Electricity International Ltd., Central Electricity Generating Board, Pergamon Press, Oxford, 1991.

**STEAM TURBINE AND ITS AUXILIARIES**

**Paper Code: ETPE-305**

**Paper: Steam Turbine and its Auxiliaries**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Steam Turbine & its Auxiliaries that are required for a power engineering student.*

**UNIT-I**

Steam Cycle Theory: Carnot Cycle, Rankine Cycle, with reference to a specific unit 500/210 MW, steam properties.

Steam Turbines: Classification of Turbines, Metallurgical considerations, working principles.

Description of main components i.e. Turbine casing, rotor, blades stream admission valves, couplings, bearing etc.

Turbine Lubrication Oil System: Construction and working principles of main oil pumps, starting oil pumps, AC, DC oil pumps, Oil coolers.

Steam Condensation and Condensers: Film wide / drop wise condensation, direct/indirect condensation and vacuum creation. Audio-Visual: Vacuum System, Turbine Lubricating System.

[T1][T2][R1][No. of Hrs. 11]

**UNIT-II**

Power Station Pumps: Classification of pumps, centrifugal pumps, positive displacement pumps.

Boiler Feed Pump: Function of BFP, Constructional details.

Circulating Water System: Open / closed system, CW Pumps, Cooling Towers, CT Pumps, CT Fans.

Plant Visit: CW System including cooling towers, CT Pumps, CT Fans, condensers, ejector, BFP.

[T1][T2][R1][R2][No. of Hrs. 11]

**UNIT-III**

Regenerative Feed Heating System: Working Principal and constructional details of L. P. Heaters, Deaerators, H.P. Heaters, GSC, Ejector.

Visit to Regenerating /feed Heating System, Turbine Lubricating Oil System, Water Treatment Plant.

Turbine Governing System: Types of Governing System, various components, systems and their functions, oil circuit for governing system, overall working of governing system with reference to load throw off, load raising.

Audio / Visual Session on Governing System.

[T1][T2][R3][No. of Hrs. 11]

**UNIT-IV**

HP / LP Bypass System and PRDS: HP / LP bypass circuit and its utility, Various interlocks for operation, Oil circuit in HP / LP by pass system, auxiliary PRDS circuit, pressure regulating system of PRDS circuit.

Plant Visit: Governing System HP / LP Bypass System.

[T1][T2][R4][No. of Hrs. 11]

**Text Books:**

[T1] "Modern Power Station Practice", Volume C, British Electricity International Ltd., Central Electricity Generating Board, Pergamon Press, Oxford, 1991.

[T2] "Power Plant Familiarisation – Vol. III", NPTI Publication.

[T3] Rajmohan Gupta, "Steam Turbine", Oxford & IBH Publishing Co. Pvt. Ltd.

**References Books:**

[R1] P.K.Nag, "Power Plant Engineering", Tata McGraw Hill Publications.

[R2] R. Yadav, "Steam Turbine", Khanna Publishers.

[R3] "Steam Turbine and Its Auxiliaries", Manufacturer's Power Plant Manual.

[R4] M. M. Vakil, "Power Plant Technology"



**ELECTRICAL GENERATOR AND AUXILIARIES****Paper Code: ETPE-307****Paper: Electrical Generator and Auxiliaries**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Electrical Generator and its auxiliaries that are required for a Power engineering student.*

**UNIT-I**

**Generator Constructional Details:** Basic principle of electricity generation, Development of generator design, Constructional details of rotor, stator etc.

Tutorial / General Discussion.

**Hydrogen Cooling System and Stator Water Cooling System:** Different types of cooling arrangements for rotor and stator, Selection and properties of coolant, Air cooling, Hydrogen cooling, Stator water cooling, Hydrogen Charging / Purging Cycle.

**[T1][R1][No. of Hrs. 11]****UNIT-II**

**Audio Visual on Hydrogen cooling system:**

**Hydrogen Seal Oil System:** Details of the system, Function and purpose of differential pressure regulator and pressure oil regulators, Types of hydrogen seals and their constructional details.

Generator Excitation System and AVR: Principles, Simple arrangement of exciter and its field winding, Classification of excitation system and exciter development, High Frequency Excitations System, Static Excitation System, Brushless Excitation system – their merits and demerits, Automatic Voltage Regulator and its control.

Audio / Visual Session on Excitation System.

**Plant Visit:** Generator and Auxiliaries, Hydrogen cooling, Stator water-cooling system, Hydrogen seal oil system.

**[T1][T2][R2][No. of Hrs. 11]****UNIT-III**

**Transformers:** Working Principle, Various types of transformers used in a power station, Constructional features of main transformer and accessories, Bucholtz relay and main protections, Types of cooling, Mulsifire and other fire protection systems.

Audio/Visual / Discussion Session.

**Motors:** Fundamentals, Constructional details of HT / LT motors, Various motors used in Power Stations.

Plant visit: Transformers / Excitation System.

**HT-LT Supply System / DC Supply System:** A typical layout of 6.6 KV, 3.3 KV and 415 KV supply system in a TPS, DC supply system in a TPS.

Audio Visual on Electrical System.

**[T1][T2][R1][No. of Hrs. 11]****UNIT-IV**

**Switchyard:** A typical layout of Switchyard of a Thermal Power Station, Bus system, Isolators, CTs, PTs, Earthing, Oil Circuit Breakers, Air Blast Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers.

**Plant Visit:** Switchyard, HT/LT Supply System, DC Supply System.

Audio / Visual Session.

Generators of Hydro/Nuclear/Gas/Diesel Power Plants, their characteristics and comparison.

**[T2][R1][No. of Hrs. 11]****Text Books:**

[T1] “Power Plant Familiarisation – Vol. IV”, NPTI Publication.

[T2] Deshpande, M.V. “Elements of Electric Power Station Design”, A. H. Wheeler and Company, Allahabad, 1979.

**References Books:**

[R1] “Power Plant Electrical Machines & Systems”, Manufacturer’s Power Plant Manual.

[R2] “Modern Power Station Practice”, Volume C & D, British Electricity International Ltd., Central -B.

**REFRIGERATION AND AIR CONDITIONING**  
**(For Mechanical Specialization)**

**Paper Code: ETPE-309**

**Paper: Refrigeration and Air Conditioning**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Refrigeration & Air conditioning that are required for an engineering student.*

**UNIT-I**

**Introduction: Necessity: Methods of refrigeration: Unit of refrigeration: Coefficient of performance (COP):** Fundamentals of air conditioning system: Refrigerants Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants. Introduction to eco-friendly refrigerants: Introduction to Cryogenics.

[T1][T2][R3][No. of Hrs. 11]

**UNIT-II**

**Air Refrigeration Systems:** Carnot refrigeration cycle. Temp. Limitations: Brayton refrigeration of the Bell Coleman air refrigeration cycle: Necessity of cooling the aero plane, Air craft refrigeration system – Simple cooling and simple cooling evaporative types, Boot strap and Boot strap evaporative types. Regenerative type and Reduced Ambient type systems, Comparison of different systems, Numerical problems.

[T1][T2][R3][No. of Hrs. 11]

**UNIT-III**

**Vapour Compression (VC ) Refrigeration System:** Simple VC Refrigeration Systems – Limitations of Reversed Carnot cycle with vapour as the refrigerant, Analysis of V.C. cycle considering degrees of sub cooling and super heating, VC cycle on p.v., t.s. and p.h. diagrams., Comparison of VC Cycle with Air Refrigeration cycle, Concepts of Multi-Stage Refrigeration Systems.

**Vapour Absorption Refrigeration System:** Basic Systems, Actual System, COP of the System Performance, Relative merits and demerits: Properties of aqua ammonia: Electrolux Refrigerator, Problems; Concepts of Steam Jet Refrigeration System and Cascade Refrigeration Systems.

[T1][T2][R2][No. of Hrs. 11]

**UNIT-IV**

**Psychrometry of Air & Air Conditioning Processes:** Properties of moist Air Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp. Thermodynamics wet bulb temp. Psychrometrics chart, Psychrometry of air conditioning processes, Mixing Process, Basic Processes in conditioning of air; Psychrometric processes in air washer Problems.

[T1][T3][R3][No. of Hrs. 11]

**Text Books:**

- [T1] C.P. Arora, “Refrigeration & Air Conditioning”, Tata McGraw Hill Publication.  
[T2] R.C. Jordand & G.B. Prister, “Refrigeration & Air Conditioning”, Prentice Hall of India Publication.

**References Books:**

- [R1] W.F. Stocker & J.W. Jones, “Refrigeration & Air Conditioning”, Tata McGraw Hill Publication.  
[R2] Manohar Prasad, “Refrigeration & Air Conditioning”, Wiley Eastern.  
[R3] S. Domkundwar, “A Course in Refrigeration & Air Conditioning”, Dhanpat Rai & Sons

**ELECTRICAL & ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(For Electrical Specialization)**

<b>Paper Code: ETPE-313</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Electrical &amp; Electronic Measurements and Instrumentation</b>	<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Electrical & Electronic Measurements & Instrumentation that are required for an engineering student.*

**UNIT-I****Electrical Measurements**

**Measurements and Instruments:** Measurements – Significance, Methods, Types; Instruments – Types, Classification; Functions of Instruments and Measurement Systems; Generalized Measurement System; Application of Measurement Systems.

**Performance Characteristics of Instruments:** Drift, Error, Reproducibility, Repeatability, Noise, Uncertainty, Accuracy, Precision, Resolution, Threshold, Sensitivity, Efficiency, Linearity, Dead Time, Dead Band, Friction, Backlash, Hysteresis, Zero stability, Overshoot, Loading effect.

**Errors in Measurement:** True value, Types of Error, Error Analysis.

[T2,T3][R1,R2][No. of Hrs. 11]

**UNIT-II**

**Units and Standards:** Absolute Units; SI Units – Base Units, Supplementary Units, Derived Units; Standards and their classification (International, Primary, Secondary and Working Standards).

**Review of Measurement of Resistance, Inductance and Capacitance:** Methods of measurement of low, medium and high resistances, Kelvin's double bridge, Wheatstone bridge, Meggers & Ohmmeters, Insulation resistance measurement, Earth resistance measurements, AC bridges for inductance and capacitance measurements, Mutual Inductance measurement, Shielding and Earthing.

**Review of Measurement of Current and Voltage:** Permanent Magnet Moving Coil (PMMC) and Moving Iron (MI) instruments, Electrodynamometer Type & Electrostatic Type Instruments, Measurement of DC / AC voltage and current, Extension of Range, Errors (Both on AC/DC), Multimeter.

**Instrument Transformers:** Current and Potential Transformers, Need & Functions, Construction, Theory, Ratio & Phase Angle Errors and their minimization, Design considerations, Testing of instrument transformers by absolute and comparison methods.

[T1,T2][R1,R2][No. of Hrs. 12]

**UNIT-III**

**Measurement of Power and Energy:** Power in DC & AC Circuits; Types of Watt meters; Construction, Operating principle, Torque equation, Shape of scale, Errors, Advantages & Disadvantages of Electrodynamometer type and Induction type Watt meters; Measurement of Power using Instrument Transformers; Measurement of Power in three phase circuits, Three Phase Watt meters, Measurement of Reactive Power; Classification of Energy Meters; Single Phase Induction Type Energy Meter – Construction, Theory & Operation, Errors, Adjustments & Compensation; Three Phase Energy Meters; Maximum Demand Indicator; KVAH & KVARH Metering; Measurement of KVA; Tri-vector Meter; Testing of Energy meters; Meters used for special purposes.

**Measurement of Phase, Frequency & Speed:** Phase (or Power Factor) Meters - Electrodynamometer and Moving Iron types; Frequency Meters – Mechanical Resonance type, Electrical Resonance type, Weston type frequency meters; Phase Sequence Indicator; Synchrosopes; Tachogenerator, Tachometer, Photo-electric meter, Stroboscope.

[T2,T3][R4,R5][No. of Hrs. 11]

**UNIT-IV****Electronic Measurements:**

Electronic Voltmeter, Multimeter, Wattmeter & Energy meter; Time, Frequency and Phase Angle measurements; CRO & Special purpose Oscilloscopes; Q-meters; Potentiometric Recorders; Spectrum Analyzer, Wave Analyzer; Harmonic Analyzer; Power Analyzer; Distortion Meter; Digital Voltmeter, Multimeter, Frequency Counter, and Storage oscilloscope; Display Devices - Nixie Tubes, LED, LCD.

**Modified Scheme and Syllabus of B. Tech-POWER Engg. (1<sup>st</sup> Semester to 8<sup>th</sup> Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23<sup>rd</sup> BOS and 40<sup>th</sup> AC meeting of USET.**

**Instrumentation:**

Transducers, Classification & Selection of transducers, Thermocouples, Thermistors, LVDT, Strain gauges, Piezoelectric crystal, Use of Transducers in measurement of non-electrical quantities like temperature, pressure, liquid level, flow-rate, displacement, acceleration, noise level etc., Data Acquisition Systems (DAS), A/D and D/A converters.

[T1,T2,T3][R2][No. of Hrs. 11]

**Text Books:**

- [T1] Helfrick and Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, PHI, Reprint 1988.  
 [T2] A. K. Sawhney, “Electrical & Electronic Measurements and Instrumentation”, Dhanpat Rai and Sons, 2003  
 [T3] Umesh Sinha, “Electrical & Electronic Measurement and Instrumentation”, Satya Prakashan, New Delhi.

**References Books:**

- [R1] Jones, B.E., “Instrumentation Measurement and Feedback”, Tata McGraw-Hill, 1986.  
 [R2] Golding, E.W., “Electrical Measurements and Measuring Instruments”, 3rd Edn., Sir Issac Pitman & Sons, 1960.  
 [R3] Buckingham, H. and Price, E.N., “Principles of Electrical Measurements”, 1961.  
 [R4] Stout, “Basic Electrical Measurements”, Prentice Hall  
 [R5] E.O. Doebin, “Measuring Systems”, McGraw Hill.

**INDUSTRIAL MANAGEMENT**

**Paper Code: ETMS-311**  
**Paper: Industrial Management**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The course provides a broad introduction to some aspects of business management and running of business organization.*

**UNIT I**

**Industrial relations-** Definition and main aspects. Industrial disputes and strikes. Collective bargaining.

**Labour Legislation-** Labour management cooperation/worker's participation in management. Factory legislation. International Labour Organization.

[T1,T2][No. of Hrs. 10]

**UNIT II**

**Trade Unionism-** Definition, Origin, Objectives of Trade Unions. Methods of Trade unions. Size and finance of Indian Trade unions-size, frequency distribution, factors responsible for the small size. Finance-sources of income, ways of improving finance.

[T1,T2][No. of Hrs. 10]

**UNIT III**

**Work Study-**Method study and time study. Foundations of work study. Main components of method study. Time study standards. Involvement of worker's unions. Work Sampling. Application of work study to office work.

[T1,T2][No. of Hrs. 10]

**UNIT IV**

**Quality Management-** What is Quality? Control Charts. Quality is everybody's job. Taguchi Philosophy. Service Quality. What is Total Quality Management (TQM)? Roadmap for TQM. Criticism of TQM. Six Sigma.

[T1,T2][No. of Hrs. 10]

**Text Books:**

- [T1] Sinha, P.R.N., Sinha I.B. and Shekhar S.M.(2013), Industrial Relations, Trade Unions and Labour Legislation. Pearson Education
- [T2] Chary, S.N. (2012), Production and Operations Management. Tata McGraw Hill Education.

**Reference Books:**

- [R1] Srivastava, S.C. (2012), Industrial Relations and Labour Laws, Vikas Publishing
- [R2] Shankar R (2012), Industrial Engineering and Management. Galgotia Publications
- [R3] Telsang, M. (2006), Industrial Engineering and Production Management. S.Chand
- [R4] Thukaram, Rao (2004), M.E. Industrial Management. Himalaya Publishing House

**COMMUNICATION SKILLS FOR PROFESSIONALS LAB**

<b>Paper Code: ETHS-351</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Communication Skills for Professionals Lab</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Objective:** To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision. These activities will enhance students' communication skills with a focus on improving their oral communication both in formal and informal situations. They will develop confidence in facing interviews and participating in group discussions which have become an integral part of placement procedures of most business organisations today.

