JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
JALPAIGURI- 735102
(An Autonomous Government College)

COURSE STRUCTURE AND SYLLABUS

FOR

BACHELOR OF TECHNOLOGY (B.TECH.)

IN

MECHANICAL ENGINEERING

(Implemented from the Academic Year 2021-22 for the new batch only)

Phone: 03561 – 255131 (Principal), Fax: 03561 – 256143
Website: www.jgec.ac.in

Jalpaiguri Government Engineering College
Affiliated to Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2021-2022)
Curriculum Structure

Course Code	Subject Code	Subject Name	Contact Hrs./ Week		Course Code	Subject Code	Subject Name	Contact Hrs./ Week	
			L-T-P-Total	Credits				L-T-P-Total	Credits
BSC	BS-PH101	Physics	3-1-0-4	4	BSC	BS-CH201	Chemistry	3-1-0-4	4
BSC	BS-M101B	Mathematics-IB	3-1-0-4	4	BSC	BS-M201B	Mathematics-IIB	3-1-0-4	4
ESC	ES-CS101	Programming for Problem Solving	3-0-0-3	3	ESC	ES-EE201	Basic Electrical Engineering	3-1-0-4	4
					HUM	HM-HU201	English	2-0-0-2	2
BSC	BS-PH191	Physics Lab	0-0-3-3	1.5					
ESC	ES-CS191	Programming for Problem Solving Lab	0-0-4-4	2	BSC	BS-CH291	Chemistry- Laboratory	0-0-3-3	1.5
ESC	ES-ME192	Workshop/Manufacturing Practice	1-0-4-5	3	ESC	ES-EE291	Basic Electrical Engineering Laboratory	0-0-2-2	1
					ESC	ES-ME291	Engineering Graphics & Design	1-0-4-5	3
					HUM	HM-HU291	Language Laboratory	0-0-2-2	1
			10-2-11-23	**17.5**				**12-3-11-26**	**20.5**
BSC	BS-M (ME)301	Mathematics III	3-1-0-4	4	PCC	PC-ME401	Applied Thermodynamics	3-1-0-4	4
BSC	BS-CH (ME)301	Biology	3-0-0-3	3	PCC	PC-ME402	Fluid Mechanics & Fluid Machines	3-1-0-4	4
ESC	ES-ECE (ME)301	Basic Electronics Engineering	3-0-0-3	3	PCC	PC-ME403	Strength of Materials	3-1-0-4	4
ESC	ES-ME301	Engineering Mechanics	3-1-0-4	4	PCC	PC-ME404	Manufacturing Processes	4-0-0-4	4
ESC	ES-ME302	Materials Engineering	3-0-0-3	3	PCC	PC-ME405	Metrology and Instrumentation	3-1-0-4	4
PCC	PC-ME301	Thermodynamics	3-1-0-4	4					
					PCC	PC-ME491	Machine Drawing II	0-0-3-3	1.5
PCC	PC-ME391	Machine Drawing I	0-0-3-3	1.5	PCC	PC-ME492	Practice of Manufacturing Processes and Systems laboratory	0-0-3-3	1.5
					MC	MC-ME481	Environmental Science	0-0-2-2	0
			18-3-3-24	**22.5**				**16-4-8-28**	**23**
PCC	PC-ME501	Heat Transfer	3-1-0-4	4	PCC	PC-ME601	Manufacturing Technology	4-0-0-4	4
PCC	PC-ME502	Solid Mechanics	3-1-0-4	4	PCC	PC-ME602	Design of Machine Elements	3-1-0-4	4
PCC	PC-ME503	Kinematics & Theory of Machines	3-1-0-4	4	PEC	PE-ME601	Elective-I	3-0-0-3	3
HUM	HM-HU501	Humanities I	3-0-0-3	3	PEC	PE-ME602	Elective-II	3-0-0-3	3
MC	MC-ME501	Essence of Indian Knowledge Tradition	2-0-0-2	0	HUM	HM-HU601	Humanities II (OR)	3-0-0-3	3
					MC	MC-ME601	Constitution of India	2-0-0-2	0
PCC	PC-ME591	Mechanical Engineering Laboratory-I (Thermal)	0-0-3-3	1.5					
PCC	PC-ME592	Practice of Manufacturing Processes	0-0-3-3	1.5	PCC	PC-ME691	Mechanical Engineering Laboratory-II (Design)	0-0-3-3	1.5
Project or (Summer internship)	PW-ME581	Project-I (30 hrs. Total)	0-0-2-2	1	Project (or Summer internship)	PW-ME681	Project-II (90 hrs. Total)	0-0-4-4	2
			14-3-8-25	**19**				**18-1-7-26**	**20.5**
PCC	PC-ME701	Advanced Manufacturing Technology	3-0-0-3	3	PEC	PE-ME801	Elective V	3-0-0-3	3
PEC	PE-ME701	Elective III	3-0-0-3	3	PEC	PE-ME802	Elective-VI	3-0-0-3	3
PEC	PE-ME702	Elective-IV	3-0-0-3	3	OEC	OE-ME801	Open Elective- II	3-0-0-3	3
OEC	OE-ME701	Open Elective- I	3-0-0-3	3	OEC	OE-ME802	Open Elective- III	3-0-0-3	3
HUM	HM-HU701	Economics for Engineers	2-0-0-2	2				12-0-0-12	12
			14-0-0-14		Project	PW-ME881	Project-IV	0-0-10-10	5
PCC	PC-ME791	Mechanical Engineering Laboratory-III (Manufacturing)	0-0-3-3	1.5	PCC	PW-ME882	Comprehensive Viva- Voce	0-0-0-0	1.5
Project	PW-ME781	Project-III	0-0-6-6	3					
			14-0-9-23	**18.5**				**12-0-10-22**	**18.5**