**Lab Activities to be conducted:**

- Listening and Comprehension Activities** – Listening to selected lectures, seminars, news (BBC, CNN, etc.). Writing a brief summary or answering questions on the material listened to.
- Reading Activities** -- Reading different types of texts for different purposes with focus on the sound structure and intonation patterns of English. Emphasis on correct pronunciation.
- Conversation Activities**-- Effective Conversation Skills; Formal/Informal Conversation; Addressing higher officials, colleagues, subordinates, a public gathering; Participating in a video conference.
- Making an Oral Presentation**–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language.
- Making a Power Point Presentation** -- Structure and format; Covering elements of an effective presentation; Body language dynamics.
- Making a Speech** -- Basics of public speaking; Preparing for a speech; Features of a good speech; Speaking with a microphone. Famous speeches may be played as model speeches for learning the art of public speaking. Some suggested speeches: Barack Obama, John F Kennedy, Nelson Mandela, Mahatma Gandhi, Jawahar Lal Nehru, Atal Bihari Vajpayee, Subhash Chandra Bose, Winston Churchill, Martin Luther King Jr.
- Participating in a Group Discussion** -- Structure and dynamics of a GD; Techniques of effective participation in group discussion; Preparing for group discussion; Accepting others' views / ideas; Arguing against others' views or ideas, etc.
- Participating in Mock Interviews** -- Job Interviews: purpose and process; How to prepare for an interview; Language and style to be used in an interview; Types of interview questions and how to answer them.

**Suggested Lab Activities:**

- Interview through telephone/video-conferencing
- Extempore, Story Telling, Poetry Recitation
- Mock Situations and Role Play; Enacting a short skit
- Debate (Developing an Argument), News Reading and Anchoring.

**Reference Books:**

- Patnaik, Priyadarshi. *Group Discussion and Interview Skills: With VCD*. Cambridge University Press India (Foundation Books), 2012 edition.
- Kaul, Asha. *Business Communication*. PHI Learning: 2009.
- Hartman and Lemay. *Presentation Success: A Step-by-Step Approach*. Thomson Learning, 2000.

**Note:** The Communication Skills Lab should be equipped with computers, microphones, an internet connection, overhead projector, screen, sound system, audio/video recording facilities, and seating arrangement for GDs and mock interviews. The student activities may be recorded and students may replay them to analyse and improve their pronunciation, tone, expressions, body language, etc.

Traditional language lab softwares are not mandatory and may be used by students to practice and enhance their language competence. Such softwares are usually elementary in nature and are mostly based on British/American English (pronunciation, accent and expression). They should preferably be in Indian English.

**THERMAL POWER PLANT SCHEME TRACING LAB****Paper Code: ETPE-353****Paper: Thermal Power Plant Scheme Tracing Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>3</b>	<b>1</b>

**NOTE:- At least 8 Experiments from the related syllabus must be done in the semester.**

**REFRIGERATION AND AIR CONDITIONING LAB**  
**(For Mechanical Specialization)**

**Paper Code: ETPE-357**

**Paper: Refrigeration and Air Conditioning Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Test on Vapour compression Test Rig.
2. Test on ice plant test rig.
3. Test on air conditioning test rig.
4. Trial on vapour absorption refrigeration system.
5. Study of installation/operation/maintenance practices for refrigeration systems.
6. Determination of refrigeration load in cold storage (case study/visit).
7. Visit to any refrigeration or air conditioning plant.
8. Thermal analysis of any refrigeration or air-conditioning cycle.

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**



**ELECTRICAL & ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(For Electrical Specialization)**

<b>Paper Code: ETPE-359</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Electrical &amp; Electronic Measurements and Instrumentation</b>	<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Measurement of Low Resistance by Kelvin Double Bridge method
2. Measurement of unknown inductance by Anderson Bridge & Maxwell's method
3. Study and use of CRO in measurement of unknown frequency
4. Calibration of Energy Meter
5. To calibrate a voltmeter and ammeter using a potentiometer
6. Measurement of active and reactive power
7. To calibrate a wattmeter using a Potentiometer
8. Measurement of power using instrument transformer
9. Measurement of unknown frequency using Wien's Bridge
10. Measurement of unknown capacitance by De Sauty's Bridge and Schering Bridge

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**LOAD DISPATCH AND ELECTRICITY REGULATIONS**

**Paper Code: ETPE-302**

**Paper: Load Dispatch and Electricity Regulations**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Load Dispatch and Regulatory issues that are required for a power engineering student.*

**UNIT-I**

**Load Dispatch**

Overview of power systems communication infrastructure, RTUs, SCADA, PLCC, Communication Systems, Network Protocols. Transfer of Energy in Power Systems, VAR flows, Power System Control, Voltage Control Methods, Load Frequency control-Speed Governing Systems, AGC, frequency limits; Economic load dispatch neglecting losses, Optimum load dispatch including transmission losses.

[T1,T2][No. of Hrs. 11]

**UNIT-II**

Unit commitment-constraints, spinning reserve, solution methods-Priority list method; Energy management Systems. LDCs-NLDC, SLDC, RLDC etc. Hydrothermal coordination-LR/SR scheduling, models, scheduling problems, dynamic programming solution to scheduling problem.

[T1,T2][No. of Hrs. 10]

**UNIT-III**

Unit commitment, State Estimation- basics, PS state estimation, ML weighted LSE-concepts, examples  
Regulatory Issues: Electricity Act 2003-IEA-1910, Electricity Supply Act 1948, Regulatory Commission Act 1998. Transition to Deregulation- Problems in conventional systems, Blackouts-Analysis Reasons for reforms.

[T1,T2][No. of Hrs. 11]

**UNIT-IV**

IEA 2003. Its impact on power Generation, Transmission and Distribution, transmission Open Access, wheeling, power banking concepts. ABT basics, Energy Conservation concepts and DSM basics.

[R2][No. of Hrs. 10]

**Text:**

[T1] C.L.Wadhwa, "Electrical Power Systems", 3rd Edition, New Age International Publishers, 2000.

[T2] Allen J.Wood; Bruce F.Wollenberg, "Power Generation, Operation and Control, 2nd edition; John Wiley & Sons, 1996. (Only the relevant sections declared in class)

**References Books:**

[R1] Power System Operation, Robert H. Miller, McGraw Hill Book Co. 1970 (Only the relevant sections declared in class)

[R2] Indian Electricity Act 2003, Universal Law Publishers, 2003

**POWER PLANT COMMISSIONING (THERMAL & HYDRO)****Paper Code: ETPE-304****Paper: Power Plant Commissioning (Thermal & Hydro)**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Power Plant Commissioning that are required for a Power engineering student.*

**UNIT-I**

Power Plant Commissioning: Preparation of commissioning, trial run of various equipments, commissioning of valves, air and gas tightness test of boiler. Chemical cleaning boiler, preparation for boiler light up, thermal flow test of water walls and economizers, steam blowing.

Safety valves setting, reliable run of boiler. Hydraulic test of boiler.

Alkaline flushing and commissioning of regenerative system, acid cleaning of oil pipe lines, oil flushing procedure of lubricating oil and governing system. Turbine Lubricating oil flow testing steam blowing, reheater safety valve, vacuum tightness test, ejector testing.

**[T1, T2][No. of Hrs. 12]****UNIT-II**

Commissioning of governing system and ATRS & ATT, and TSE.

Commissioning of generator and auxiliaries (Generator testing, rotor and stator cooling system, excitation system)

Commissioning of electrical system (Circuit breakers, isolators, CT and PT, rectifiers, switchgear, DC System).

C&I Commissioning activities (Minimum instrumentations required for major C&I commissioning, commissioning of control valve, tuning of control valves).

**[T1, T2, R1][No. of Hrs. 11]****UNIT-III**

Hydro power plant commissioning: Hydraulic test of valves, commission of ATRS & ATT and ATE

NDT (Non-Destructive Testing)

Purpose of NDT and types of defects covered by NDT. NDT Methods used in power station (Principle, equipments, utilization, merits and de-merits).

**[T1, T3, R2][No. of Hrs. 10]****UNIT-IV**

Industrial Safety: Accidents (Causes & Factors, Cost of Accidents, Accident Prevention, Investigation of Accidents, Reporting and Recording Systems for Accidents. First Aid (Basics of First Aid, How injuries are caused in lifting, falls etc.) Fire Fighting (Fundamentals of Fire, Fire Fighting Equipments and Systems, Fire Extinguishing Methods, Demonstration of various Fires).

Industrial Safety & Hazards (Industrial Hazards, Protective Clothing and Equipment, Safe Working Practices in Power Plant, Permit to work system, Safety in Movement and storage of Materials, House Keeping, Safety Rules.

**[T1, T4, R2][No. of Hrs. 12]****Text Books:**

- [T1] Power Plant Operation - NPTI Publications
- [T2] Power Plant Operation - BHEL Manual
- [T3] Hydro power plant operation – NPTI Publications
- [T4] Power Plant Safety – NPTI Publications

**References Books:**

- [R1] Power Plant Engineering by P.K.Nag, TMH
- [R2] Power Plant Engineering by Morse

**POWER PLANT CONTROL AND INSTRUMENTATION**

**Paper Code: ETPE-306**

**Paper: Power Plant Control and Instrumentation**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Power Plant Control & Instrumentation that are required for an engineering student.*

**UNIT-I**

Transducers, Classification, Analog & Digital transducers, Selection of transducers, Strain gauges, Inductive & Capacitive transducers, Piezoelectric and Hall-effect transducers, Measurement of non-electrical quantities like temperature, pressure, liquid level, flow-rate, displacement, velocity, acceleration, noise level etc., Thermistors, Thermocouples, LVDT, Photo-diodes & Photo-transistors, Encoder type digital transducers, Signal conditioning and telemetry.

[T1, T2][No. of Hrs. 11]

**UNIT-II**

Basic concepts of smart sensors and application, Data Acquisition Systems (DAS), A/D and D/A converters. Concept and layout of Control and Instrumentation in Thermal Power Plant  
Measurement & Measuring instruments

Pressure Measurement and measuring instruments, Temperature Measurement and measuring Instruments, Flow measurement and measuring instruments, Level Measurement and measuring instruments

[T1, T2, R1][No. of Hrs. 11]

**UNIT-III**

Practical demonstration on pressure, flow, level and temperature measurements, Protection and interlocks of Boiler, Turbine and their auxiliaries. Introduction to auto control, Auto control loops used in thermal power stations. Turbomachinery instrumentation (Parameters limits, Basic concepts of measuring devices), Commissioning of control loops – Practical demonstration

ATRS, Visit to control and instrumentation lab. and control / control stations in thermal power stations.

[T1, R2][No. of Hrs. 11]

**UNIT-IV**

Analytical Instrumentation for Boiler (Water, Steam, Flue Gas, H<sub>2</sub> / O<sub>2</sub> / CO<sub>2</sub>), Practical demonstration and practice on analytical instruments (Correct approach for sampling and testing)

Introduction to DDC and DAS in Thermal Power Station, Introduction to new / latest technology in Control and Instrumentation in modern thermal power station.

[R2][No. of Hrs. 11]

**Text Books:**

[T1] “Control & Instrumentation”, NPTI Manuals Volumes I, II, III.

[T2] A.K.Sawhney, “Electrical & Electronic Measurements and Instrumentation”, Dhanpat Rai and Sons, 2003.

**References Books:**

[R1] “Modern Power Station Practice”, Volume F, British Electricity International Ltd., Central Electricity Generating Board, Pergamon Press, Oxford, 1991.

[R2] “Control & Instrumentation”, Manufacturer’s Manuals.

**POWER SYSTEM TRANSMISSION AND DISTRIBUTION**

**Paper Code: ETPE-308**

**Paper: Power System Transmission and Distribution**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the power system distribution and utilization applications that are required for a power engineering student.*

**UNIT-I**

**Power Distribution**

**Distribution System Planning:** Load forecasting, Power Quality parameters, Choice of systems for different consumers, Planning Criteria, Standards, System layout.

**Distribution Lines / Cables:** Towers/Poles, Stay wires; Conductor - Types, characteristics & selection; Underground Cables - Selection, laying, cable box and jointing; Earth wire; Insulators & hardware fittings; Distributors, Feeders, Services Mains (LV, MV, HV); Clearances; Pole-mounted sub-stations and its location; Earthing HT & LT poles/supports; Selection & fixing of control devices.

**Distribution Sub-stations:** Types, General Arrangement, Layout, Bus-bar arrangements; Sub-station equipment – Construction details, selection and specification of equipment (distribution transformer, Circuit Breakers, etc.); Auxiliary Systems; Earthing of sub-station equipment; Basic operational aspects of equipments/systems.

[T1, T2, T3, T4, R1, R5][No. of Hrs. 12]

**UNIT-II**

**Meters & Metering:** Meters/Indicators – Types & Function; Metering system; Location of meters; Testing & Setting of meters/indicators; Latest development in metering technologies.

**Distribution Losses And Efficient Energy Management:** Classification, Causes and Calculation of power losses; Methods of reducing power losses and Anti-theft measures; Causes and cures for breakdowns, tripping and fluctuations in distribution system; System voltage drops and improvements; Distribution transformer failures – causes & remedies; Demand Side Management (DSM), HVDS, Energy efficiency monitoring and corrective measures.

**Cost Economics / Commercial Aspects:** Cost Engineering, Costing & Control, Estimation, Estimate for providing service (LT/HT) connections; Tariff structure & types, Rational & Competitive tariff, Energy Accounting, Energy Billing and Revenue realization.

[T1, T2, R3, R4][No. of Hrs. 12]

**UNIT-III**

**Power Utilisation**

**Electric Heating And Welding:** Electric Heating – Advantages, Methods, Resistance ovens, Induction heating, Dielectric heating, Arc Furnace, Heating of buildings; Electric Welding – Resistance and Arc Welding, Control Devices and Welding Equipment.

**Electrolytic Process:** Principle of Electro-deposition, Laws of Electrolysis, Extraction and Refining of Metals, Electro-plating, Factors affecting electro-deposition, Manufacture of chemicals, Application of Electrolysis.

**Illumination:** Laws of Illumination, Polar curves, Distribution and Control of light, Lighting calculations, Factory lighting, Flood lighting, Street lighting, Different types of lamps – Incandescent, Fluorescent, Vapour, CFL and their working, Glare and its remedy.

[T2, R4][No. of Hrs. 11]

**UNIT-IV**

**Electric Traction:** Salient features, Comparison with other types of traction systems, Types of electric traction, Systems of track electrification, Speed-Time curves, Tractive effort and specific energy consumption, Co-efficient of Adhesion, Suitability of electric motors for traction service, Conventional and Solid-state control of traction motors, Electric braking, Current collection systems, DC & AC substations, Signaling systems, Diesel electric traction, Train lighting system.

[T4, R2, R4][No. of Hrs. 10]

**Text Books:**

- [T1] A. S. Pabla, "Electric Power Distribution", 5th Edition, Tata McGraw Hill, 1997.
- [T2] C.L.Wadhwa, "Electrical Distribution & Utilisation", New Age Publishing Co.Soni, Gupta & Bhatnagar, "A Course in Electrical Power",
- [T3] Burke James, J., "Power Distribution Engineering: Fundamentals and Applications", Marcel Dekker Inc., 1996.
- [T4] S. Rao, "EHV – AC, HVDC Transmission & Distribution Engineering", Khanna Publishers, 2003.

**References Books:**

- [R1] N. K. Jangalwa, "Modern Trends and Practices in Power Sub-Transmission and Distribution E. O. [R2] Taylor, "Utilisation of Electrical Energy", Pitman & Sons.
- [R3] H. Cotton," Transmission & Distribution of Electrical Energy",
- [R4] J. B. Gupta, "Utilisation of Electric Power and Electric Traction", S. K. Kataria & Sons.
- [R5] G. Ramamurthy,"Hand Book of Electrical Power Distribution", Orient Longman Pvt. Ltd., Hyderabad.

**I.C. ENGINES & GAS DYNAMICS**  
(For Mechanical Specialization)

**Paper Code: ETPE-310**

**Paper: I.C. Engines & Gas Dynamics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of IC Engines & Gas Dynamics that are required for an engineering student.*

**UNIT-I**

**Internal Combustion (I.C.) Engines I.C. Engine Cycles:** Otto, Diesel and Dual cycles. Fuel air cycles volumetric, combustion and overall efficiency. Fundamental difference between SI and CI engines. Deviation of actual cycle from ideal cycle. Calculation of IHP & BHP. Numericals

**S.I. ENGINES – Principles of carburetion.** Factors affecting carburetion, Air fuel ratio, working principle of simple carburetion, effect of nozzle tip and compressibility, jet size and depression at venturi, choke, compensation, Introduction to multipoint fuel injection system, valve timing diagrams, Flame development and its propagation, ignition lag, effect of engine parameters, pre-ignition, combustion chamber, Battery and Coil ignition system, Magneto system, spark advancing, octane Number.

[T1, T2],[No. of Hrs. 12]

**UNIT-II**

**C.I. Engines:** Introduction, Injection System, Injection pump - Jwerk type and distributor type, Injection nozzle, direct and indirect injection. Valve timing diagram, stages of combustion in C.I. engines. Factors affecting delay period, knocking, comparison of knock in SI and CI engine Cetane number, aniline point, Diesel index, Alternative fuels.

[T1, R1, R2][No. of Hrs. 11]

**UNIT-III**

**Cooling and Lubrication:** Types of cooling system – liquid and air cooling system. Forced circulation system, pressure cooling system, Radiator, cooling fins, Baffles. Types of lubrication system; Mist, Wet sump lubrication system, oil additives.

[T1, T2, R5][No. of Hrs. 10]

**UNIT-IV**

**Gas Dynamics - Isentropic Flow:** Acoustic velocity, - Mach number, Mach line and Mach angle, Flow parameters, Stagnation temperature and pressure.

**Adiabatic Flow:** Stagnation temperature change, Rayleigh line, Pressure ratio and temperature ratio, entropy consideration, Maximum heat transfer, Detonation and Deflagration.

**Flow With Friction:** The fanning equation, friction factor and friction parameter, Fanno line Fanno equation.

**Wave Phenomena:** Classification of wave phenomena, Analysis of shock phenomena, weak waves, compression waves, oblique shocks, Normal shock waves, entropy considerations, Rayleigh pilot equation.

[T3, T4, R3, R4][No. of Hrs. 12]

**Text Books:**

- [T1] V. Ganesan, "Internal Combustion Engines", TMH
- [T2] Compbell & Jenninys, "Gas Dynamics", MCGraw Hill.
- [T3] Mathur & Sharma, "Internal Combustion Engines", Dhanpat Rai Publications.
- [T4] Rolty, "Introduction to Gas Dynamics", Wiley.
- [T5] Taylor & Taylor, "The I.C. Engines", E.S. MIT Press.

**References:**

- [R1] A.R. Rogowskli, "Elements of I.C. Engines", MCGraw Hill.
- [R2] Maleegv, "I.C. Engines", MCGraw Hill.
- [R3] Liepmann & Rashko, "Element of Gas Dynamics", Wiley.
- [R4] Shaplo, "The Dynamics & Thermodynamics of Compressible fluid flow", (Ronold press)

**POWER ELECTRONICS AND ELECTRIC DRIVES***(For Electrical Specialization)***Paper Code: ETPE-312****Paper: Power Electronics and Electric Drives**

L	T/P	C
3	1	4

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Power Electronics and Electric Drives that are required for an engineering student.*

**UNIT-I****Power Electronics**

**SCR and its characteristics:** gate characteristics, SCR ratings, series and parallel connections of SCRs. Triac, GTO, IGBT characteristics and ratings. Unijunction Transistors. Triggering circuits and optocouplers.

**[T1, T2],[No. of Hrs. 10]****UNIT-II**

**Linear commutated converters:** single pulse, two pulse midpoint, three pulse mid-point and 3 phase six pulse converters. Effect of source inductance on converters. Freewheeling diode effect.

D.C. Choppers – Principles of step down chopper, step up chopper and classification. Impulse commutated and resonant pulse choppers. Multiphase choppers. Application of choppers.

**[T1, T2],[No. of Hrs. 11]****UNIT-III**

Single phase and three phase bridge inverters. Commutation and trigger circuits for forced commutated thyristier inverters. Output voltage control. Harmonics in output voltage waveform harmonics attenuation by filters. Harmonic reduction by pulse width modulation. Working of current source inverters. Switched Mode Power Supplies.

**[T1, R2],[No. of Hrs. 11]****UNIT-IV****Electric Drives**

Review of characteristics of A.C. and D.C. Motors, Phase controlled and chopper controlled drive of D.C. motor. Pulse width modulated (PWM) Induction motor drive (voltage source and current source inverters).

Digital Control Drive, Stepper Motors, Electrical drives in steel, cement, Textile, paper mills, Machine tool drive and computerized numerical control (CNC).

**[T1, R1],[No. of Hrs. 11]****Text Books:**

[T1] P.S. Bhimbra, "Power Electronics", Khanna Publisher.

[T2] M.H. Rashid, "Power Electronics Circuits Devices and Applications", Pearson Education

**References:**

[R1] G.K. Dubey, "Elements of Electrical Drives",

[R2] Ashfaq Ahmed, "Power Electronics for Technology", Pearson Education



**MACHINE DESIGN**  
(For Mechanical Specialization)

**Paper Code: ETAT-302**  
**Paper: Machine Design**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objectives: The primary objective of this course is to demonstrate how engineering design uses the many principles learned in previous engineering science courses and to show how these principles are practically applied. The emphasis in this course is on machine design: the design and creation of devices that consist of interrelated components used to modify force and/or motion.*

**UNIT– I**

**Introduction:** Principles of mechanical design, systematic design process, aesthetic and ergonomic considerations in design, use of standards in design. Manufacturing consideration in design, casting, machining, forging, Dynamic and fluctuating stresses, fatigue failure and endurance limit, stress concentration, causes and remedies in design. Factor of safety Tolerances and types of fits as per BIS Selection of materials, designation of steels .Design of Cotter and knuckle joints.

[T1,T2][No. of Hrs.10]

**UNIT - II**

**Design of Elements:** screwed fastenings, bolted and riveted joints under direct and eccentric loads, initial tightening loads in bolts. Welded joints, strength of welded joints, eccentrically loaded joints, welded joints subjected to bending moment and torsion.

**Translation screws:** force analysis and design of various types of power screws,: screw jack, C- clamp, toggle screw jack.

[T1,T2][No. of Hrs.10]

**UNIT - III**

Shafts, keys and couplings –design of rigid and pin bushed flexible couplings. Levers design Springs, uses and design of close coiled helical springs shot peening of springs.

[T1,T2][No. of Hrs. 12]

**UNIT – IV**

Classification of Gears, spur gears, Lewis equation, subjected to dynamic and wear loads, gear failures. Bearings - types of sliding bearing, design of sliding bearing using McKee's equation; types of lubrication Types of Ball & Roller Bearings- selection of bearings from manufacturer's catalogue based on static & dynamic load carrying capacity, load-life relationships.

[T1,T2][No. of Hrs. 12]

**Text Books:**

- [T1] Maleeve Hartman and O.P.Grover, "Machine Design", CBS Publication & Publishers  
[T2] V.B. Bhandari, "Machine Design", Tata McGraw Hill

**Reference Book:**

- [R1] Mahadevan, "Design Data Book", CBS Publishers & Distributors  
[R2] J.E. Shigley & C.R. Mischke, "Mechanical Engineering Design", Tata McGraw Hill Co.Inc.  
[R3] P.C. Sharma and D.K Aggarwal., "Machine Design", S.K. Kataria & Sons  
[R4] Juvinal R C, Marshak K M, "Fundamentals of Machine component Design", Wiley India  
[R5] Norton R. I. "Machine Design" Pearson

**ELECTROMAGNETIC FIELD THEORY***(For Electrical Specialization)***Paper Code: ETPE-316****Paper: Electromagnetic Field Theory**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**Objectives:** *To list Maxwell's equations and solve them for specific regular geometries, understand general electromagnetic wave propagation and its applications to engineering problems.*

**UNIT I**

**Introduction:** Review of scalar and vector field, Dot and Cross products, Coordinate Systems-Cartesian, cylindrical and spherical. Vector representation of surface, Physical interpretation of gradient divergence and curl, Transformation of vectors in different co-ordinate systems, dirac-delta function.

**Electrostatics:** Electric field due to point-charges, line charges and surface charges, Electrostatic potential, Solution of Laplace and Poisson's equation in one dimension, M-method of image applied to plain boundaries, field mapping and conformal transformation, Electric flux density, Boundary conditions. Capacitance: calculation of capacitance for simple rectangular, cylindrical and spherical geometries, Electrostatic energy.

**[T1,T2][No. of Hrs. : 10]****UNIT II**

**Magnetostatics :** Magnetic Induction and Faraday's Law, Magnetic Flux Density, Magnetic Field Strength H, Ampere, Gauss Law in the Differential Vector Form, Permeability, Energy Stored in a Magnetic Field, Ampere's Law for a Current Element, Volume Distribution of Current , Ampere's Law Force Law, Magnetic Vector Potential, The Far Field of a Current Distribution, Maxwell's Equations: The Equation of Continuity for Time Varying Fields, Inconsistency of Ampere's Law, Maxwell's Equations, Conditions at a Boundary Surface.

**[T1,T2][No. of Hrs. : 10]****UNIT III**

**Electromagnetic Waves:** Continuity equations, Displacement current, Maxwell's equation, Boundary conditions, Plane wave equation and its solution in conducting and non-conducting media, Phasor notation, Phase velocity, Group velocity, Depth of penetration, Conductors and dielectrics, Impedance of conducting medium. Polarization, Reflection and refraction of plane waves at plane boundaries, Poynting vectors, and Poynting theorem.

**[T1,T2][No. of Hrs. : 10]****UNIT IV**

**Transmission Lines:** Transmission line equations, Characteristic impedance, Distortion-less lines, Input impedance of a lossless line, computation of primary and secondary constants, Open and Short circuited lines, Standing wave and reflection losses, Impedance matching, Loading of lines, Input impedance of transmission lines, RF lines, Relation between reflection coefficient and voltage standing wave ratio (VSWR), Lines of different lengths –  $\lambda/2$ ,  $\lambda/4$ ,  $\lambda/8$  lines, Losses in transmission lines, Smith chart and applications, impedance matching Single stub, Double stub..

**[T1,T2][No. of Hrs. : 10]****Text Books:-**

- [T1] Matthew N. O. Sadiku , "Elements of Electromagnetics", Oxford University Press  
 [T2] E. C. Jordon, K. G. Balman, "Electromagnetic Waves & Radiation System" PHI – 2nd Edition

**Reference Books:**

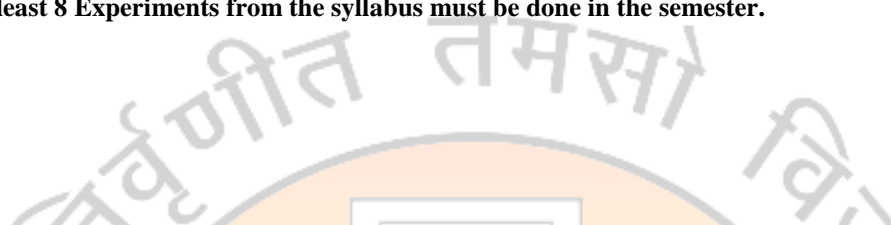
- [R1] William H. Hayt, "Engineering Electromagnetics", TMH  
 [R2] J.D. Kraus, "Electromagnetics", TMH  
 [R3] David K. Cheng, "Field and Wave Electromagnetic", 2<sup>nd</sup> Edition, Pearson Education Asia,2001  
 [R4] John R. Reitz, "Foundations of Electromagnetic Theory". Pearson

**ROTATIONAL ON-JOB TRAINING**  
**(Operation - Steam Generator & Its Auxiliaries)**

<b>Paper Code: ETPE-354</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Steam Generator &amp; Its Auxiliaries</b>	<b>0</b>	<b>3</b>	<b>1</b>

**Steam Generator & Its Auxiliaries training based on syllabus ETPE-306.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**ROTATIONAL ON-JOB TRAINING**  
***(Operation - Steam Turbine & Its Auxiliaries)***

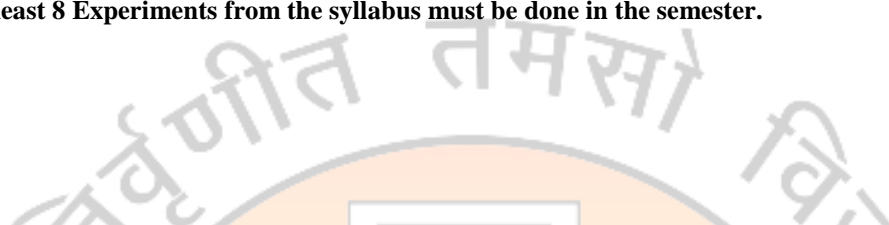
Paper Code: ETPE-356

Paper: Steam Turbine & Its Auxiliaries

L	T/P	C
0	3	1

**Steam Turbine & Its Auxiliaries training based on syllabus ETPE-306.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**ROTATIONAL ON-JOB TRAINING**  
***(Operation – Power Plant Electrical Machines & Systems)***

<b>Paper Code: ETPE-358</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Power Plant Electrical Machines &amp; Systems</b>	<b>0</b>	<b>3</b>	<b>1</b>

**Power Plant Electrical Machines & Systems training based on syllabus ETPE-306.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**I.C. ENGINES & GAS DYNAMICS LAB***(For Mechanical Specialization)***Paper Code: ETPE-360****Paper: I.C. Engines & Gas Dynamics Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. To study several IC Engine.
2. To conduct load test on a single cylinder 2 stroke petrol engine & study its performance under various Load.
3. To conduct load test on a single cylinder 4 stroke petrol engine & study its performance under various Load.
4. To conduct load test on a single cylinder 4 stroke diesel engine & study its performance under various Load.
5. To conduct load test on a multi (4) cylinder 4 stroke petrol engine & study its performance under various Load.

**NOTE:- All the Experiments out of the list must be done in the semester.**

**POWER ELECTRONICS AND DRIVES LAB***(For Electrical Specialization)***Paper Code: ETPE-362****Paper: Power Electronics and Drives Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. V-I Characteristics of the given SCR
2. V-I characteristics of the DIAC
3. V-I Characteristics of the TRIAC
4. Study of UJT- Characteristics and saw tooth oscillations
5. Firing control of SCR – using , DC, pulse and R-C triggering on kit
6. Phase control of rectifiers using DC, RC trigger and Traic/DIAC combination
7. DC to AC inverter (Class B)
8. Speed control of the DC motor (open loop control)
9. Speed control of the DC motor using Microprocessor control (Closed loop)
10. Study of MOSFET controller in speed control of DC motor

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**POWER PLANT OPERATION**

**Paper Code: ETPE-401**  
**Paper: Power Plant Operation**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the power plant operation basics that are required for a power engineering student.*

**UNIT-I**

Availability of electrical supply to the equipment (source feeder of each equipment, points of isolation of the equipment, locking during isolation, permit to work system). Boiler pre light up checks. (Meaning of light up, shut down, tripping, starting etc., 1 No pending permits, local checks).

**[T1,T2][No. of hrs. 10]****UNIT-II**

Operation of service auxiliaries (cooling water pump, compressors, auxiliary steam, fuel oil pump), Operation of air-pre heater and ID fan (Rechecks, flow path line up, permissives, interlocks). Operation of FD & PA Fans (pre checks, flow path line up permissives, interlocks). Mill operation (pre checks, flow path line up, permissives, interlocks). FSSS (Secondary air, burner tilt, fuel and air control).

**[T1][T2][R1] [No. of hrs. 10]****UNIT-III**

Drum level control, Super Heater, Re-Heater, temperature control and their interlocks. Operation of turbine lubricating system and barring gear. Operation of condensate and feed water system (BFP, Heaters CEP). HP/LP Bypass operation and turbine heating. Turbine rolling and synchronization.

**[T2][R2][R3] [No. of hrs. 10]****UNIT-IV**

Operation of generator cooling system (stator and hydrogen cooling). Operation of Generator excitation system AVR. Operation of Turbine governing system. Integrated operation of unit (unit loading and shut down sequence) Operational difference between cold start up, warm start up and hot start up. Load dispatching and coordination with load dispatch center. Power plant emergencies (Boiler & Turbine), Discussion and appraisal.

**[T2][R1][R2][No. of hrs. 10]****Text Books:**

- [T1] Power Plant Engineering by P.K.Nag, TMH  
 [T2] Power plant operation – NPTI Publication

**References Books:**

- [R1] CEGB Manual on power Plant Operation  
 [R2] BHEL manual  
 [R3] Power Plant Engineering by Morse



## RENEWABLE ENERGY RESOURCES

**Paper Code: ETEE-419**  
**Paper: Renewable Energy Resources**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

### **INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to introduce the knowledge of upcoming and future promising area of renewable energy resources to the students, which is developing rapidly.*

### **UNIT- I**

Solar Energy: radiation – extra terrestrial, spectral distribution, solar constant, solar radiation on earth, measurements; solar thermal system – solar thermal power and its conversion, solar collectors, flat plate, solar concentrating collectors, - types and applications; photovoltaic (PV) technology - photovoltaic effect, efficiency of solar cells, semi-conductor materials, solar PV system, standards and applications, tracking.

[T1][No. of hrs. 10]

### **UNIT- II**

Wind and Small Hydropower Energy: wind data, properties, speed and power relation, power extracted, wind distribution and speed prediction, wind map of India; wind turbines and electric generators. fundamentals – types of machines and their characteristics, horizontal and vertical wind mills, elementary design principle, wind energy farms, off-shore plants; small, mini and micro hydro power plants and their resource assessment, plant layout with major components shown.