Curriculum Structure

First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**L**	**T**	**P**	**Credits**
Theory							
1	Basic Science course	BS-PH101	Physics	3	1	0	4
2	Basic Science course	BS-M101B	Mathematics –IB	3	1	0	4
3	Engineering Science Courses	ES-CS101	Programming for Problem Solving	3	0	0	3
	Total Theory			**9**	**2**	**0**	**11**
Practical							
1	Basic Science course	BS-PH191	Physics-I Laboratory	0	0	3	1.5
2	Engineering Science Courses	ES-CS191	Programming for Problem Solving Lab	0	0	4	2
3	Engineering Science Courses	ES-ME192	Workshop/Manufacturing Practices	1	0	4	3
	Total Practical			**1**	**0**	**11**	**6.5**
			Total of First Semester	**10**	**2**	**11**	**17.5**
First Year Second Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science course	BS-CH201	Chemistry	3	1	0	4
2	Basic Science course	BS-M201B	Mathematics –IIB	3	1	0	4
3	Engineering Science Courses	ES-EE201	Basic Electrical Engineering	3	1	0	4
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			**11**	**3**	**0**	**14**
Practical							
1	Basic Science course	BS-CH291	Chemistry Laboratory	0	0	3	1.5
2	Engineering Science Courses	ES-EE291	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME291	Engineering Graphics & Design	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			**1**	**0**	**11**	**6.5**
			Total of Second Semester	**12**	**3**	**11**	**20.5**

Second Year Third Semester							
Sl. No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science course	BS-M (ME)301	Mathematics III	3	1	0	4
2	Basic Science course	BS-CH (ME)301	Biology	3	0	0	3
3	Engineering Science Courses	ES-ECE (ME)301	Basic Electronics Engineering	3	0	0	3
4	Engineering Science Courses	ES-ME301	Engineering Mechanics	3	1	0	4
5	Engineering Science Courses	ES-ME302	Materials Engineering	3	0	0	3
6	Professional Core courses	PC-ME301	Thermodynamics	3	1	0	4
	Total Theory			**18**	**3**	**0**	**21**
Practical							
1	Professional Core courses	PC-ME391	Machine Drawing I Practice of Manufacturing Processes	0	0	3	1.5
	Total Practical			**0**	**0**	**3**	**1.5**
			Total of Third Semester	**18**	**3**	**3**	**22.5**
Second Year Fourth Semester							
Sl. No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Core courses	PC-ME401	Applied Thermodynamics	3	1	0	4
2	Professional Core courses	PC-ME402	Fluid Mechanics & Fluid Machines	3	1	0	4
3	Professional Core courses	PC-ME403	Strength of Materials	3	1	0	4
4	Professional Core courses	PC-ME404	Manufacturing Processes	4	0	0	4
5	Professional Core courses	PC-ME405	Metrology and Instrumentation	3	1	0	4
	Total Theory			**16**	**4**	**0**	**20**
Practical							
1	Professional Core courses	PC-ME491	Practice of Manufacturing Processes and Systems Laboratory	0	0	3	1.5
2	Professional Core courses	PC-ME492	Machine Drawing I	0	0	3	1.5
3	Mandatory courses	MC-ME481	Environmental Science	0	0	2	0
	Total Practical			**0**	**0**	**8**	**3**
			Total of Fourth Semester	**16**	**4**	**8**	**23**

Third Year Fifth Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Core courses	PC-ME501	Heat Transfer	3	1	0	4
2	Professional Core courses	PC-ME502	Solid Mechanics	3	1	0	4
3	Professional Core courses	PC-ME503	Kinematics & Theory of Machines	3	1	0	4
4	Humanities and Social Sciences including Management courses	HM-HU501	Humanities	3	0	0	3
5	Mandatory courses	MC-ME501	Essence of Indian Knowledge Tradition	2	0	0	0
	Total Theory			**14**	**3**	**0**	**15**
Practical/ Sessional							
1	Professional Core courses	PC-ME591	Mechanical Engineering Laboratory I (Thermal)	0	0	3	1.5
2	Professional Core courses	PC-ME592	Practice of Manufacturing Processes	0	0	3	1.5
3	Project (or Summer internship)	PW-ME581	Project-I (30 hrs. Total)	0	0	2	1
	Total Practical			**0**	**0**	**8**	**4**
	Total of Fifth Semester			**14**	**3**	**8**	**19**

Third Year Sixth Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Core courses	PC-ME601	Manufacturing Technology	4	0	0	4
2	Professional Core courses	PC-ME602	Design of Machine Elements	3	1	0	4
3	Professional Elective courses	PE-ME601	Elective-I	3	0	0	3
4	Professional Elective courses	PE-ME602	Elective-II	3	0	0	3
5	Humanities and Social Sciences including Management courses	HM-HU601	Humanities II (OR)	3	0	0	3
6	Mandatory courses	MC-ME601	Constitution of India	2	0	0	0
	Total Theory			**18**	**1**	**0**	**17**
Practical/ Sessional							
1	Professional Core courses	PC-ME691	Mechanical Engineering Laboratory II (Design)	0	0	3	1.5
2	Project (or Summer internship)	PW-ME681	Project-II (90 hrs. Total)	0	0	4	2
	Total Practical			**0**	**0**	**7**	**3.5**
	Total of Sixth Semester			**18**	**1**	**7**	**20.5**

Two papers for (Professional Elective Courses- Elective I and II, that is, PE-ME601 and PE-ME602) are to be chosen among the List of Professional Elective Papers.