[T2][No. of hrs. 10]

### **UNIT- III**

Other Non-conventional Energy Sources: biomass – photosynthesis and origin of biomass energy, resources, cultivated resources, waste to biomass, terms and definitions – incineration, wood and wood waste, harvesting super tree, energy forest, phyrolysis, thermo-chemical biomass conversion to energy, gasification, anaerobic digester, fermentation, gaseous fuel; geothermal – resources, hot spring, steam system, principle of working, site selection, associated problems in development; ocean and tidal energy – principle of ocean thermal energy conversion, wave energy conversion machines, problems and limitations, fundamentals of tidal power, conversion systems and limitations; hydrogen energy – properties of hydrogen, sources, production and storage, transportation, problems for use as fuel; fuel cells – introduction with types, principle of operation and advantages.

[T1, R2][No. of hrs. 12]

### **UNIT-IV**

Grid Connectivity: wind power interconnection requirement - low-voltage ride through (LVRT), ramp-rate limitations, supply of ancillary services for frequency and voltage control, load following, reserve requirement, impact of connection on steady-state and dynamic performance of power system; interfacing dispersed generation of solar energy with the grid, protective relaying, islanding, voltage flicker and other power quality issues; role of non-conventional energy system in smart grid.

[T2, R3][No. of hrs. 10]

### **Text Books:**

- [T1] Tiwari and Ghosal, “Renewable Energy Resources: Basic Principle & Application”, Narosa Pub.  
 [T2] S N Bhadra ,D, Kastha, 'Wind Electrical Systems" Oxford Publication 2014

### **References Books:**

- [R2] John Twidell, “Renewable Energy Sources”, Taylor and Francis  
 [R3] Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future”, Oxford University Press  
 [R4] Ewald F. Fuchs, “Power Conversion of Renewable Energy Systems”, Springer  
 [R5] B. H. Khan, “Non Conventional Energy”, Tata McGraw Hill  
 [R6] D P Kothari, “Wind energy System and applications” Narosa Pub 2014

**POWER PLANT PERFORMANCE & EFFICIENCY**

**Paper Code: ETPE-405**

**Paper: Power Plant Performance & Efficiency**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the power plant efficiency measurements that are required for a power engineering student.*

**UNIT-I**

**Performance & Efficiency Calculations**

Introduction, Need for performance monitoring, uncontrollable factors, basic requirements. Factors influencing performance of boilers and optimization (Fuel properties, excess air, finess of P.F. etc.).

Performance Monitoring of Boiler Auxiliaries (Pulverisers, factors, sampling of pulverized, coal classifier adjustments, mill rejects, causes and remedies) Air Heaters (effect of AH outlet temperature, performance tests) Fans) Fans (Performance, curves, optimum operating point). Boiler efficiency calculation (Direct method, calculation, limitations in adopting direct method.) Losses method, other standard method

[T1][T2][No. of Hrs. 12]

**UNIT-II**

Factors influencing performance of turbine (Steam pressure, temperature and back pressure, cylinder efficiency, deposits on turbine blades, blade roughness, effect of loading). Turbine Losses. Factors affecting performance of condenser and feed heater (TTD, CW inlet, temperature, CW flow, heat transfer across tubes) Heaters (air accumulation, steam side/water side fouling drainage, effect of attemperation in reheaters) Heat balancing

[T1][T2][No. of Hrs. 12]

**UNIT-III**

Turbine heat rate calculation: Method, parameters required). Optimization of auxiliary power consumption (scope variable speed drives, operation of un-necessary running auxiliaries).

Logging and recording (Scope of logging and recording, use of DAS/DDC in performance monitoring). Discussion and appraisal. Maintenance Planning And Cost Control: Aims and objective of maintenance efficient service, high plant availability, maintenance and planning engineer's duties. Integration of maintenance with operational requirements, plant reliability, plant outages and daily work programmes.

[T1][R1][No. of Hrs.10]

**UNIT-IV**

Preventive maintenance of running units. Planning of major plant overhauls during shutdowns.

Planning techniques – critical path analysis, charting system etc. Purchasing and stores control –standards cost codes, control of stores and store records.

Cost control, direct costs, indirect costs, outage costs, budgeting and costing work, budgetary control. Contract procedures (conditions of contract, capital applications and procedures, project evaluation, interest and depreciation charges.) Use of computers in maintenance planning. Group Discussion and practice.

[T1][T2][R1][No. of Hrs. 10]

**Text Books:**

[T1] A. B. Gill, "Power Plant Performance".

[T2] NPTI Manual on Maintenance Planning and Cost Control.

**References Books:**

[R1] NPTI Manual on Performance & Efficiency.

**POWER SYSTEM PROTECTION AND SWITCHGEAR****Paper Code: ETPE-403****Paper: Power System Protection and Switchgear**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Power System Protection and Switchgear that are required for an engineering student.*

**UNIT-I  
PROTECTION**

**Protection System:** Importance of protective relaying in power systems; Fundamental requirements of a good protection scheme; Zones of protection, Primary and Back-up Relaying.

**Protective Relays :** Terms used in protective relaying; Classifications of Relays - Constructional / Functional; Electromagnetic Relays – attracted armature, induction disc, induction cup types relays; Overcurrent and Earth fault relays, Directional, Differential, Distance Relays etc.; Principles & Characteristics of relays; Operation, setting, testing and applications, maintenance requirements of relays; Translay relay; Negative Sequence relays; Universal Relay Torque Equation; Electronic relays; Static relays; Digital relays; Microprocessor and PC based relaying; Current & Future trends.

**[T1][T2][T3][T5][No. of Hrs. 11]****UNIT-II  
SWITCHGEAR**

**Circuit Interruption:** Fuses - Types of fuses, Terms (Fusing factor, Breaking capacity etc.), Fuse selection, HRC fuses and their applications; Arcing phenomena, Essential properties of arc, Initiation and Maintenance of an arc, Arc voltage, Arc interruption theories, Recovery and Restriking voltages, Rate of Rise of Restriking Voltage (RRRV), Resistance Switching, Inductive current chopping, Capacitive current breaking.

**[T3][T4][R2 & R4][No. of Hrs. 10]****UNIT-III**

**Circuit Breakers:** AC and DC circuit breaking, Types of Circuit Breakers - ACB, OCB, ABCB, SF6CB, VCB; Static Circuit Breakers; Comparative merits and demerits of different types of CBs, Rating of Circuit Breakers, Testing and Selection of Circuit Breakers, Autoreclosing.

**POWER PLANT PROTECTION**

**Protection Schemes:** Schemes for protection of transmission line; Merz-Price circulating current scheme, Percentage differential relay, Restricted earth fault protection, Negative Sequence protection, Translay scheme, Carrier relaying scheme, Pilot relaying scheme, Static and other relays used in transmission line protection.

**[T1][T2][R1 & R3][No. of Hrs. 12]****UNIT-IV**

**Generator Protection:** Neutral earthing, stator and rotor earth faults, sustained external faults, instability, protective systems.

**Transformer Protection:** Various transformer protections, protective systems for Generator Transformers (GTs), Unit Auxiliary Transformers (UATs) and Station Transformers (STs).

**Motor Protection:** Faults and Protection systems.

**Busbar Protection:** Continuity of supply, Discrimination, Circulating current systems, special features relating to different voltage systems.

**Feeder Protection:** Continuity of supply discrimination, outline of protection systems – Pilot wire, carrier current, distance protection, PLCC – Telemetry Communication.

**[T2][T5][R5][No. of Hrs. 12]****Text Books:**

- [T1] The Electricity Council, "Power System Protection", Vol.1, 2 & 3, Peter Peregrinus Ltd., 1990.  
 [T2] M. V. Despande, "Switchgear and Protection"  
 [T3] B. Ram and D. N. Vishwakarma, "Power System Protection & Switchgear", TMH  
 [T4] T. S. M. Rao, "Power System Protection: Static Relays with Microprocessor Applications", TMH.  
 [T5] "Modern Power Station Practice", Vol. D & K, British Electricity International Ltd., Central Electricity Generating Board, Pergamon Press, Oxford, 1991.

**Reference Books:**

- [R1] Van, A. R., & Warrington, C., "Protective Relays : Their Theory and Practice", Vol. 1 & 2, Chapman and Hall, 1969.
- [R2] Sunil S. Rao, "Switchgear and Protection", Khanna Publishers.
- [R3] Paithankar, Y. G., "Transmission Network Protection : Theory and Practice", Marcel Dekker, Inc., 1998.
- [R4] B. Ravindranath and M. Chander, "Power System Protection and Switchgear", Wiley Eastern Ltd.
- [R5] L. P. Singh, "Digital Protection", New Age International.



**THEORY OF MACHINES**  
(For Mechanical specialization)

**Paper Code: ETPE-409**  
**Paper: Theory of Machines**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with theory of machines and its applications that are required for a power engineering student.*

**UNIT-I**

**Static And Inertia Force Analysis:** Static force Analysis of reciprocating engine mechanism and quick return mechanism. Effect of friction, kinematically equivalent systems and its application for inertia analysis, Numericals.

[T1][T2][R1][No. of Hrs. 10]

**UNIT-II**

**Balancing Of Rotating Components:** Unbalance in one & several planes, Balancing machines, influence coefficient method of balancing, numericals.

**Turning Moment Diagram & Flywheel:** Approximate expression, Turning moment diagram, Coefficients of fluctuation of energy & speed, Flywheel (An approximate analysis), Flywheel in punching press, Numericals.

[T1][T2][R1][No. of Hrs. 11]

**UNIT-III**

**Dynamometers:** Dynamometers, measurement of power by Prony brake and Rope brake dynamometers, Transmission dynamometer, Hydraulic dynamometer, Numericals.

**Gyroscopic:** Gyroscopic forces & couple, Thin rod rotating about its centroidal axis, Gyroscopic stabilization, Stability of a four & two wheel vehicles, Numericals.

[T1][R1][No. of Hrs. 11]

**UNIT-IV**

**Vibration:** Free vibrations of a body with single degree of freedom; transverse vibration of beams with uniform and concentrated loads by Rayleigh method; torsional free Vibrations of two rotor system, three rotor system and geared systems; damped free vibrations with viscous damping; logarithmic decrement; response of damped spring mass system to a harmonic force; whirling of shafts, vibration isolation and vibration of mass supported on foundations subject to vibrations; vibration simulation.

[T2][R2][No. of Hrs. 11]

**Text Books:**

[T1] Theory of Machine - S.S. Rattan, Tata McGraw Hill Publ., New Delhi.

[T2] Theory of Mechanism and Machines – A Ghosh & A.K. Malik, Affiliated East-West Press Pvt. Ltd. New Delhi (Unit I, VI, VII).

**Reference Books:**

[R1] Mechanism and machine Theory – J.S. Rao & R.V. Dukkipati, Willey Eastern Ltd., new Delhi (Unit II, III, IV, V & VIII).

[R2] Theory of Machine – Shigley.

**POWER PLANT MAINTENANCE**  
**(PLANT MAINTENANCE PLANNING & COST CONTROL)**

**Paper Code: ETPE-407**

**Paper: Power Plant Maintenance**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the power plant maintenance basics that are required for a power engineering student.*

**UNIT-I**

**Boiler And Its Auxiliaries:** Boiler structure steel work – Importance, Inspection and maintenance aspects, Problems in structure works & hanging arrangements.

**Boiler Pressure Parts:** Economizer: - Tube size, material, spacing and their alignment; Causes and effects of erosion & corrosion on tubes; Causes for failure of economizer tubes; Inspection for damage of tubes and their repair / replacement methods.

**Boiler Drum & Drum Internals** – Different connections to boiler drum & their Maintenance, Instrumentation tapings, Safety valves and air vents Problems, Causes and Remedies.

Water Wall Tube Arrangement - Tube materials, spacing and connections, Expansion & Sealing of boiler bottom and prevention of dust accumulation in seal chamber, Effect of water, erosion & corrosion on water wall tubes, Inspections of water valve tubes, Causes of tube failures, Repair/Replacement Procedures of punctured / damaged tubes, Procedure for alkali boil out & acid cleaning, preservation & flushing, Hydraulic statics test.

**Superheaters** - Causes of tube failures, Pattern of tube punctures and their repair / welding / replacement procedures, Different types of welding utilized. Re-heaters -Inspections of tubes for erosion and corrosion & failures.

[T1][R1] [No. of hrs. 12]

**UNIT-II**

**Boiler Draught System**

**Draught Fans** – ID Fan, FD Fan, PA Fan and their ducts, Causes of erosion and corrosion, Remedial action, Vibration analysis, Bearing/ coupling Maintenance and Shaft Alignment.

**Air Pre-Heater** - Seal arrangement settings & replacement, Cold end corrosion in Air heaters, Causes & remedies, Driving Unit and its maintenance.

**SCAPH** - Inspection of tubes for erosion and corrosion, soot blowers maintenance

**Pulverisers & Raw Coal Feeders**

Pulverisers -Setting of spring assembly, Fitting of bearings and rollers on journals shaft, Mounting worm gear and shaft, Lubrication system of mills, Setting of classifier vanes, Repair of discharge dampers, Major problems encountered in coal mills & their causes and remedies, Constructional details working and maintenance aspect of driving units and PIV gearbox, Maintenance of coal flow indicators & inlet gate of coal, Maintenance of coal carrying system, i.e. drag link chain / conveyers / rotating blades. ESP maintenance practices.

[T1][R2] [No. of hrs. 11]

**UNIT-III**

**Coal Handling Plant & Ash Handling Plants Maintenance** - Coal handling machines -their working and maintenance aspects, Bunker & Chutes- Effect of erosion and corrosion due to coal and their rectification, Coal crusher- Maintenance problems and repairs.

**Turbine Maintenance** - Pre-checks & dismantling sequence of Turbine Measurement of clearances, Checking the conditions of babbitt metal for score pitting, chipping of or lack of bondage between the babbitt and the shell, Checking of turbo supervisory instrument for total expansion & differential expansion, Checking of turbine cylinders for cracks/ deformation, Turbine support arrangements, Cleaning inspection and NDT, Centering of shafts, Alignment of rotors of HP, IP & LP rotors w.r.t. generator, Turbine generating system & control valves and governors, Inspection of barring gears, Vibration analysis, Turbine insulation inspection.

[T1][R2 & R3] [No. of hrs. 11]

**UNIT-IV**

**Modified Scheme and Syllabus of B. Tech-POWER Engg. (1<sup>st</sup> Semester to 8<sup>th</sup> Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23<sup>rd</sup> BOS and 40<sup>th</sup> AC meeting of USET.**

**Turbine Auxiliaries Maintenance** - Boiler feed pump, C.W. pump, Feed Heaters- LP & HP Heater, Condensers- Inspection cleaning & repair of tubes, Chemical dosing pumps- reciprocating pumps, Condensate extraction pump, Construction & function of each part and maintenance problems of all equipments, Removal of complete cartridge of boiler feed pump, Inspection of shaft, bearings, seals, glands, balancing arrangements and wear rings, Dismounting & mounting of bearings, Maintenance of Hydraulic coupling, Alignment of pumps, Trouble shooting of pumps.

**Generator Maintenance** - Stator & Rotor maintenance, Vibration monitoring, Hydrogen leakage, Rotor earth fault detection, Excitation system maintenance.

**Electrical Plant & Auxiliary Equipment Maintenance**– Switchgears, Isolators, Motors, Transformers, Batteries, Cable & earthing, Actuators. Major Maintenance aspects of Hydro-electric/Gas Power Stations.

[T1][R2] [No. of hrs. 10]

**Text Books:**

[T1] NPTI Manual on Power Plant Maintenance.

**References Books:**

[R1] Modern Power Station Practice. C.E.G.B. Vol-III.

[R2] Operator's hand book - CEGB

[R3] BHEL Operation & Maintenance Manual.

**BALANCE OF POWER PLANT****Paper Code: ETPE-413****Paper: Balance of Power Plant**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of other auxiliaries that are required for a Power engineering student*

**UNIT-I****Power Plant Civil Works****Surveying:** Importance, Types of Survey (Chain Survey, Plane Table Survey, Leveling, Triangulation etc.),

Soil Mechanics and Soil Investigation: Types of Soil, Properties/Characteristics of Soil, Soil Classification, Objective &amp; Methods of Soil Investigation, Field Testing, Soil Improvement Methods.

**Structure:** Types of Structures (RCC, Steel, etc.) and their construction,**Foundations:** Purpose, Bearing capacity, Types of Foundations, Shallow Foundations - Spread (Isolated, Combined, Raft) Foundation and Rock Foundation, Deep Foundations - Pile Foundation and Well Foundation, Seismic aspects.**[T1][T2][R2][R3][No. of Hrs. 12]****UNIT-II**

**Construction Materials:** Lime, Cement, Brick, Aggregate (Sand, Stone, etc.), Steel, Aluminium, Timber, Admixtures, Flooring Materials, Roofing Materials, Sanitary & Water Supply Materials, Painting / Finishing Materials. Construction Equipment: Earth-Moving Equipment, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Pneumatic Equipment, Pumping & Dewatering Equipment, Civil works in generating stations, sub-stations: transmission system: civil maintenance and safety: Corrosion, Erosion, Cracks, Ageing, Foundation failure,

**[T1][T2][R2][R3][No. of Hrs. 12]****UNIT-III****Safety**General Safety, Fire, Extinguishers and different types of extinguishers, safety measurements in storage of hydrogen, Fuels, CO<sub>2</sub> and Ammonia, water treatment plant.**[R1][No. of Hrs. 10]****UNIT-IV****Piping networks**

Piping basics, Design of piping for power plants, Commissioning and Inspection of piping, Maintenance of pipes in plant, NDT methods for leakage detection .

**[R4][R5][No. of Hrs. 10]****Text Books:**

[T1] J. Jha and Prof. S. K. Sinha, "Construction and Foundation Engineering", Khanna Publishers.

[T2] K. R. Arora, "Construction Materials"

**References:**

[R1] Power Plant Safety, NPTI Publications

[R2] CBIP Manual on "Layout of Sub-station", Technical Report No.3, 1974, Re-revised in 1996.

[R3] CBIP Manual on Sub-station, Chapter on "Design of Earthing Mat for HV Sub-station", Publication No.223, 1992, Re-revised in 1996.

[R4] George A. Antaki, Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair CRC Press, 28-May-2003 - Technology &amp; Engineering - 564 pages

[R5] Peter Smith ISBN: 9781933762043, The Fundamentals of Piping Design: Drafting and Design Methods for Process Applications, Bentley Press



**PREVENTIVE MAINTENANCE & CONDITION MONITORING**

**Paper Code: ETPE-415**

**Paper: Preventive Maintenance & Condition Monitoring**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with techniques being adopted in industry for quality control.*

**UNIT- I**

**Maintenance Policies and Preventive Maintenance:** Maintenance, Scope of Responsibilities, Types of maintenance, Maintenance planning & control, Maintainability & Availability, Failure modes and the Bath Tub Curve. Preventive maintenance, Maintenance schedules: Repair cycle, Principles and methods of lubrication, Fault Tree Analysis, Total Productive Maintenance: Methodology and Implementation.

[T1, T2][No. of Hrs: 10]

**UNIT- II**

**Principles And Practices Of Maintenance Planning:** Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability, Equipment Life cycle, Measures for Maintenance Performance: Equipments breakdowns, Mean Time Between Failures, Mean Time To Repair, Factors of availability, Maintenance organization, Maintenance economics.

[T1, T2][No. of Hrs: 10]

**UNIT- III**

**Condition Monitoring:** Condition Monitoring: Cost comparison with and without Condition Monitoring, Onload testing and off load. Methods and instruments for Condition Monitoring, Temperature sensitive tapes, Pistol thermometers, wear-debris analysis, noise vibration and harshness analysis of machines.

[T1, T2][No. of Hrs: 10]

**UNIT-IV**

**Repair methods for basic machine elements & equipment:**

Repair methods for beds, slide-ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location. Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

[T1, T2][No. of Hrs: 10]

**Text Books:**

- [T1] Srivastava, S.K., “Industrial Maintenance Management”, S. Chand and Co.  
 [T2] Bhattacharya, S.N., “Installation, Servicing and Maintenance”, S. Chand and Co.

**Reference Books:**

- [R1] White, E.N., “Maintenance Planning”, Documentation, Gower Press  
 [R2] Garg, M.R., “Industrial Maintenance”, S. Chand and Co.  
 [R3] Higgins, L.R., “Maintenance Engineering Hand book”, 5th Edition, McGraw Hill  
 [R4] Armstrong, “Condition Monitoring”, BSIRSA  
 [R5] Davies, “Handbook of Condition Monitoring”, Chapman and Hall

**NON-CONVENTIONAL MANUFACTURING PROCESSES**

**Paper Code: ETME-413**

**Paper: Non-Conventional Manufacturing Processes**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with non conventional manufacturing processes.*

**UNIT - I**

**Introduction:** Limitations of conventional manufacturing processes need of unconventional manufacturing processes & its classification and its future possibilities.

[T1][No. of Hrs. 10]

**UNIT - II**

**Unconventional Machining Process:** Principle, Working, Process parameters and applications of unconventional machining process such as Electro-Discharge machining, WEDM, Chemical machining, Electrochemical machining, Ultrasonic machining, Abrasive jet machining, Abrasive flow machining, Water jet machining, Laser beam machining, Electron beam machining, IBM and other advanced manufacturing processes.

[T1][No. of Hrs. 12]

**UNIT – III**

**Unconventional welding processes:** Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma arc welding/cutting etc.

[T1][No. of Hrs. 10]

**UNIT-IV**

**Unconventional Forming processes:** Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro Discharge forming, water hammer forming, explosive compaction etc.

**Electronic-device Manufacturing:** Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing.

[T1][No. of Hrs. 11]

**Text Books:**

[T1] P.C. Pandey & H.S. Shan, “Modern Machining Process”, Tata McGraw Hills, 2001

[T2] Amitabh Gosh and A.K. Mallik, “Manufacturing Science”, Affiliated East-West Press Pvt. Ltd., 1985.

**Reference Books:**

[R1] J.T. Black, Ronald A. Kosher DeGarmo's Materials and Processes in Manufacturing, 11th Edition, Wiley

[R2] Mikell P. Groover" Principles of Modern Manufacturing, 5th Edition SI Version, Wiley

**DATABASE MANAGEMENT SYSTEMS**

**Paper Code: ETCS-425**

**Paper: Database Management Systems**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The concepts related to database, database techniques, SQL and database operations are introduced in this subject. This creates strong foundation for application data design.*

**UNIT-I : Introductory Concepts of DBMS:** Introduction and application of DBMS, Data Independence, Database System Architecture – levels, Mapping, Database users and DBA, Entity – Relationship model, constraints, keys, Design issues, E-R Diagram, Extended E-R features- Generalization, Specialization, Aggregation, Translating E-R model into Relational model.

[T1, T2][No. of Hrs. 10]

**UNIT-II : Relational Model:** The relational Model, The catalog, Types, Keys, Relational Algebra, Fundamental operations, Additional Operations-, SQL fundamentals, DDL,DML,DCL PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Integrity – Triggers.

[T2, R3][No. of Hrs. 10]

**UNIT-III:** Functional Dependencies, Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation, Boyce/Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

[T2, R1][No. of Hrs. 10]

**UNIT-IV: Transaction Management:** ACID properties, serializability of Transaction, Testing for Serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, Database recovery management.

**Implementation Techniques:** Overview of Physical Storage Media, File Organization, Indexing and Hashing, B+ tree Index Files, Query Processing Overview, Catalog Information for Cost Estimation, Selection Operation, Sorting, Join Operation, Materialized views, Database Tuning.

[T1, T2, R2][No. of Hrs. 12]

**Text Books:**

- [T1] Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 5<sup>th</sup> Edition, Tata McGraw Hill, 2006
- [T2] Elmsari and Navathe, “Fundamentals of Database Systems”, 4th Ed., A. Wesley, 2004

**References Books:**

- [R1] C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, 8<sup>th</sup> Edition, Pearson Education, 2006.
- [R2] J. D. Ullman, “Principles of Database Systems”, 2nd Ed., Galgotia Publications, 1999.

**MANUFACTURING AND INDUSTRIAL ENGINEERING***(For Mechanical specialization)***Paper Code: ETPE-421****Paper: Manufacturing and Industrial Engineering**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: The objective of the paper is to facilitate the student with the basics of Manufacturing & Industrial Engineering that are required for an engineering student.*

**UNIT-I****Machining and Machine Tool Operations:**

**Machining processes**-turning, drilling, boring, milling, shaping planning, sawing, gear cutting thread production, broaching, grinding, lapping, honing super finishing; mechanics of cutting-Merchant's analysis, geometry of cutting tools, cutting forces, power requirements; selection of process parameters; tool materials, tool wear and tool life, cutting fluids, machinability.

**UNIT-II**

**Non-conventional machining processes and hybrid processes:** EDM, CHM, ECM, USM, LBM, EBM, AJM, PAM and WJM; economics of machining.

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

**UNIT-III**

**Computer Integrated Manufacturing:** Basic concepts of CAD, CAM, and their integration tools.

**Work Study:** Method study, work measurement, time study, works sampling, job evaluation, merit rating.

**Production Planning and Control:** Forecasting models, aggregate production planning, master scheduling, materials requirements planning.

**UNIT-IV**

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

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

**Text Books:**

[T1] Production Technology by Sh. R.K. Jain.

[T2] Computer Aided production by Sh. Mahapatra

[T3] Production Management Planning & Inventory Control - Narsimhan.

**References Books:**

[R1] Work Study by – ILO

[R2] Operation Research: An Introduction by Sh. Taha.

**COMMUNICATION ENGINEERING****Paper Code: ETPE-423****Paper: Communication Engineering**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: This is the first course which introduces the concepts of communication systems, channels and various analog modulation methods. Further, an insight into the behavior of noise is dealt.*

**UNIT-I**

**Introduction:** Signals, Functions, Mathematical basis, Fourier Analysis, Power spectral Density, Power System scenario vis-à-vis Communication engineering-its impact, Communication Systems overview.

**Modulation System:** Analog communication – Need for Modulation, Modulation concept, techniques-AM-Envelop & synchronous detection, DSBSC-generation and demodulation; SSB-generation and detection.

**[T1][T2][R1][No. of Hrs. 11]****UNIT-II**

**Angle Modulation**-concept of frequency and phase modulation, frequency deviation and modulation index, FM spectra, Carson's rule, narrowband and broadband FM, generation using Armstrong method, direct FM generation, Demodulation; PLL

Sampling and Discrete Time Modulation, Sampling Theorem, PAM, PWM, PPM. Review of random signals and noise, SNR, Thermal and shot noise.

**[T1][T2][R2][No. of Hrs. 11]****UNIT-III**

**Digital Communication:** PCM, Quantization Noise, Bandwidth, advantages/disadvantages, DPCM, Delta Modulation, Digital Modulation.

**PLCC:** Interfacing with power system, Concept and description of typical systems. Case studies

**[T1][T2][R1][No. of Hrs. 10]****UNIT-IV**

**Microwave Communication:** Concepts, Line budgets, Satellite links, VSATS, TDMA, and CDMA

**Optical Communication:** Fiber optics basics, Transmitter/receiver, PIN/LASER/LED/APD; Fiber Optic Link, Optical systems-SDH/PDH/DWDM, OPGW.

**[T1][R1][No. of Hrs. 10]****Text Books:**

[T1] Lathi, "Modern Digital and Analog Communication System", Oxford University Press

[T2] Haykins, Simon: "Communication Systems", 3<sup>rd</sup> Edition, John Wiley, Singapore, 1984.

**References:**

[R1] Keiser, Gerd: "Optical Fiber Communications", 2<sup>nd</sup> Edition, McGraw Hill (International Student Edition), 1991.

[R2] Couch, Leon W.: "Modern Communication Systems", Prentice Hall, India, 1998.

**INFORMATION THEORY AND ITS APPLICATIONS**

**Paper Code: ETPE-425**

**Paper: Information Theory and its Applications**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: In this course the students will study a number of efficient encoding/decoding strategies which have proven important in practice with a categorization on the notion of decoding.*

**UNIT-I**

Review of Probability Theory, Random Variables and Random Process. Information Theory Introduction, Uncertainty, Information, and Entropy, Information Rate, Conditional and Joint Entropies. Source Coding Theorem, Data Compaction, Prefix Coding, Kraft McMillan Inequality, Huffman Coding, Lempel Ziv Coding, Discrete Memoryless Channels, Mutual Information, Markov Sources, Channel Capacity.

[T1] [T2][No. of Hrs. 12]

**UNIT-II**

Channel Coding Theorem, Differential Entropy and Mutual Information for Continuous Ensembles, Information Capacity Theorem and its implications, Information Capacity of a colored noise channel. Discrete Memoryless Channels and Channel Coding Theorem revisited.

[T1][T2][R1][R5][No. of Hrs.10]

**UNIT-III**

Linear Block codes, Repetition Codes, Syndrome Decoding, Hamming Codes, Dual Code, Cyclic Codes, Maximal Length Codes, CRC Codes, BCH Codes, Reed-Solomon Codes, Golay Codes, Convolutional Codes: Code Tree, Trellis and State Diagram.

[T1] [R2][R4][No. of hrs.11]

**UNIT-IV**

Decoding of Convolutional Codes: Maximum Likelihood decoding, Viterbi's algorithm, free distance of a convolutional code. Turbo Codes: Turbo Encoder and Decoder, Puncturing, Performance of Turbo Codes. Introduction to Cryptography.

[T1] [R2] [R3][R5] [No. of Hrs.11]

**Text Books:**

- [T1] Simon Haykins, "Communication Systems", 4<sup>th</sup> edition Wiley, 2001.  
 [T2] J G Proakis, "Digital Communications", Mc Graw Hill, 2001.

**Reference Books:**

- [R1] T M Gover, J M Thomos, "Elements of Information Theory", Wiley, 1999.  
 [R2] Arijit Saha, Nilotpal Manna, Surajit Mandal, "Information Theory, Coding and Cryptography", Pearson Education, 2013.  
 [R3] Schaum's Outlines, Analog and Digital Communications, Second Edition.  
 [R4] Amitabha Bhattacharya, "Digital Communication", TMH 2006.  
 [R5] J. H. Van Lint.. "Introduction to Coding Theory", Springer -Verlag.

**FINITE ELEMENT METHODS**

**Paper Code: ETME-423**  
**Paper: Finite Element Methods**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objectives: The objectives of the subject are to equip the students with the Finite Element Analysis fundamentals. The study of this subject is also enabling the students to formulate the design problems into FEA and introduce basic aspects of finite element technology.*

**UNIT – I**

**Basic of Finite Element Method, Variational calculus, Integral formulation, variational methods:** Methods of weighted residuals, Approximate solution using variational method, Modified Galerkin method, Boundary conditions

**Basic Finite Element Concepts:** Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method, Axis symmetric Problems

[T1, T2][No. of Hrs. 11]

**UNIT II**

**Discrete System:**

Axial spring element, Axial bars, Torsion bars, Application in Heat transfer and Solid Mechanic Problems, Plane truss problem, software application ANSYS etc

**Beam:** Euler Beam element and its application.

[T1, T2][No. of Hrs. 11]

**UNIT III**

**Eigen value problems:** Formulation and problems

**Single value problem in 2D:** Boundary value problem, axis symmetric problems

[T1, T2][No. of Hrs. 11]

**UNIT IV**

**Numerical on 2D Solid mechanics**

Interpolation function (triangular, Quadrilateral, serendipity elements), numerical integration and modelling consideration.

[T1, T2][No. of Hrs. 11]

**Text Books:**

- [T1] J N Reddy “An Introduction to finite element method” Tata Mc Graw Hill 3rd edition  
 [T2] S.S. Rao, “Finite Element Method In Engineering”, Pergaman Press

**Reference Books:**

- [R1] O.C. ZienKiewicz, “The Finite Element Method”, Tata McGraw Hill  
 [R2] Larry J. Segerlind, “Applied Finite-Element Analysis”, John Wiley and Sons  
 [R3] Kenneth H. Huebner, “Finite Element Method for Engineers”, John Wiley and Sons  
 [R4] Darell W. Pepper, J.C Heinrich “The Finite Element Method” CRC press  
 [R5] V.Ramamurti “Finite Element Method in Machine Design”Norosa Publishing House.

**ROTOR DYNAMICS**

**Paper Code: ETME-427**  
**Paper: Rotor Dynamics**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objectives: The aim of this course is to provide a physical understanding of rotor dynamics. Rotor dynamics basically deals with the vibration characteristics of rotating machinery. Since most of these machines operate in critical services in the oil and gas industries, one has to ensure that the machines operate with a high degree of reliability. The dynamic characteristics of the turbo machinery need to be completely understood before the machine is placed in service. A basic knowledge of the underlying principles of the rotor dynamics will help in a better understanding of the behavior of rotating machinery.*

**UNIT-I**

**Torsional Vibrations in Rotating Machinery:** Modelling of rotating machinery shafting, Transfer matrix analysis for free vibrations, Excitation torque, Transient response in torsional vibration, Branched systems.