Fourth Year Seventh Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Core courses	PC-ME701	Advanced Manufacturing Technology	3	0	0	3
2	Professional Elective courses	PE-ME701	Elective III	3	0	0	3
3	Professional Elective courses	PE-ME702	Elective-IV	3	0	0	3
4	OpenElective courses	OE-ME701	Open Elective- I	3	0	0	3
5	Humanities and Social Sciences including Management Courses	HM-HU701	Economics for Engineers	2	0	0	2
	Total Theory			**14**	**0**	**0**	**14**
Practical/ Sessional							
1	Professional Core courses	PC-ME691	Mechanical Engineering Laboratory III (Manufacturing)	0	0	3	1.5
2	Project	PW-ME781	Project-III	0	0	6	3
	Total Practical			**0**	**0**	**9**	**4.5**
	Total of Seventh Semester			**14**	**0**	**9**	**18.5**

Fourth Year Eighth Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Elective courses	PE-ME801	Elective V	3	0	0	3
2	Professional Elective courses	PE-ME802	Elective VI	3	0	0	3
3	OpenElective courses	OE-ME801	Open Elective-II	3	0	0	3
4	OpenElective courses	OE-ME802	Open Elective- III	3	0	0	3
	Total Theory			**12**	**0**	**0**	**12**
Practical/ Sessional							
1	Project	PW-ME881	Project-IV	0	0	10	5
2	Professional Core courses	PW-ME882	Comprehensive viva-Voce	0	0	0	1.5
	Total Practical			**0**	**0**	**10**	**6.5**
	Total of Eighth Semester			**12**	**0**	**10**	**18.5**
	Total			114	16	67	**160**

Two papers for (Professional Elective Courses- Elective III and IV, that is, PE-ME701 and PE-ME702) for the Seventh Semester and two papers for (Professional Elective Courses- Elective V and VI, that is, PE-ME801 and PE-ME802) for the Eighth semester are to be chosen among the List of Professional Elective Papers that were not completed in the earlier semesters.

Similarly, one paper for (Open Elective Course- Open Elective I, that is, OE-ME701) for the Seventh Semester and two papers for (Open Elective Courses- Open Elective II and III, that is, OE- ME801 and OE-ME802) are to be chosen among the List of Open Elective Papers that were not completed in the earlier semesters.

Professional Electives

B.Tech (Mechanical Engineering) Course

There are six Professional Elective Course Papers in Semester VI, VII and VIII as follows: (Elective-I) PE-ME601, (Elective-II) PE-ME602, (Elective-III) PE-ME701, (Elective-IV) PE-ME702, (Elective-V) PE-ME801 and (Elective VI) PE-ME802.

Students are to choose one paper for each of the Professional Elective Courses specified in the curriculum structure of a Semester from the following list of Professional Elective Papers. Selection of a paper should be non-repetitive. If a student chooses the paper, **Internal Combustion Engines and Gas Turbines (Code: A1)** as a **Professional Elective I in Semester VI**, its paper code will be **PE-ME601A1**. Similarly, in case **Mechanical Vibration (Code: B3)** is chosen by one in **Semester VII as Professional Elective-IV**, its paper Code will be **PE-ME702B3**.

Subject Code	Subject name
Thermo-Fluid Group	
A1	Internal Combustion Engines and Gas Turbines
A2	Automobile Engineering
A3	Gas Dynamics and Jet Propulsion
A4	Refrigeration and Air Conditioning
A5	Turbo Machinery
A6	Fluid Power Control
A7	Advanced Fluid Mechanics
A8	Analysis and Performance of Fluid Machines
A9	Computational Fluid Dynamics
A10	Power Plant Engineering
A11	Cryogenics
A12	Introduction to Wind Engineering
A13	Elements of Atmospheric Fluid Dynamics
Design Group	
B1	Composite Materials
B2	Selection and Testing of Materials
B3	Mechanical Vibration
B4	Tribology
B5	Finite Element Analysis
B6	Mechatronics
Manufacturing Group	
C1	Advanced Welding Technology
C2	Quantity Production Methods
C3	3D Printing and Design
C4	Micro and Nano Manufacturing
C5	CAD/CAM
C6	Robotics
C7	Material Handling
C8	Principles and Practices of Management
C9	Process Planning and Cost Estimation
C10	Maintenance Engineering

Open Electives

B.Tech (Mechanical Engineering) Course

There are three Open Elective Course Papers in Semester VII and VIII as follows: (Open Elective-I) OE-ME701, (Open Elective-II) OE-ME801, and (Open Elective-III) OE-ME802.

Students are to choose one paper for each of the Open Elective Courses specified in the curriculum structure of a Semester from the following list of Open Elective Papers. Selection of a paper should be non-repetitive. If a student chooses the paper, **Industrial Engineering (Code: A)** as an **Open Elective-I in Semester VII**, its paper code will be **OE-ME701A**. Similarly, in case **Safety and Occupational Health (Code: F)** is chosen by one in **Semester VIII as Open Elective-III**, its paper Code will be **OE- ME802F**.

Subject Code	Subject Name
A	Industrial Engineering
B	Total Quality Management
C	Project Management
D	Entrepreneurship Development
E	Introduction to Product Design and Development
F	Safety and Occupational Health
G	Industrial Pollution and Control
H	Energy Conservation and Management
I	Renewable Energy Resources
J	Waste to Energy- An Overview
K	Biomechanics and Biomaterials
L	Computational Methods in Engineering
M	Automation & Control
N	Internet of Things (IoT)
O	Artificial Intelligence (AI)
P	Block Chain
Q	Cyber Security
R	Quantum Computing
S	Data Sciences
T	Machine Learning
U	Virtual Reality (VR)
V	Water Resource Engineering

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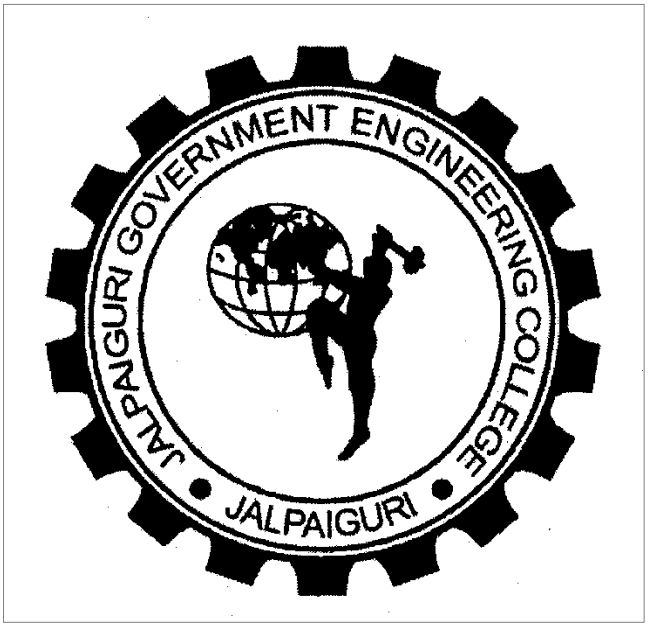
COURSE STRUCTURE AND SYLLABUS
FOR
FIRST YEAR (FIRST SEMESTER AND SECOND SEMESTER) B.TECH.

IN
CIVIL ENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
COMPUTER SCIENCE & ENGINEERING
ELCTRRONICS & COMMUNICATION ENGINEERING
INFORMATION TECHNOLOGY
(Implemented from the Academic Year 2021-22 for the new batch only)



www.jgec.ac.in

Phone: 03561 – 255131 (Principal), Fax: 03561 – 256143

CC: Course Code, SC: Subject Code. Cr.: Credit, L-T-P-TO: Lecture-Tutorial-Practical-Total

First Semester:				
Mandatory Induction Program- 3 weeks duration. It is to be done before initiation of classes (theoretical, laboratory & sessional) as per syllabus following guidelines of AICTE and MAKAUT				
CC	SC	Subject Name	Contact Hrs./Week	
			L–T-P-TO	Cr.
Theory				
BSC	BS-PH101 BS-CH101	Physics for CE/EE/ME Chemistry for CSE/ECE/IT	3-1-0-4 3-1-0-4	4 4
BSC	BS-M101A BS-M101B	Mathematics-IA for CSE/IT Mathematics-IB for CE/EE/ME/ECE	3-1-0-4 3-1-0-4	4 4
ESC	ES-CS101 ES-EE101	Programming for Problem Solving for CE/EE/ME Basic Electrical Engineering for CSE/ECE/IT	3-0-0-3 3-1-0-4	3 4
Practical				
BSC	BS-PH191 BS-CH191	Physics Laboratory for CE/EE/ME Chemistry Laboratory for CSE/ECE/IT	0-0-3-3 0-0-3-3	1.5 1.5
ESC	ES-CS191 ES-EE191	Programming for Problem Solving Laboratory for CE/EE/ME Basic Electrical Engineering Laboratory for CSE/ECE/IT	0-0-4-4 0-0-2-2	2 1
ESC	ES-ME192 ES-ME191	Workshop/Manufacturing Practice for CE/EE/ME Engineering Graphics & Design for CSE/ECE/IT	1-0-4-5 1-0-4-5	3 3
Total : CE/EE/ME CSE/ECE/IT			10-2-11-23 10-3-09-22	17.5 17.5

Second Semester:				
CC	SC	Subject Name	Contact Hrs./Week	
			L –T-P-TO	Cr.
Theory				
BSC	BS-CH201 BS-PH201	Chemistry for CE/EE/ME Physics for CSE/ECE/IT	3-1-0-4 3-1-0-4	4 4
BSC	BS-M201A BS-M201B	Mathematics-IIA for CSE/IT Mathematics-IIB for CE/EE/ME/ECE	3-1-0-4 3-1-0-4	4 4
ESC	ES-EE201 ES-CS201	Basic Electrical Engineering for CE/EE/ME Programming for Problem Solving for CSE/ECE/IT	3-1-0-4 3-0-0-3	4 3
HUM	HM-HU201	English for CE/EE/ME/CSE/ECE/IT	2-0-0-2	2
Practical				
BSC	BS-CH201 BS-PH291	Chemistry-I Laboratory for CE/EE/ME Physics-I Laboratory for CSE/ECE/IT	0-0-3-3 0-0-3-3	1.5 1.5
ESC	ES-EE291 ES-CS291	Basic Electrical Engineering Laboratory for CE/EE/ME Programming for Problem Solving Laboratory for CSE/ECE/IT	0-0-2-2 0-0-4-4	1 2
ESC	ES-ME291 ES-ME292	Engineering Graphics & Design for CE/EE/ME Workshop/Manufacturing Practice for CSE/ECE/IT	1-0-4-5 1-0-4-5	3 3
HUM	HM-HU291	Language Laboratory for CE/EE/ME/CSE/ECE/IT	0-0-2-2	1
Total : CE/EE/ME CSE/ECE/IT			12-3-11-26 12-2-13-30	20.5 20.5

First Year (First Semester & Second Semester)

BS-PH101/ BS-PH201 :Physics: 3-1-0 -4: 4

Course Objectives:

1. The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses.
2. Students will be able to demonstrate competency and understanding of the concepts found in Mechanics, Harmonic Oscillations, Waves in one dimension, wave Optics, Lasers, Fiber Optics and a broad base of knowledge in physics.
3. The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits.
4. Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his career.