**Torsional Vibrations in Reciprocating Machinery:** Modelling of the reciprocating machine systems, Free vibration calculations, Excitation torque, Forced vibration, Cyclic irregularity, Finite element analysis by consistent mass matrix, Gear elements.

[T1][No. of Hrs. 11]

**UNIT-II**

**Gyroscopic Effects:** Gyroscopics of a spinning disk, Synchronous whirl of an overhung rotor, Rotor system with a coupling, Whirl speed analysis.

**Bending Critical Speeds of Simple Shafts:** Whirling of an unbalanced simple elastic rotor, Simple shafts with several disks, Transfer matrix analysis for bending critical speeds, Finite elements method, Effect of axial stiffness, Consistent mass matrix, Effect of axial torque, Effect of gear mesh stiffness.

[T1][No. of Hrs. 11]

**UNIT-III**

**Rotors Mounted on Fluid Film Bearings:** Simple rotor in fluid film bearings, Transfer matrix analysis of rotors in fluid film bearings, Transfer matrix analysis of rotors by distributed elements, Dual rotor system analysis.

**Instability Due to Fluid Film Forces and Hysteresis:** Instability of rotors mounted on fluid film bearings, rigid rotor instability, Instability of a flexible rotor, Instability threshold by transfer matrix method, internal hysteresis of shafts, Instability due to negative cross-coupled stiffness, Orbital analysis by transfer matrix method.

[T1][No. of Hrs. 11]

**UNIT-IV**

**Shafts with Dissimilar Moments of Area:** Stability of a shaft with dissimilar stiffness, Whirling of a shaft with dissimilar stiffness, Effect of disk unbalance, Effect of gravity on a balanced disk, Transient response by time marching technique.

**Balancing of Rotors:** Classification of rotors, rigid rotor classification and balancing criteria, balancing of rigid rotors, balancing of flexible rotors.

**Text Books:**

[T1] J.S Rao, "Rotor Dynamics", New Age International Publishers.

[T2] M.I. FrisWell, "Rotor Dynamics", Cambridge University Press

**Reference Books:**

[R1] John Vance, Fouad Zeidan, Brian Murphy "Machinery Vibration and Rotor Dynamics" John Wiley &amp; Sons



**MANAGEMENT INFORMATION SYSTEMS AND ERP****Paper Code: ETME-421****Paper: Management Information Systems and ERP**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objectives: The objective of this course is to expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in this regard.*

**UNIT I**

Meaning and Role of Information Systems. Types of Information Systems: Operations Support Systems, Management Support Systems, Expert Systems, and Knowledge Management Systems. Information Systems for Strategic Management: Competitive Strategy Concepts, Strategic Role of Information Systems. Integrating Information Systems with Business Strategy, Value Chain Analysis, and Strategic Information Systems Framework.

**[T1,T2][No. of Hrs. 12]****UNIT II**

Planning for Information Systems: Identification of Applications, Business Planning Systems and Critical Success Factors, Method of Identifying Applications, Risks in Information Systems. Resource Requirements for Information Systems: Hardware and Capacity Planning, Software Needs, Procurement Options – Make or Buy decisions, Outsourcing as an Option.

**[T1,T2][No. of Hrs. 12]****UNIT III**

Systems design and Development Methodologies: SDLC Approach, Prototyping, Spiral Method, End User Development. Logical and Physical Design. Evaluation of Information Systems.

**[T1,T2][No. of Hrs. 10]****UNIT IV**

Emerging Concepts and Issues in Information Systems: Supply Chain Management, Customer Relationship Management, ERP. Introduction to Data Warehousing, Data Mining and its Applications.

**[T1,T2][No. of Hrs. 10]****Text Books:**

- [T1] Kenneth Laudon and Jane Laudon (2013). Management Information Systems, Twelfth Edition, Pearson, New Delhi.
- [T2] James O'Brien, George Marakas and Ramesh Behl (2014). Management Information Systems, Tenth Edition, McGraw Hill Education, New Delhi.

**References Books:**

- [R1] Sahil Raj, "Management Information Systems", Pearson 2013
- [R2] Girdhar Joshi (2013). Management Information Systems, Oxford University Press, New Delhi.
- [R3] Effy Oz (2009). Management Information Systems, Sixth Edition, Cengage Learning, Delhi.
- [R4] Nirmalya Bagchi (2014). Management Information Systems, Vikas Publishing House, New Delhi.

**SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS**

**Paper Code: ETHS-419**

**Paper: Sociology and Elements of Indian History for Engineers**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: The objective of this course is to familiarize the prospective engineers with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues and problems in Indian society. The course would enable them to analyze critically the social processes of globalization, modernization and social change. All of this is a part of the quest to help the students imbibe such skills that will enhance them to be better citizens and human beings at their work place or in the family or in other social institutions.*

**UNIT I**

*Module 1A: Introduction to Elements of Indian History: What is History? History Sources-Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography.*

[3 Lectures]

*Module 1B: Introduction to sociological concepts-structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). State & civil society.*

[7 Lectures]

[T1][No. of Hrs. 10]

**UNIT II**

*Module 2A: Indian history & periodization; evolution of urbanization process: first, second & third phase of urbanization; Evolution of polity; early states of empires; Understanding social structures-feudalism debate.*

[3 Lectures]

*Module 2B: Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim.*

[7 Lectures]

[T1][No. of Hrs. 10]

**UNIT III**

*Module 3A: From Feudalism to colonialism-the coming of British; Modernity & struggle for independence.*

[3 Lectures]

*Module 3B: Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim.*

[9 Lectures]

[T1][No. of Hrs. 12]

**UNIT IV**

*Module 4A: Issues & concerns in post-colonial India (upto 1991); Issues & concerns in post-colonial India 2<sup>nd</sup> phase (LPG decade post 1991).*

[3 Lectures]

*Module 4B: Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization.*

[10 Lectures]

[T1][No. of Hrs. 13]

**Text Books:**

[T1] Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan.

[T2] Giddens, A (2009), Sociology, Polity, 6<sup>th</sup> Edition

**Reference Books:**

[R1] Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan

[R2] Haralambos M, RM Heald, M Holborn, (2000), Sociology, Collins

**ROTATIONAL ON-JOB TRAINING**  
***(Operation - Steam Generator & Its Auxiliaries)***

Paper Code: ETPE-451

Paper: Steam Generator & Its Auxiliaries

L	T/P	C
0	3	1

**Steam Generator & Its Auxiliaries training based on syllabus ETPE-306.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**ROTATIONAL ON-JOB TRAINING**  
***(Operation - Steam Turbine & Its Auxiliaries)***

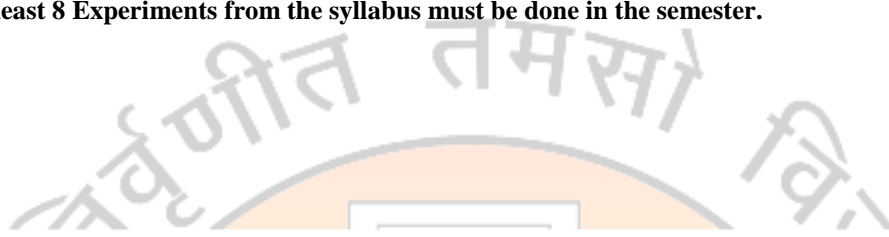
Paper Code: ETPE-453

Paper: Steam Turbine & Its Auxiliaries

L	T/P	C
0	3	1

**Steam Turbine & Its Auxiliaries training based on syllabus ETPE-306.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**ROTATIONAL ON-JOB TRAINING**  
***(Operation – Power Plant Electrical Machines & Systems)***

<b>Paper Code: ETPE-455</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Power Plant Electrical Machines &amp; Systems</b>	<b>0</b>	<b>3</b>	<b>1</b>

**Power Plant Electrical Machines & Systems training based on syllabus ETPE-306.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**POWER SYSTEM PROTECTION AND SWITCHGEAR LAB****Paper Code: ETPE-457****L****T/P****C****Paper: Power System Protection and Switchgear Lab****0****2****1****Power System Protection and Switchgear Lab Experiments based on syllabus ETPE-403.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**THEORY OF MACHINE LAB**

**Paper Code: ETPE-455(ELECTIVE)**  
**Paper: Theory of Machine Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**Theory of Machine Lab Experiments based on syllabus ETPE-407.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**



**POWER SYSTEM LAB**

**Paper Code: ETPE-455(ELECTIVE)**  
**Paper: Power System Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**Power System Lab Experiments based on syllabus ETPE-409.**

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**





**HUMAN VALUES & PROFESSIONAL ETHICS – II****Paper Code: ETHS-402****Paper : Human Values & Professional Ethics-II**

<b>L</b>	<b>T</b>	<b>C</b>
<b>1</b>	<b>0</b>	<b>1</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. In addition to Question No. 1, the paper shall consist of questions from each of the four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks
3. Two internal sessional test of 10 marks each and one project report\* carrying 5 marks.

**Objectives:**

1. *The main object of this paper is to inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the engineering profession.*
2. *To enable student to understand the need and importance of value-education and education for Human Rights.*
3. *To acquaint students to the National and International values for Global development*

**UNIT I - Appraisal of Human Values and Professional Ethics:**

**Review of Universal Human Values:** Truth, Love, Peace, Right conduct, Non violence, Justice and Responsibility. Living in harmony with 'SELF', Family, Society and Nature. Indian pluralism - the way of life of Islam, Buddhism, Christianity, Jainism, Sikhism and Hinduism, Greek - Roman and Chinese cultural values.

Sensitization of Impact of Modern Education and Media on Values:

- a) Impact of Science and Technology
- b) Effects of Printed Media and Television on Values
- c) Effects of computer aided media on Values (Internet, e-mail, Chat etc.)
- d) Role of teacher in the preservation of tradition and culture.
- e) Role of family, tradition & community prayers in value development.

**Review of Professional Ethics:** Accountability, Collegiality, Royalty, Responsibility and Ethics Living. Engineer as a role model for civil society, Living in harmony with 'NATURE', Four orders of living, their inter-correctness, Holistic technology (eco-friendly and sustainable technology).

[T1] [T2] [R1] [R5] [R4][No. of Hrs. 03]

**UNIT II – Engineers responsibility for safety:**

Safety and Risks, Risk and Cost, Risk benefit analysis, testing methods for safety. Engineer's Responsibility for Safety Social and Value dimensions of Technology - Technology Pessimism – The Perils of Technological Optimism – The

Promise of Technology – Computer Technology Privacy

**Some Case Studies:** Case Studies, BHOPAL Gas Tragedy, Nuclear Power Plant Disasters, Space Shuttle Challenger , Three Mile Island Accident, etc.

[T1] [T2] [R4] [R2][No. of Hrs. 03]

**UNIT III – Global Issues:**

**Globalization and MNCs:** International Trade, Issues,

**Case Studies:** Kellogg's, Satyam, Infosys Foundation, TATA Group of Companies

**Business Ethics:** Corporate Governance, Finance and Accounting, IPR.

**Corporate Social Responsibility (CSR):** Definition, Concept, ISO, CSR.

**Environmental Ethics:** Sustainable Development, Eco-System, Ozone depletion, Pollution.

**Computer Ethics:** Cyber Crimes, Data Stealing, Hacking, Embezzlement.

[T1] [T2] [R4][No. of Hrs. 05]

**UNIT IV - Engineers Responsibilities and Rights and Ethical Codes:**

Collegiality and loyalty, Conflict of interests, confidentiality, occupational crimes, professional rights, responsibilities. To boost industrial production with excellent quality and efficiency, To enhance national economy, To boost team spirit, Work Culture and feeling of job satisfaction, National integration, Examples of some illustrious professionals.

Need for Ethical Codes, Study of some sample codes such as institution of Electrical and Electronics Engineers, Computer Society of India etc., Ethical Audit.

**Development and implementation of Codes:** Oath to be taken by Engineering graduates and its importance\*\*,

[T1] [T2] [R4][R2][No. of Hrs. 05]

**Text Books:**

- [T1] Professional Ethics, R. Subramanian, Oxford University Press.  
 [T2] Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.

**References Books:**

- [R1] Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Eecel Books (2010, New Delhi). Also, the Teachers' Manual by the same author  
 [R2] Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press  
 [R3] Values Education: The paradigm shift, by Sri Satya Sai International Center for Human Values, New Delhi.  
 [R4] Professional Ethics and Human Values – M.Govindrajan, S.Natarajan and V.S. Senthil Kumar, PHI Learning Pvt. Ltd. Delhi  
 [R5] A Textbook on Professional Ethics and Human Values – R.S. Naagarazan – New Age International (P) Limited, Publishers New Delhi.  
 [R6] Human Values & Professional Ethics- S B Gogate- Vikas publishing house PVT LTD New Delhi.  
 [R7] Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill  
 [R8] Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning  
 [R9] PSR Murthy, "Indian Culture Values and Professional Ethics", BS Publications  
 [R10] Caroline Whitback< Ethics in Engineering Practice and Research, Cambridgs University Press  
 [R11] Charles D Fleddermann, "Engineering Ethics", Prentice Hall.  
 [R12] George Reynolds, "Ethics in Information Technology", Cengage Learning  
 [R13] C. Sheshadri; The Source book of Value Education, NCERT  
 [R14] M. Shery; Bhartiya Sanskriti, Agra (Dayalbagh)

\*Any topic related to the experience of the B.Tech student in the assimilation and implementation of human values and professional ethics during the past three years of his/her studies in the institute OR A rigorous ethical analysis of a recent case of violation of professional ethics particularly related to engineering profession.

\*\*All students are required to take OATH in writing prior to submission of major project and the record of the same is to be maintained at the college level and/or, this oath may be administered by the head of the institutions during the graduation ceremonies. The draft for the same is available alongwith the scheme and syllabus.

**OATH TO BE TAKEN BY ENGINEERING GRADUATES**

In a manner similar to the Hippocratic Oath taken by the medical graduates, Oath to be taken by the engineering graduates is as given below.

1. I solemnly pledge myself to consecrate my life to the service of humanity.
2. I will give my teacher the respect and gratitude, which is their due.
3. I will be loyal to the profession of engineering and be just and generous to its members.
4. Whatever project I undertake, it will be for the good of mankind.
5. I will exercise my profession solely for the benefit of humanity and perform no act for criminal purpose and not contrary to the laws of humanity.
6. I will keep away from wrong, corruption and avoid tempting others to vicious practices.
7. I will endeavor to avoid waste and consumption of non-renewable resources.
8. I will speak out against evil and unjust practices whenever and wherever I encounter them.
9. I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my work, even under threat.
10. I will practice my profession with conscience, dignity and uprightness.
11. I will respect the secrets, which are confided to me.

I make these promises solemnly, freely and upon my honor.

(Name of the Student)

**Correspondence Address:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Email:** \_\_\_\_\_

**ENVIRONMENTAL MANAGEMENT****Paper Code: ETPE-404****Paper: Environment Management**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of Environmental Management and Energy conservation that are required for a power engineering student.*

**UNIT-I****Energy Management And Energy Audit**

Energy Scenario, Basics of energy and its various forms. Material and energy balance, Energy action planning, Energy monitoring and targeting. Fuels and combustion, Boilers, FBC boilers, Steam system, Furnaces, Insulation and refractory.

Heat exchangers, co-generation. Electrical Systems, Electric Motors and variable speed drive, Lighting systems.

**[T1,T2][No. of Hrs. 12]****UNIT-II**

D.G. Set system, Energy efficient technology in electrical systems. Fans and blowers, Pumps and pumping systems, Compressors and compressed air systems. HVAC and refrigeration systems, cooling towers.

Application of Non-conventional and Renewable energy sources, Wastes minimization and Resource Conservation, Waste heat recovery.

**Environmental Management****Air Pollution**

Air Pollution Standards; Effects of Air Pollutants on Materials, Vegetation and Health Origin and Fate of Pollutants (Carbon monoxide, Hazardous Air Pollutants, Lead, Nitrogen Dioxide, Photochemical Oxidants, Sulphur Oxides, Particulates) Acid Rain, Ozone depletion & Greenhouse effect.

**[T1,T2][No. of Hrs. 11]****UNIT-III****Waste Water Treatment**

Waste water Microbiology, Characteristics of Waste Water, Municipal and Industrial waste water treatment, Unit operation of Pretreatment, Primary Treatment, Unit processes of Secondary treatment, disinfections, Land treatment, Sludge treatment and disposal.

**Solid Waste Management**

Waste characteristics, Disposal by Sanitary landfill, thermal conversion; combustion or incineration system, Pyrolysis, Gasification, Pelletization. Waste to Energy, Resource conservation and recovery, Biological processing of Solid wastes.