1. Mechanics (7L):

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D.Angular velocity vector. Moment of inertia.

2. Optics (5L):

Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulae only), characteristics of diffraction grating and its applications. Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.

Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L):

permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation(expression only), applications of dielectrics.

Magnetisation , permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

4. Quantum Mechanics (16 L):

Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics: (8L)

Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Diracand Bose-Einstein statistics.

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola ,Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited

17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics ,Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemanntics.

Course Outcomes:

1. The knowledge of Physics relevant to engineering is critical for converting ideas into technology.
2. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.
3. In the present course, the students can gain knowledge on the mechanism of physical bodies upon the action of forces on them, the generation, transmission and the detection of the waves, Optical Phenomena like Interference, diffraction, the principles of lasers and Fibre Optics.
4. Various chapters establish a strong foundation on the different kinds of characters of several materials and pave a way for them to use in at various technical and engineering applications.

BS-PH191 / BS-PH291 Physics Laboratory.: 0-0-3-3:1.5

Course Objectives:

The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipments. Design of circuits using new technology and latest components and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

Experiments in Optics:

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton"s ring
3. Determination of wavelength of a monochromatic light by Fresnel"s bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson"s method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a PV solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster"s bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics.

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a PV solar cell.

Miscellaneous experiments.

1. Determination of Young"s modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle"s capillary flow method

Course Outcomes: On Completion of this course, students are able to –

- Develop skills to impart practical knowledge in real time solution.
- Understand principle, concept, working and application of new technology and comparison of results with theoretical

calculations.
• Design new instruments with practical knowledge.
• Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
• Understand measurement technology, usage of new instruments and real time applications in engineering studies.

BS-CH101 / BS-CH201 :Chemistry: 3-1-0 -4: 4

i) Atomic and molecular structure (10 lectures):

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures):

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii)* Intermolecular *forces and potential energy surfaces (4 lectures):

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures):

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures):

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries:

vi)* Stereochemistry *(4 lectures):

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

vii)* Organic *reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization andring openings. Synthesis of a commonly used drug molecule.

Learning Resources:

1. University chemistry, by B. H. Mahan.
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
5. Physical Chemistry, by P. W. Atkins.
6. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers.
7. Physical Chemistry, P. C. Rakshit, Sarat Book House.
8. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition. http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular

levels. The course will enable the student to:

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5. List major chemical reactions that are used in the synthesis of molecules.

BS-CH191 / BS-CH291: Chemistry Laboratory:0-0-3-3:1.5

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscos meters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

Laboratory Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate rate constants of reactions from concentration of reactants/products as a function of time
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
3. Synthesize a small drug molecule and analyse a salt sample

BS-M101A: Mathematics-IA: 3-1-0-4:4 for CSE/IT

1. ***Calculus (Integration):*** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.8
2. ***Calculus (Differentiation):*** Rolle"s Theorem, Mean value theorems, Taylor"s and Maclaurin"s theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.6
3. ***Matrices:*** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer"s Rule, inverse of a matrix, Gauss elimination and Gauss-Jordanelimination.7
4. ***Vector Spaces:*** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity,Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.9
5. ***Vector Spaces (Continued):*** Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.10

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. Michael Greenberg, Advanced Engineering Mathematics, Pearson.

3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. Kanti B. Dutta, Mathematical Methods of Science and Engineering, CenageLearning.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi.
6. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
7. Hoffman and Kunze: Linear algebra, PHI.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle"s Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

BS-M101B: Mathematics-IB: 3-1-0-4:4 for CE/EE/ME/ECE

1. ***Calculus (Integration):*** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.8
2. ***Calculus (Differentiation):*** Rolle"s Theorem, Mean value theorems, Taylor"s and Maclaurin"s theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.6
3. ***Sequence and Series:*** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval"s theorem.11
4. ***Multivariate Calculus:*** Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.9
5. ***Matrices:*** Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. The fallouts of Rolle"s Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensive manner.

BS-M201A: Mathematics-IIA:3-1-0-4:4 for CSE/IT

1. **Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. 11
2. **Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities. 4
3. **Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule. 5
4. **Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. 8
5. **Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. 8
6. **Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. 4

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. S. Ross, A First Course in Probability, Pearson Education India

3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
4. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
6. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Course Outcomes:

1. The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

   The students will learn:
2. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
3. The fallouts of Rolle"s Theorem that is fundamental to application of analysis to Engineering problems.
4. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
5. To deal with functions of several variables that are essential in most branches of engineering.
6. The essential tool of matrices and linear algebra in a comprehensive manner.
7. The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
8. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
9. The mathematical tools needed in evaluating multiple integrals and their usage.
10. The effective mathematical tools for the solutions of differential equations that model physical processes.
11. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems
12. The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
13. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.
14. The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

BS-M201B:Mathematics-IIB: 3-1-0-4:4 for CE/EE/ME/ECE

1. ***Multivariate Calculus (Integration):*** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. 11
2. ***First order ordinary differential equations:*** Exact, linear and Bernoulli"s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut"s type. 5
3. ***Ordinary differential equations of higher orders:*** Second order linear differential equations with constant coefficients, Use of D operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. 9
4. ***Complex Variable – Differentiation:*** Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties. 6
5. ***Complex Variable – Integration:*** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville"s theorem and Maximum-Modulus theorem(without proof); Taylor"s series, Zeros of analytic functions, Singularities, Laurent"s series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. 9

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.2. Michael Greenberg, Advanced Engineering Mathematics, Pearson.