**[T1,T2][No. of Hrs. 12]****UNIT-IV**

**Hazardous Wastes Management:** Characteristics of Hazardous Waste, Management of Hazardous Waste; Chemical. Oxidation, vitrification, Hazardous wastes landfills, Radioactive waste; Detection and analysis, classification and disposal of Radioactive Wastes, Fly ash characteristics and disposal, Site remediation techniques.

**Environmental Impact Assessment :**Legal Framework, Purpose, EIA methodology; Baseline studies, Prediction of impacts, Evaluation of Impact and Environmental management plan, Environmental Audit.

**[T1,T2][No. of Hrs. 11]****Text Books:**

[T1] Energy Management, Murphy WR, Mc Kay G, Butterworth Heinamn 20091

[T2] Environmental Engg –A Design Approach , Sincereo, Arcadio P, PHI

[T3] Environmental Engineering, Water Supply, Sanitary Engineering and Pollution Kamala A Rao, Tata MC – Graw Hill

**References Books:**

[R1] Environmental Engineering, Dean J, Horward S, Mc Grwa Hill -1985

[R2] Energy Management handbook, John Wiley and Sones – Wayne C. Turner

**MICROPROCESSORS AND MICROCONTROLLERS****Paper Code: ETPE-406****Paper: Microprocessors and Microcontrollers**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the knowledge of microprocessor systems and microcontroller.*

**UNIT- I**

**Introduction to Microprocessor Systems:** Architecture and PIN diagram of 8085, Timing Diagram, memory organization, Addressing modes, Interrupts. Assembly Language Programming.

**[T1][No. of hrs. 10]****UNIT- II**

**8086 Microprocessor:** 8086 Architecture, difference between 8085 and 8086 architecture, generation of physical address, PIN diagram of 8086, Minimum Mode and Maximum mode, Bus cycle, Memory Organization, Memory Interfacing, Addressing Modes, Assembler Directives, Instruction set of 8086, Assembly Language Programming, Hardware and Software Interrupts.

**[T2][No. of hrs. :12]****UNIT- III**

**Interfacing of 8086 with 8255, 8254/ 8253, 8251, 8259:** Introduction, Generation of I/O Ports, Programmable Peripheral Interface (PPI)-Intel 8255, Sample-and-Hold Circuit and Multiplexer, Keyboard and Display Interface, Keyboard and Display Controller (8279), Programmable Interval timers (Intel 8253/8254), USART (8251), PIC (8259), DAC, ADC, LCD, Stepper Motor.

**[T1][No. of hrs. :12]****UNIT-IV**

**Overview of Microcontroller 8051:** Introduction to 8051 Micro-controller, Architecture, Memory organization, Special function registers, Port Operation, Memory Interfacing, I/O Interfacing, Programming 8051 resources, interrupts, Programmer's model of 8051, Operand types, Operand addressing, Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions, Timer & Counter Programming, Interrupt Programming.

**[T3][No. of hrs. 11]****Text Books:**

- [T1] Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006  
 [T2] Douglas V Hall, "Microprocessors and Interfacing, Programming and Hardware" Tata McGraw Hill, 2006.  
 [T3] Ramesh Gaonkar, "MicroProcessor Architecture, Programming and Applications with the 8085", PHI

**References Books:**

- [R1] Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. MCKinlay "The 8051 Microcontroller and Embedded Systems", 2<sup>nd</sup> Edition, Pearson Education 2008.  
 [R2] Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.  
 [R3] A K Ray, K M Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill, 2007.  
 [R4] Vaneet Singh, Gurmeet Singh, "Microprocessor and Interfacing", Satya Prakashan, 2007.

**MECHANICAL VIBRATION***(For mechanical specialization)***Paper Code: ETME-416****Paper: Mechanical Vibration**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of mechanical vibration that are required for an engineering student.*

**UNIT-I**

**Fundamentals of Vibration:** Introduction, Definitions, Vector method of representing harmonic motions, complex method of representing harmonic vibrations, work done by a harmonic force on a harmonic motion, Fourier series and harmonic analysis.

**[T1,T2][No. of Hrs. 10]****UNIT-II**

**Undamped Free vibrations of single degree of freedom systems:** Introduction, Derivation of Differential equation, Solution of differential equation, Torsional Vibrations, Equivalent stiffness of spring combinations (Springs in series, springs in parallel) Energy method.

Damped Free Vibration of Single degree of freedom systems.

Introduction, different types of Dampings, Free vibrations with viscous damping (over-damped system, critically-damped system, under damped system).

**[T1,T2][No. of Hrs. 11]****UNIT-III**

**Forced vibrations of single Degree of Freedom Systems:** Introduction, Force vibrations with constant harmonic excitation (steady state vibrations), Forced vibrations with rotating and reciprocating unbalance. Forced vibration due to excitation of the support (Absolute amplitude, Relative amplitude) Energy dissipated by damping.

**[T1,T2][No. of Hrs. 10]****UNIT-IV**

**Two Degree of Freedom System:** Introduction, Principal Modes of Vibration, Other cases of simple two degrees of freedom systems (Two masses fixed on tightly stretched string).

**Critical speed of shafts:** Introduction, Critical speed of a light shaft having a single disc without damping. Critical speed of a light shaft having a single Disc with damping (Critical speeds of a shaft having multiple discs.

**[T1,T2][No. of Hrs. 11]****Text Books:**

- [T1] R.S. Khurmi-Mechanical Vibration and Analysis, S. Chand & company Ltd., 7361, New Delhi  
 [T2] Sadhu Singh-Mechanical Vibrations, Khanna Publication

**References Books:**

- [R1] G.K. Grover – Mechanics of vibrations, Roorkee Press Roorkee  
 [R2] N.S. V. Kameswara Rao - Vibration theory S. Chand & company Ltd. 7361, New Delhi

**DESIGN OF ELECTRICAL MACHINES**

**Paper Code: ETPE-410**  
**Paper: Design of Electrical Machines**

L	T/P	C
2	1	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective:** Providing sound knowledge about the principles of operation of various electrical machines, their constructional features, and their behavior and Design concepts of various components of each electrical machine so that machines after manufacturing operate at optimum efficiency and economy under various condition of operation.*

**UNIT I**

**General Concepts:** Major considerations in Design of Electrical Machines Electrical Engineering Materials, Space factor, Choice of Specific Electrical and Magnetic loadings, Thermal considerations, Heat flow, Temperature rise, Rating of machines, Standard specifications.

**DC Machines :** Output Equations, Main Dimensions, Magnetic circuit calculations, Carter's Coefficient, Net length of Iron, Real & Apparent flux densities, Selection of number of poles, Design of Armature, Design of commutated and brushes, performance prediction using design values.

**[T1, T2][No. of Hrs. 10]****UNIT II**

**Transformers:** Output Equations, Main Dimensions, KVA output for single and three phase transformers, Window space factor, Overall dimensions, Operating characteristics, Regulation, No load current, Temperature rise in Transformers, Design of Tank, Methods of cooling of Transformers.

**[T1, T2][No. of Hrs. 10]****UNIT III**

**Induction Motors:** Output equation of Induction motor, Main dimensions, Length of air gap, Rules for selecting rotor slots of squirrel cage machines, Design of rotor bars & slots, Design of end rings, Design of wound rotor, Magnetic leakage calculations, leakage reactance of poly phase machines, Magnetizing current, Short circuit current, Circle diagram, Operating characteristics.

**[T1, T2][No. of Hrs. 10]****UNIT IV**

**Synchronous Machines:** Output equations, choice of loadings, Design of salient pole machines, Short circuit ratio, shape of pole face, Armature design, Armature parameters, Estimation of air gap length, Design of rotor, Design of damper winding, Determination of full load field mmf, Design of field winding, Design of turbo alternators, Rotor design.

**[T1, T2][No. of Hrs. 10]****Text Books:**

- [T1] Electrical Machine Design the Design and Specification of Direct and Alternating Current Machinery, Alexander Gray, Nabu Press, First reprint edition, 2014
- [T2] Electric Machines Steady State, Transients, and Design with MATLAB, IonBoldea, Lucian Tutelea, CRC Press, Taylor & Francis, First edition, 2010.

**Reference**

- [R1] Principles of Electrical Machine Designs with Computer Programmes, Sen, S.K., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, 1987.
- [R2] Electrical Machine Design Data Book, A. Shanmugasundaram, G. Gangadharan, R. Palani, New Age International Pvt. Ltd., Reprint 2007.
- [R3] Design and Testing of Electrical Machines, M.V. Deshpande, PHI, 2013.
- [R4] Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Co., New Delhi, 6<sup>th</sup> Edition, 2013.

**PROJECT MANAGEMENT****Paper Code: ETPE-412****Paper: Project Management**

L	T/P	C
2	1	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objectives: The student is introduced to the concepts of project management which becomes back bone knowledge for an engineer to have a holistic view of executing a project.*

**UNIT – I**

Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.

**[T1,T2][No. of Hrs. 11]****UNIT –II**

Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks.

**[T1,T2][No. of Hrs. 11]****UNIT – III**

Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Leveling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.

**[T1,T2][No. of Hrs. 10]****UNIT – IV**

Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management. Post-Project Analysis.

**[T1,T2][No. of Hrs. 10]****Text Books:**

- [T1] Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India
- [T2] P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

**Reference Books:**

- [R1] Cleland and King, VNR Project Management Handbook.
- [R2] Lock, Gower, Project Management Handbook.
- [R3] Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. India
- [R4] Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers.
- [R5] S. Choudhury, Project Scheduling and Monitoring in Practice.
- [R6] John M Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall, India.
- [R7] N. J. Smith (Ed), Project Management, Blackwell Publishing.
- [R8] Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley.
- [R9] Jack R Meredith and Samuel J Mantel, Project Management: A Managerial Approach, John Wiley.



**SMART GRID**

**Paper Code: ETPE-414**  
**Paper: Smart Grid**

L	T/P	C
2	1	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: To introduce the students about the knowledge of smart grid, microgrid and information & communication Technology for Smart Grid.*

**UNIT I**

**Introduction to Smart Grid:** Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid.

**Smart Grid Technologies: Part 1:** Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

[T1, T2][No. of Hrs. 10]

**UNIT II**

**Smart Grid Technologies: Part 2:** Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

**Microgrids and Distributed Energy Resources:** Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Variable speed wind generators, microturbines, Captive power plants, Integration of renewable energy sources.

[T1, T2][No. of Hrs. 11]

**UNIT III**

**Power Quality Management in Smart Grid:** Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

[T1, T2][No. of Hrs. 10]

**UNIT IV**

**Information and Communication Technology for Smart Grid:** Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols.

[T1,T2][No. of Hrs. 10]

**Text Books:**

- [T1] Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
- [T2] Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press

**Reference Books:**

- [R1] Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley
- [R2] Jean Claude Sabonnadière, Nouredine Hadjsaïd, "Smart Grids", Wiley Blackwell

**POWER SYSTEM ANALYSIS & STABILITY**

**Paper Code: ETEL-402**

**Paper: Power System Analysis & Stability**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>4</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with detailed study of flow of power in the network, subsequent faults and the stability limits in the system.*

**UNIT- I**

**Load Flow Studies**

Type of buses, bus admittance method, load flow equation, GS method, NR method, Fast decoupled load flow.

[T1], [T2],[T3][No. of hrs. 10]

**UNIT- II**

**Fault Calculations**

Symmetrical Components, symmetrical faults, unsymmetrical faults, Sequence networks for synchronous Machines, Transformers and Transmission Line, Sequence impedance.

[T1], [T2], [T3][No. of hrs. 10]

**UNIT- III**

**Power System Stability**

Introduction, swing equation, steady state stability, equal area criteria, critical clearing angle, point by point method, factors affecting Steady State and Transient Stability and Methods of Improvements.

[T1], [T2], [T3][No. of hrs. 10]

**UNIT-IV**

**Optimal Power Flow**

Problem statement, solution of optimal power flow , gradient method , Newton method , Linear sensitivity analysis, LP methods- with real power variables only, LP method with ac power flow variable and detailed cost functions, security constraint optimal power flow

[T1], [T2], [T3][No. of hrs. 10]

**Text Books:**

[T1] J. J. Grainger & W.D. Stevenson ,Power System Analysis, TMH Publication,2006.

[T2] D.P. Kothari& I.J. Nagrath, Power System Engineering, TMH Publication, 2007.

[T3] P.Kundur, Power system stability and control, TMH Publication.

**Reference Books:**

[R1] Computer- Aided Power System Analysis, George L. Kusic, PHI Publication.

[R2] Hadi Saadat,Power System Analysis , PSA Publishing, 2010.

[R3] [D.P. Kothari](#), [I Nagrath](#), Modern Power System Analysis, TMH Publication.

[R4] L.P Singh, Advanced power system analysis and dynamics, New age International Ltd.

[R5] [C. L. Wadhwa](#), Electrical Power Systems, New age International Ltd.

**NUCLEAR POWER GENERATION AND SUPPLY****Paper Code: ETME-408****Paper: Nuclear Power Generation and Supply**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: To introduce the students about the knowledge of nuclear power generation and supply, reactor design and nuclear power plant.*

**UNIT- I:**

**Introduction:** Systems in nuclear reactor- Reactor fuels: Natural and enriched fuels, sources, merits and demerits of different fuels for reactor use, fabrication, handling of fuels and irradiated fuels, fuel management, storage, reprocessing of irradiated fuels. Reactor shutdown systems: Materials for reactor control and choices, liquid vs. solid shut down systems, design aspect- fall safe features, loading consideration, actuation methodology. Primary heat transport (cooling) system: Heat generation and distribution, Coolant characteristics, Selection of coolants, Coolant Circuit, Core thermal hydraulics, design aspects, radioactivity generation. Decay heat removal system: Functional requirements, cooling circuits, Design aspects, Loading considerations, Passive features.

**[T1, T2, R1, R2][No. of Hrs. 11]****UNIT- II:**

**Reactor structure:** Core composition, Reflector, Reactor vessel, Safety vessel, Shielding. Thermal, biological, Shield cooling system, Neutron flux monitoring and control, instrumentations. Moderator system: Materials, Selection, Design consideration, Circuit, Radioactivity aspects. Cover gas system: Purpose, Selection of material, Design considerations, Circuit. Reactor regulating system: Purpose, Methodology, Design considerations, Actuating mechanism. Auxiliary cooling circuit: Functions, Design considerations, cooling circuit. Containment and ventilation system: Functions, Types, Arrangement, Design considerations, loading, Testing.

**[T1, T2, R1, R2][No. of Hrs. 11]****UNIT- III:**

**Reactor Design:** Principles, Safety classifications, Seismic quality group, Loading considerations under normal operations, anticipated operational occurrences, design basis accidents such as earthquake, loss of coolant accident (LOCA), blackout, flood, missiles, operator error, dual failures as applicable, Safety features for server accidents, standards, soft ware, verifications etc.

**Nuclear power plants:** Types .Thermal reactors: BWR, PWR, PHWR, GCR, APWR, AHWR etc. Fast reactors Breeders; Fusion power; Off-land NPPs:- space power unit, nuclear ships, submarines. Economics of NPPs: Various costs, ROI, Sizing, Operational characteristics.

**[T1, T2, R1, R2][No. of Hrs.12]****UNIT- IV:**

**Radiation protection and Radioactive Waste Management:** Radiation hazard, Exposures, Exposure pathways, dose unit, measurement, and radiation protection. CRP and other guidance document etc. Radioactive Waste Management: Waste categorization, Generation, Handling of wastes, Liquid, gaseous and solid, Short term / long term storage / disposed.

**Reactor Stages and Safety Assurances-** Nuclear safety assurance.

**[T1, T2, R1, R2][No. of Hrs. 11]****Text Books:**

[T1] P.K. Nag. Nuclear Power Plant, Power Plant Engg. (Steam & Nuclear)

[T2] A.K. Raja, A.P. Srivastava & M. Dwivedi, An Introduction on Nuclear Engineering,

**Reference Books:**

[R1] Glasstone & Sesons- Nuclear Engineering

[R2] Arora & Domkundwar, A course in Power Plant Engg-

**ROBOTICS**

**Paper Code: ETMT-402**  
**Paper: Robotics**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>2</b>	<b>1</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

*Objective: To introduce the foundations of robotics. Also, a course on Robotics must use one or more software to not only visualize the motion and characteristics of robots but also to analyzer/synthesize/design robots for a given application.*

**UNIT - I****Fundamentals of Robot Technology:**

Robot definition, automation and robotics, Robot anatomy, Work volume, Drive systems. Control systems and dynamic performance. Accuracy and repeatability. Sensors and actuators used in robotics. Machine Vision, Robot configurations, Path control. Introduction to robot languages. Applications; Types (Mobile, Parallel); Serial: Cartesian, Cylindrical, etc.; Social Issues

**[T1,T2,T3][No. of Hrs: 10]****UNIT - II**

**Robot Kinematics:** Mapping, Homogeneous transformations, Rotation matrix, Forward Kinematics (DH Notation) and inverse kinematics: Closed form solution.