3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

Course Outcomes:

1. The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

   The students will learn:
2. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
3. The fallouts of Rolle"s Theorem that is fundamental to application of analysis to Engineering problems.
4. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
5. To deal with functions of several variables that are essential in most branches of engineering.
6. The essential tool of matrices and linear algebra in a comprehensive manner.
7. The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
8. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
9. The mathematical tools needed in evaluating multiple integrals and their usage.
10. The effective mathematical tools for the solutions of differential equations that model physical processes.
11. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems
12. The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
13. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.
14. The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

ES-EE101 / ES-EE201: Basic Electrical Engineering: 3-1-0-4:4

Module 1: DC Circuits (8 hours): Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time- domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours): Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours): Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours): Generation of rotating magnetic fields, Construction and working of a three- phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours): DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours): Components of LT Switchgear: Switch Fuse Unit (SFU),

MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Learning Recourses:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes:

1. To understand and analyze basic electric and magnetic circuits
2. To study the working principles of electrical machines and power converters.
3. To introduce the components of low voltage electrical installations

ES-EE191 / ES-EE291: Basic Electrical Engineering Lab.:0-0-2-2:1

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do"s and Don"ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation. 2. Introduction and uses of following instruments : (a) Voltmeter
(b) Ammeter (c) Multimeter (d) Oscilloscope
Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.
3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

Laboratory Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of power electronic converters.

ES-CS101/ES-CS201: Programming for Problem Solving: 3-0-0-3:3

Unit 1: Introduction to components of a computer system (disks, memory, processor, where a program is

stored and executed, operating system, compilers etc.) - (1 lecture).
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. (1 lecture)
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures)
Unit 2: Arithmetic expressions and precedence (2 lectures) Conditional Branching and Loops (6 lectures)
Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures)

Unit 3: Arrays (6 lectures):
Arrays (1-D, 2-D), Character arrays and Strings

Unit 4: Basic Algorithms (6 lectures):
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5: Function (5 lectures):
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6: Recursion (4 -5 lectures)
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7: Structure (4 lectures)
Structures, Defining structures and Array of Structures

Unit 8: Pointers (2 lectures)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
Unit 9: File handling (only if time is available, otherwise should be done as part of the lab)
Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
Suggested Reference Books
(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India

Course Outcomes:

The student will learn:

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

ES-CS191 / ES-CS291: Programming for Problem Solving Laboratory: 0-0-4-4:2

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures Tutorial 4: Loops, while and for

loops:
Lab 4: Iterative problems e.g., sum of
series Tutorial 5: 1D Arrays: searching,
sorting:
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and
Strings
Lab 6: Matrix problems, String
operations Tutorial 7: Functions, call
by value:
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive
calls Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory
allocation Lab 11: Pointers and structures
Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes:

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self referential structures.
8. To be able to create, read and write to and from simple text files.

ES-ME191 / ES-ME291:Engineering Graphics & Design:1-0-4-5:3

1. **INTRODUCTION TO ENGINEERING DRAWING:** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes. 1T+4P
2. **LETTERING, DIMENSIONING, SCALES:** Plain scale, Diagonal scale and Vernier Scales. 1T+4P
3. **GEOMETRICAL CONSTRUCTION AND CURVES:** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Arch-median Spiral. 1T+ 4P
4. **PROJECTION OF POINTS, LINES, SURFACES:** Principles of Orthographic Projections- conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes- Auxiliary Planes. 1T+ 4P
5. **PROJECTION OF REGULAR SOLIDS:** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone). 1T+4P
6. **COMBINATION OF REGULAR SOLIDS, FLOOR PLANS:** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. 1T+4P
7. **ISOMETRIC PROJECTIONS:** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; 1T+4P
8. **SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULARSOLIDS:** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only) 1T+4P
9. **OVERVIEW OF COMPUTER GRAPHICS**, C**USTOMISATION&CAD DRAWING:** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase

objects.; Isometric Views of lines, Planes, Simple and compound Solids];Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

1T+4P

10. **ANNOTATIONS, LAYERING & OTHER FUNCTIONS:** applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling; 2T+8P
11. **DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT:** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

General Instructions:

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment. Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)
7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
3. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. Corresponding set of CAD Software Theory and User Manuals

Course Outcomes:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

1. to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability to prepare you to communicate effectively
2. to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

ES-ME192 / ES-ME292: 1-0-4-5:3 Workshop/ Manufacturing Practices:

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

Course Outcomes:

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

(ii) Workshop Practice:

Machine shop (8 hours) *Typical jobs that may be made in this practice module:*

- To make a pin from a mild steel rod in a lathe.
- To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)*Typical jobs that may be made in this practice module:*

- To make a Gauge from MS plate.