**Robot Differential Motion:** Linear and Angular velocity of rigid link, Velocity along link, Manipulator jacobian, Statics: Use of jacobian.

**[T1,T2,T3][No. of Hrs: 10]****UNIT – III**

**Robot Dynamics:** Lagrangian Mechanics, Lagrangian Formulation and numericals. Dynamics, Newton-Euler Recursive Algorithm, Simulation. Euler-Lagrange Equations of motion/Any one other formulation like using Decoupled Natural Orthogonal Complements (DeNOC)

**End effectors:** Mechanical and other types of grippers. Tools as end effectors. Robot and effector interface. Gripper selection and design.

**[T1,T2,T3][No. of Hrs: 10]****UNIT - IV**

**Applications for Manufacturing.** Flexible automation. Robot cell layouts. Machine interference. Other considerations in work cell design. Work cell control, interlocks. Robot cycle time analysis. Mechanical design of robot links.

Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

**[T1,T2,T3][No. of Hrs: 10]****Text Books:**

- [T1] R.K. Mittal, I.J. Nagrath, "Robotics & Control", Tata McGraw & Hills, 2005.  
 [T2] Mikell P Groover, Mitchell Weiss "Industrial Robotics :Technology, Programming and Application" Tata McGraw & Hills, 2009.  
 [T3] Saha, S.K., Introduction to Robotics, 2<sup>nd</sup> Edition, McGraw-Hill Education, New Delhi, 2014

**Reference Books:**

- [R1] John J.Craig; "Introduction to Robotics Mechanics & Control", Pearson Education, 2004.  
 [R2] Robert J. Schilling, "Fundamentals of Robotics, analysis & Control", Prentice Hall (I) P. Ltd., 2002  
 [R3] Mark W. Spong, Seth Hutchinson, M. Vidyasagar "Robot Modeling and Control" John Wiley 2<sup>nd</sup> Ed  
 [R4] J Srinivasan, R.V.Dukkipati, K. Ramji, "Robotics control & programming", Narosa.  
 [R5] Ghosal, Ashitava, "Robotics: Fundamental Concepts and Analysis," Oxford University Press, 2006  
 [R6] M. Murray, M., Li, Zexiang, Sastry, S.S., "A Mathematical Introduction to Robotic Manipulation," CRC Press, 1994  
 [R7] Tsai, L.W., "Robot Analysis: The Mechanics of Serial & Parallel Manipulators," Wiley 1999  
 [R8] Niku, S. B., "Introduction to Robotics: Analysis, Systems, Applications", Prentice Hall, 2001

**DATA COMMUNICATION & NETWORK****Paper Code: ETEC-420****Paper: Data Communication & Network**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objectives: The objective of the paper is to provide an introduction to the fundamental concepts on data communication and the design, deployment, and management of computer networks.*

**UNIT- I**

**Data Communications :** Components, protocols and standards, Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview ,topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media-guided and unguided, transmission impairment, Performance, wavelength and Shannon capacity. Review of Error Detection and Correction codes.

**Switching:** Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

**[T1, T2, R1, R4] [No. of Hours: 11]****UNIT- II**

**Data Link Layer:** Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point – to- Point Protocol, PPP Stack,

**Medium Access Sub layer:** Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Token ring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

**[T1, T2,R1][No. of Hours: 11]****UNIT- III**

**Network Layer:** Design issues, Routing algorithms, Congestion control algorithms, Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6.

**[T1, T2,R1][No. of Hours: 11]****UNIT- IV**

**Transport Layer:** Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

**Application Layer:** Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

**[T2, T1, R1, R4][No. of Hours: 11]****Text Books:**

- [T1] A. S. Tannenbum, D. Wetherall, “Computer Networks”, Prentice Hall, Pearson, 5<sup>th</sup> Ed  
 [T2] Behrouz A. Forouzan, “Data Communications and Networking”, Tata McGraw-Hill, 4<sup>th</sup> Ed

**Reference Books:**

- [R1] Fred Halsall, “Computer Networks”, Addison – Wesley Pub. Co. 1996.  
 [R2] Larry L, Peterson and Bruce S. Davie, “Computer Networks: A system Approach”, Elsevier, 4<sup>th</sup> Ed  
 [R3] Tomasi, “Introduction To Data Communications & Networking”, Pearson 7<sup>th</sup> impression 2011  
 [R4] William Stallings, “Data and Computer Communications”, Prentice Hall, Imprint of Pearson, 9<sup>th</sup> Ed.  
 [R5] Zheng , “Network for Computer Scientists & Engineers”, Oxford University Press  
 [R6] Data Communications and Networking: White, Cengage Learning

**ENERGY MANAGEMENT****Paper Code: ETPE-426****Paper: Energy Management**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of Energy Management that are required for an engineering student.*

**UNIT-I****Energy an Overview:**

Introduction, Primary and Secondary Energy, Commercial Energy and Non commercial Energy, Renewable and Non Renewable energy, Global Primary Energy Reserves, Energy Needs of Growing Economy, Long Term Energy Scenario – India, Energy Pricing in India, Energy Sector Reforms, Energy and Environment, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, The Energy Conservation Act, 2001 and its Features.

**[T1][T2][T3][No. of Hrs. 10]****UNIT-II**

**Basics of Energy And Its Various Forms:** Definition, Various Forms of Energy, Electrical Energy and Thermal Energy Details, Units and Conversions.

Energy Management And Application: Definition & Objectives of Energy Management, Principles of Energy Management, Energy Management Skills, Energy Management Strategy, Understanding and Energy Performance, Matching Energy Usage to Requirement, Maximizing System Efficiency, Fuel and Energy substitution.

**[T1][T2][R1][No. of Hrs. 10]****UNIT-III****Material and Energy Balance:**

Introduction to Material and Energy Balance, The Sankey Diagram and its Use, Method for Preparing Process Flow Chart, Facility as an Energy System.

Energy Action Planning: Key Elements, Force Field Analysis, Energy Policy, Organizing: Location of Energy Manager, Top Management Support, Energy Manager: Responsibilities and Duties to be Assigned Under The Energy Conservation Act, 2001, Accountability, Motivation of Employees, Requirements for Energy Action Planning, information Systems, Marketing and Communicating, Planning and Training.

**[R1][T2][T3][No. of Hrs. 10]****UNIT-IV**

**Financial Management:** Introduction, Investment Need, Appraisal and Criteria, Financial Analysis, Financial Analysis Techniques, Risk and Sensitivity Analysis Factors, Financing Options.

Energy Monitoring And Targeting :Definition, Elements of Monitoring & Targeting system, A Rationale for Monitoring, Targeting and Reporting, Data and Information Analysis, Relating Energy Consumption and Production, CUSUM, Case Study.

**[R3][No. of Hrs. 10]****Text Books:**

- [T1] Encyclopaedia of Energy – McGraw Hill Publication
- [T2] Energy Management handbook, John Weiley and Sones – Wayne C. Turner.
- [T3] Guide to Energy Management, Cape Hart, Turner and Kennedy

**References Books:**

- [R1] NPC Energy Audit Manuals
- [R2] General Aspects of Energy management & Energy Audit – BEE Publication.
- [R3] Financial Management , Tata McGraw Hill – Prasanna Chandra.

**HIGH VOLTAGE AC AND DC TECHNOLOGY****Paper Code: ETPE-428****Paper: High Voltage AC and DC Technology**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

*Objective: The objective of the paper is to facilitate the student with the basics of High voltage AC & DC Technology that are required for an engineering student.*

**UNIT-I**

Fundamental design aspects of EHV AC transmission lines and their power carrying capabilities. EHV AC Transmission lines analysis – nominal and equivalent circuits. Problems related with long lines. Reactive Power Management of Power System. Reactive power problems associated with EHV systems. Reactive power devices – their operation and control, Series compensation of EHV AC system, different equipment and scheme details.

**[T1, T2][No. of Hrs. 10]****UNIT-II**

Fundamental aspects of HVDC systems and their comparison with EHV AC Systems. Different types of HVDC of HVDC Schemes and their fundamental details. HVDC Equipment and their rating, construction and characteristics.

**[T1, T2][No. of Hrs. 11]****UNIT-III**

Power Converter circuits associated with HVDC systems, Design aspects of 12-pulse converters. Simple design problems of HVDC Systems. Power flow control in HVDC systems – different controllers and their operational characteristics.

**[T1, R1][No. of Hrs. 10]****UNIT-IV**

Harmonic Filters – HVDC current and voltage filters. Different types of filters. Simple design problems of single tuned harmonic current filters, Fundamental aspects of HVDC circuit breaking.

**[T1, T2][No. of Hrs. 10]****Text Books:**

- [T1] EHV AC & HVDC Transmission Engineering & practice – By S. Rao.
- [T2] EHV AC Transmission - By Begamudre, New Age Publications

**References Books:**

- [R1] HVDC Power Transmission Systems – By K.R. Paadiyar (New Publishers)

**RESIDUAL LIFE ASSESSMENT OF EXTENSION OF THERMAL POWER PLANT(TPP)****Paper Code: ETPE-430****Paper: Residual Life Assessment of Extension of Thermal Power Plant**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To introduce the students about the knowledge of thermal power plant (TPP) in residual life, analysis and assessment of TPP.*

**UNIT-I****Introduction to Residual Life Assessment of Thermal Power Plant**

Design life of power plant, RLA and Failure Analysis study of power plant components, Significance of RLA, Creditability of RLA, hydro test of pressure parts, Thickness measurement techniques in boiler & turbine. High temperature failures in boiler.

**[T1, T2][No. of Hrs. 12]****UNIT-II****Non Destructive Techniques used in Thermal Power Plant**

Welding technology, Radiography, Dye penetrate testing, Eddy current testing, holiday testing, Magnetic particle inspection, Ultrasonic testing, procedure followed for review of welds – film checking, permissible limits in weld defects in power plant.

**[T1, T2][No. of Hrs. 11]****UNIT-III****Various Techniques followed Of RLA in Thermal Power Plant**

Mettallography, Mechanical testing, corrosion testing, Material grain structure analysis, spectrophotometer for metal component testing, NDT techniques used for RLA in power plant.

**[T1, T2][No. of Hrs. 10]****UNIT-IV****Advantages of RLA in Thermal Power Plant**

Cost benefit analysis of RLA of thermal power plants, agencies performing RLA of Indian power plants, High temperature failure analysis and remedy in power plant, Performance testing, Energy auditing in thermal power plant.

**[T1, T2][No. of Hrs. 11]****Text Books:**

[T1] NPTI Manual on NDT.

[T2] High Temperature Component Life Assessment, G.A. Webster, R.A. Ainsworth.

[T3] CMERI websites, <http://steag.in/rla-ca> and expert guest lectures.



**CRYOGENIC ENGINEERING**

**Paper Code: ETME-424**  
**Paper: Cryogenic Engineering**

L	T/P	C
3	0	3

**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

*Objective: To introduce the students about the knowledge of principles of refrigeration and liquefaction, gas liquefaction systems and cryogenic equipment.*

**UNIT-I**

**Refrigeration And Liquefaction Principles:** Joule Thomson effect and inversion curve; Adiabatic and isenthalpic expansion with their comparison. Properties of cryogenic fluids; Properties of solids at cryogenic temperatures, Superconductivity. Adiabatic Expansion - Liquefaction Systems for Air, Neon, Hydrogen and Helium - Effect of component efficiencies on System Performance.

**[T1, T2, R1, R2][No. of Hrs.11]****UNIT-II**

**Gas Liquefaction Systems:** Recuperative – Linde – Hampson, Claude, Cascade, Heylandt, Kapitza, Collins, Simon; Regenerative – Stirling cycle and refrigerator, Slovaý refrigerator, Gifford-McMahon refrigerator, Vuilleumier refrigerator, Pulse Tube refrigerator; Liquefaction of natural gas.

**Cryogenic insulation:** Vacuum insulation, Evacuated porous insulation, Gas filled Powders and fibrous materials, Solid foams, Multilayer insulation, Liquid and vapour Shields, Composite insulations.

**[T1, T2, R2][No. of Hrs.12]****UNIT-III**

**Storage Of Cryogenic Liquids:** Design considerations of storage vessel; Dewar vessels; Industrial storage vessels; Storage of cryogenic fluids in space; Transfer systems and Lines for cryogenic liquids; Cryogenic valves in transfer lines; Two phase flow in Transfer system; Cool-down of storage and transfer systems.

**Cryogenic instrumentation:** Measurement of strain, pressure, flow, liquid level and Temperature in cryogenic environment; Cryostats.

**[T1, T2, R1, R2][No. of Hrs.11]****UNIT-IV**

**Cryogenic equipment:** Cryogenic heat exchangers – recuperative and regenerative; Variables affecting heat exchanger and system performance; Cryogenic compressors, Pumps, expanders; Turbo alternators; Effect of component inefficiencies; System Optimization. Magneto-caloric refrigerator; 3He-4He Dilution refrigerator; Cryopumping Cryogenic Engineering applications in energy, aeronautics, space, industry, biology, preservation Application of Cryogenic Engineering in Transport.

**[T1, T2, R1, R2][No. of Hrs.11]****Text Books:**

- [T1] Randall Baron, Cryogenic System, Mc Graw Hill  
 [T2] K.D. Timmerhaus & T.M. Flynn, Cryogenic Process Engineering, Plenum Press

**Reference Books:**

- [R1] Russel B Scott, Cryogenic Engineering, Van Nostrand  
 [R2] R W Yance and WM Duke, Applied Cryogenic Engineering, John Willey.

**TOTAL QUALITY MANAGEMENT**

**Paper Code: ETME – 426**  
**Paper: Total Quality Management**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>3</b>

**INSTRUCTIONS TO PAPER SETTERS:**

**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

**UNIT – I (T1, T2)**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

**UNIT –II (T1, T2)**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

**UNIT – III (T1, T2)**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

**UNIT – IV (T1, T2)**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

**Text Books:**

- [T1] Janakiraman, B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.
- [T2] Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education Asia

**Reference:**

- [R1] James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
- [R2] Oakland, J.S., “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition,
- [R3] Suganthi, L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006

**ENVIRONMENTAL AND ENERGY AUDIT LAB****Paper Code: ETPE-452****Paper: Environmental and Energy Audit Lab**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Study of SPM on air using the analyzer
2. CO<sub>2</sub> Analyzer
3. NO<sub>2</sub> Analyzer
4. Calibration of Energy meters using a standard meter
5. Energy Auditing of appliances against the specifications
  - a. Air conditioner
  - b. pumps
  - c. motors
  - d. Transformers

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**

**MICROPROCESSORS AND MICROCONTROLLERS LAB**

<b>Paper Code: ETPE-454</b>	<b>L</b>	<b>T/P</b>	<b>C</b>
<b>Paper: Microprocessors and Microcontrollers Lab</b>	<b>0</b>	<b>2</b>	<b>1</b>

**List of Experiments:**

1. Instruction sets and Routines
2. WAP in 8085 to add two nos and store the result in new location (2000)H
3. WAP in 8085 to compare three nos and store the biggest no in another location (2001)H
4. WAP in 8085 to add two BCD digits and store the result in locations (2002)H and (2003)H
5. WAP in 8085 to add 10 numbers from the HL pointing locations from (2010)H to (2019)H and keep the sum in (201A)H
6. WAP with routines to generate 1 sec delay and update the time counter initialized to 0 Seconds. The program should display the number in the LCD screen. (use the display routine)
7. Write a program to simulate an elevator control. The building has 3 floors and 2 basements (-2). The person entering the elevator has to give his desired floor which is to be displayed. Then the elevator moves on to the corresponding floor. In between it can be stopped to the nearest floor.
8. Write a program to give output to the Peripheral Device.(DAC). Depending on the Digital o/p compare the linearity of the DAC.
9. Architecture of 8086.
10. Write the above mentioned programs 3 to 8 using 8086 programming language
11. Control the stepper motor rotation using the 8085 / 8086 instruction

**NOTE:- At least 8 Experiments out of the list must be done in the semester.**

**LAB BASED ON ELECTIVE GROUP A OR B****Paper Code: ETPE-458****Paper: Lab based on elective group A or B**

<b>L</b>	<b>T/P</b>	<b>C</b>
<b>0</b>	<b>2</b>	<b>1</b>

**NOTE:- At least 8 Experiments from the syllabus must be done in the semester.**