Carpentry (8 hours)*Typical jobs that may be made in this practice module:*

- To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))*Typical jobs that may be made in this practice module:*

- ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.
- GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)*Typical jobs that may be made in this practice module:*

- One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy (4 hours): *Typical jobs that may be made in this practice module:*

- A simple job of making a square rod from a round bar or like

Plastic moulding& Glass cutting (4 hours) *Typical jobs that may be made in this practice module:*

- For plastic moulding, making at least one simple plastic component should be made.
- For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point. Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and

electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008. 4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998. 5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest

HM-HU201: English : 2-0-0-2:2

1. Vocabulary Building
   The concept of Word Formation
   Root words from foreign languages and their use in English
   Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
   Synonyms, antonyms, and standard abbreviations.
2. Basic Writing Skills
   Sentence Structures
   Use of phrases and clauses in sentences
   Importance of proper punctuation
   Creating coherence
   Organizing principles of paragraphs in documents
   Techniques for writing precisely
3. Identifying Common Errors in Writing
   Subject-verb agreement
   Noun-pronoun agreement
   Misplaced modifiers
   Articles
   Prepositions
   Redundancies
   Clichés
4. Nature and Style of sensible Writing
   Describing
   Defining
   Classifying
   Providing examples or evidence
   Writing introduction and conclusion
5. Writing Practices
   Comprehension
   Précis Writing
   Essay Writing
6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

   Listening Comprehension
   Pronunciation, Intonation, Stress and Rhythm
   Common Everyday Situations: Conversations and Dialogues
   Communication at Workplace
   Interviews
   Formal Presentations

Suggested Readings:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007
(iii)*On Writing Well.*William Zinsser. Harper Resource Book. 2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly.Cambridge University Press. 2006.
(v) *Communication Skills*. Sanjay Kumar and PushpLata.Oxford University Press. 2011.
(vi) *Exercises in Spoken English.* Parts.I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes: At the end of the semester the student will be able to

- Understand doing self introspection and self vigilance
- Achieve high quality of life, strength and sovereignty of a developed nation
- Understand the importance of writing skills and its techniques
- Envision the dangers of scientific and technological innovations
- Improve the exposure to universal happenings
- Communicate the necessity to exercise humour in the daily life

HM-HU291:Language Laboratory. 0-0-2-2:1

1) Honing „Listening Skill" and its sub skills through Language Lab Audio device; 3P
2) Honing „Speaking Skill" and its sub skills 2P
3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech 2P
4) Honing „Conversation Skill" using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &Role Play Mode) 2P
5) Introducing „Group Discussion" through audio –Visual input and acquainting them with key strategies for success 2P
6) G D Practice Sessions for helping them internalize basic Principles(turn- taking, creative intervention, by using correct body language, courtesies &other soft skills) of GD 4P
7) Honing „Reading Skills" and its sub skills using Visual / Graphics/Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension; 2P
8) Honing „Writing Skill" and its sub skills by using Language Lab Audio –Visual input; Practice Sessions 2P

Course Outcomes:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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MAN: Induction Program: No Credit: 3 weeks entry program

A Guide:

1 Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.1 This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.). Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed. There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students. The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine. To come out of this situation, a multi- pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them 1A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

2 Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

**Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gandhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counseling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsory course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments

got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonizing or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counseling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member. Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, now into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting sta_ in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4- year stay and possibly beyond. The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week o_ campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department
means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

3 Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

3.1 Initial Phase

Time Activity Day 0

Whole day Students arrive - Hostel allotment. (Preferably do pre-allotment) Day 1
09:00 am - 03:00 pm Academic registration 04:30 pm - 06:00 pm Orientation
Day 2
09:00 am - 10:00 am Diagnostic test (for English etc.) 10:15 am - 12:25 pm Visit to respective depts.
12:30 pm - 01:55 pm Lunch
02:00 pm - 02:55 pm Director's address 03:00 pm - 05:00 pm Interaction with parents.

03:30 pm - 05:00 pm Mentor-mentee groups - Introduction within group. (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable. Session. Time Activity Remarks

Day 3 onwards
06:00 am Wake up call
I 06:30 am - 07:10 am Physical activity (mild exercise/yoga), 07:15 am - 08:55 am Bath, Breakfast, etc.
II 09:00 am - 10:55 am Creative Arts / Universal Human Values, Half the groups do Creative Arts
III 11:00 am - 12:55 pm Universal Human Values / Creative Arts, Complementary alternate 01:00 pm - 02:25 pm Lunch
IV 02:30 pm - 03:55 pm Afternoon Session See below.
V 04:00 pm - 05:00 pm Afternoon Session See below. 05:00 pm - 05:25 pm Break / light tea
VI 05:30 pm - 06:45 pm Games / Special Lectures 06:50 pm - 08:25 pm Rest and Dinner
VII08:30 pm - 09:25 pm Informal interactions (in hostels)

Sundays are off. Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)
The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs): Activity Session Remarks

Familiarization with Dept/Branch & Innovations IV For 3 days (Day 3 to 5)
Visits to Local Area IV, V and VI
For 3 days - interspersed (e.g., 3 Saturdays) Lectures by Eminent People
IV As scheduled - 3-5 lectures Literary (Play / Book Reading / Lecture) IV For 3-5 days
Proficiency Modules V Daily, but only for those who need it

3.3 Closing Phase Time Activity Last But One Day

08:30 am - 12 noon Discussions and finalization of presentation within each group
02:00 am - 05:00 pm Presentation by each group in front of 4 other groups besides their own (about 100 students) Last Day
Whole day Examinations (if any).May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student
guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.) Such a group
should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline. Here we list some important suggestions which have come up and which have been experimented with.

3.4.1 Follow Up after Closure { Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up { Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters. It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution. The graduating student must have values as a human being, and knowledge and meta skills related to his/her profession as an engineer and as a citizen. Most students, who get demotivated to study engineering or their branch, also lose interest in learning. The Induction Program is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character. The Universal Human Values component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept. nature, and character to follow through. It also makes them react on their relationship with their families and extended family in the college (with hostel sta_ and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies, Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors), March 2016, IIT Directors' Secretariat, IIT Delhi.

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Model Curriculum for
First Year
Undergraduate Degree Courses in Engineering & Technology

Chapter -1
General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:-

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical(Lab)/week	1 credit

B. Range of credits –

A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program:-

S. No.	Category	Suggested Breakup of Credits(Total 160)
1	Humanities and Social Sciences including Management courses	12*
2	Basic Science courses	25*
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24*
4	Professional core courses	48*
5	Professional Elective courses relevant to chosen specialization/branch	18*
6	Open subjects – Electives from other technical and /or emerging subjects	18*
7	Project work, seminar and internship in industry or elsewhere	15*
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160*

**Minor variation is allowed as per need of the respective disciplines.*

Mentoring: Related Articles

P R E F A C E

Guidance & Counselling is part & parcel of educational excellence. Maulana Abul Kalam Azad University of Technology, West Bengal having 194 affiliated Institutes/Colleges offering UG/PG Programmes in Engineering / Technology / Architecture / Pharmacy / Management / Computer Application / Hotel Management & Catering Technology / Applied Sciences / Professional Courses is the nodal University in the state of West Bengal having largest number of affiliated Colleges / Institutes on its roll.

The University has taken the initiative to start the **Mentoring Process** to the students under its umbrella as a policy of the present State Government to achieve excellence by the students studying in West Bengal.

Maulana Abul Kalam Azad University of Technology, West Bengal requests all stakeholders and the Head of the affiliated Institutes to start **Mentorship** with immediate effect as a model compulsorily from July 2018.

We solicit kind co-operation of all Trust / Society / Institutes under its affiliations.

Modification / Suggestions are most welcome to make this **Mentoring Exercise at par with the world's best educational Institutes.**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
(Formerly WEST BENGAL UNIVERSITY OF TECHNOLOGY)
BF – 142, Sector – I, Salt Lake City, Kolkata – 700064

STUDENT MENTORSHIP

1. Name of the Student :

   Mobile No.: Email Id :

2. Programme of Study :

   Academic Year of Admission :

   Department :

   University Registration No. :

3. Father's Name :

   Father's Home Address :

   Father's Mobile No.: Landline No.:

   Occupation :

   Annual Income :

4. Mother's Name :

   Mobile No.: Email Id :

   Occupation :

5. Medical History

   Weight : Blood Group : Veg/Non-Veg :

   Identification Marks :

Allergic to :

Major Health Problem :

Chronic Health Problem :

Health Condition of Father / Mother / Brother / Sister :

6. Hostel Information :

Details of Paying Guest/Mess/Rented-House :

Issues for Academic Excellence

1. Attendance in Class :-

a) Theory Class :-

b) Practical / Field Work / Project :-

c) Habitual late / Regular / Irregular

d) Habitual late with Regular

e) Early departure from the University

2. Behavioural Pattern :-

a) Attentive / Inattentive in Class

b) Normal everywhere

c) Normal in Institute but in attentive in Class

d) Very Cordial with everybody

e) Cordial with Teachers only

f) Very helpful with Classmate/Friends only

g) Very Competitive with Classmate & proud but polite

h) Very Selfish

i) Very Simple & Kind Hearted

j) Needs special attention because ..... (type of deficiency)

3. Programme of Studies :-

a) Fit and appropriate attitude for the course.

b) Unfit & lack of attitude

c) Weak in Mathematical ability

d) Weak in Memorisation of Study

e) Excellent in understanding & Communication ability

f) Strong perception in ..... (subject)

g) Technical skill is excellent in Laboratory / Project work

h) Unable to understand class in English

i) Writing Skill is good / poor

4. Special Interest :-

a) Computer and Internet : Excellent / Good / Moderate / Poor

b) Manufacturing / Model Making : Excellent / Good / Moderate / Poor

c) Memory : Excellent / Good / Moderate / Poor

d) Team Building : Excellent / Good / Moderate / Poor

e) Imagination ability : Excellent / Good / Moderate / Poor

f) Writing Skill : Excellent / Good / Moderate / Poor

g) Speaking / Communication ability : Excellent / Good / Moderate / Poor

h) Poster-making / Preparation of synopsis : Excellent / Good / Moderate / Poor

i) Extra curricular activities : Excellent / Good / Moderate / Poor

Name of the Mentor :
Signature :
Date :

Maulana Abul Kalam Azad University of Technology, West Bengal

(formerly West Bengal University of Technology)
NH-12, Haringhata, Nadia-741249

August 17, 2018

The Director/Principal
All Colleges/Institutes affiliated to MAKAUT,WB

Sub: Information regarding student mentoring activities

Dear Sir/Madam,

The undersigned has been directed by the Competent Authority to request you to implement the under graduate student mentoring activities as per the following guidelines:-

1. The mentors of first year students should be from the second year
2. The mentors of second year students should be from the third year
3. The mentors of third year students should be from the fourth year

4. All students should be mentored by the faculties.

- Serial number 1 to 3 should be on one-to-one basis and
- Serial number 4 should be twenty-to-one basis
- The student mentors should be from the same or similar streams
- The mentors should maintain records of such activities

You are requested to send the mentor-mentee list for students of all years to registrar.makaut@gmail.com within 30th September, 2018 positively.

sd/-
Registrar(Acting)

MOOCS for Honours: Related Articles

Annexure-I

MOOCs for B. Tech Honours

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours
(Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology