# B. E. MECHANICAL ENGINEERING

# CURRICULUM AND SYLLABI
## (2015 AND ONWARDS)

# (REGULAR PROGRAMME)

## Department of Mechanical Engineering
## FACULTY OF ENGINEERING

Enable | Enlighten | Enrich
KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956 )


## KARPAGAM ACADEMY OF HIGHER EDUCATION

*(Deemed to be University Established Under Section 3 of UGC Act 1956)*

Eachanari Post, Coimbatore 641 021, India

# B. E. MECHANICAL ENGINEERING (REGULAR)

## COURSE OF STUDY AND SCHEME OF EXAMINATIONS

## (2015 and onwards)

### SEMESTER I

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | |
| 15BECC101 | Communicative English –I | 1 | 1,2,3 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECC102 | Engineering Mathematics – I | 1 | 1,2,8,9 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BECC103 | Engineering Physics | 1, 3 | 1,2,3,5,8,9 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECC104 | Engineering Chemistry | 1, 2 | 1,2,3,8,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME105 | Basic Electrical and Electronics Engineering | 1, 3 | 1,2,3,8,9,11 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| 15BECC111 | Engineering Physics and Chemistry Laboratory | 1 | 1,2,5, 10 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME112 | Engineering Practice Laboratory | 1, 2 | 1,2,3,5 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME113 | Engineering Graphics - I | 1, 2 | 1,2,3,5,9 | 1 | 0 | 4 | 3 | 40 | 60 | 100 |
| **TOTAL** | | | | **16** | **2** | **10** | **23** | **320** | **480** | **800** |
| **VALUE ADDED COURSE** | | | | | | | | | | |
| 15BECC151 | Human Values | - | - | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

### SEMESTER II

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | |
| 15BECC201 | Communicative English –II | 2 | 4,5, 10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECC202 | Engineering Mathematics – II | 1 | 1,2,8,9 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BECC203 | Material Science | 1, 3 | 1,2,3,5,8,9 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECC204 | Environmental Studies | 1 | 1,2,3,4,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME205 | Basic Civil Engineering | 1, 3 | 1,2,3,8,9,11 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME206 | Computer Fundamentals and C Programming | 1 | 1,2,5, 10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| 15BEME211 | Computer Practices and Programming Laboratory | 1 | 1,2,9 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME212 | Engineering Graphics - II | 1, 2 | 1,2,3,5,9 | 1 | 0 | 4 | 3 | 40 | 60 | 100 |
| **TOTAL** | | | | **19** | **2** | **7** | **24** | **320** | **480** | **800** |
| **VALUE ADDED COURSE** | | | | | | | | | | |
| 15BECC251 | Elementary Biology | - | - | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

### SEMESTER III

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | | |
| 15BEME301 | Methods of Applied Mathematics | 1 | 1,3,5,6,7,8 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BEME302 | Engineering Mechanics | 1 | 1,2,3,4,10,11 | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 15BEME303 | Manufacturing Technology – I | 1 | 1,2,3,4,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME304 | Fluid Mechanics and Machinery | 1 | 1,2,3,4,10 | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 15BEME305 | Electrical Drives and Controls | 1,2 | 1,2,3,4,6,9,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **PRACTICAL** | | | | | | | | | | |
| 15BEME311 | Fluid Mechanics and Machinery Laboratory | 1 | 1,2,3,4,5,6,9 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME312 | Machine Drawing | 1 | 1,2,3,4,10 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME313 | Electrical Drives and Control Laboratory | 1,2 | 1,2,3,4,6,9,12 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| **TOTAL** | | | | **15** | **4** | **9** | **24** | **320** | **480** | **800** |
| **VALUE ADDED COURSE** | | | | | | | | | | |
| 15BEME351 | Aptitude Training | | | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

## SEMESTER IV

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | | | | |
| 15BEME401 | Strength of Materials | 1 | 1,2,3,4,10 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BEME402 | Manufacturing Technology – II | 1 | 1,2,3,6,8,9 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME403 | Engineering Thermodynamics | 1 | 1,2,3,4,10 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BEME404 | Industrial Metallurgy | 1 | 1,2,3,4,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME405 | Kinematics of Machinery | 1 | 1,2,3,4,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME406 | Engineering Metrology and Measurements | 1 | 1,2,3,6,8,9 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **PRACTICAL** | | | | | | | | | |
| 15BEME411 | Strength of Materials and Metallurgy Laboratory | 1 | 1,2,3,5,9,10 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME412 | Manufacturing Technology Laboratory | 1 | 1,2,3,6,8,9,12,14 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| **TOTAL** | | | | **18** | **4** | **6** | **24** | **320** | **480** | **800** |
| | **VALUE ADDED COURSE** | | | | | | | | | |
| 15BEME451 | Personality Development | - | -- | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

## SEMESTER V

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | | | | |
| 15BEME501 | Heat Power Engineering | 1 | 1,2,3,4,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME502 | Design of Machine Elements | 1 | 1,2,3,4,9 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BEME503 | Automobile Engineering | 1 | 1,2,3,4,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME504 | Dynamics of Machinery | 1 | 1,2,3,4,10 | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 15BEME5E– – | Departmental Elective I | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **PRACTICAL** | | | | | | | | | |
| 15BEME511 | Scientific Computing Laboratory | 1 | 1,3,5,6,7,8,10 | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| 15BEME512 | Dynamics and Metrology Laboratory | 1 | 1,2,3,4,6,9,12 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME513 | Thermal Engineering Laboratory– I | 1 | 1,2,3,4,7,11 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| **TOTAL** | | | | **17** | **3** | **8** | **24** | **320** | **480** | **800** |
| | **VALUE ADDED COURSE** | | | | | | | | | |
| 15BEME551 | In–plant training | - | -- | - | - | - | 1 | 100 | 0 | 100 |
| 15BEME552 | Geometrical Dimensioning and Tolerance | - | -- | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

## SEMESTER VI

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | | | | |
| 15BEME601 | Operations Research | 1 | 1,3,5,6,7,8 | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 15BEME602 | Design of Transmission System | 1 | 1,2,3,4,8,9,10 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME603 | Heat and Mass Transfer | 1 | 1,2,3,4,5 | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 15BEME604 | Engineering Economics and Financial Management | 1 | 1,2,3,5,7 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E– – | Department Elective II | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E– – | Department Elective III | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **PRACTICAL** | | | | | | | | | |
| 15BEME611 | Computer Aided Modeling and Simulation Laboratory | 1 | 1,2,3,4,5,8,9 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| 15BEME612 | Thermal Engineering Laboratory II | 1 | 1,2,3,4,7,11 | 0 | 0 | 3 | 2 | 40 | 60 | 100 |
| **TOTAL** | | | | **18** | **2** | **6** | **24** | **320** | **480** | **800** |
| | **VALUE ADDED COURSE** | | | | | | | | | |
| 15BEME651 | Mini Project | - | -- | 0 | 0 | 2 | 1 | 100 | 0 | 100 |
| 15BEME652 | Technical Presentation | - | -- | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

## SEMESTER VII

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | | | | |
| 15BEME701 | Professional Ethics, Principles of Management and Entrepreneurship Development | 1 | 1,2,3,4,5, 10,11 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME702 | Finite Element Methods | 1 | 1,2,3,4,5 | 3 | 2 | 0 | 4 | 40 | 60 | 100 |
| 15BEME703 | Mechatronic Systems | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E– – | Department Elective IV | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E– – | Department Elective V | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15– – – –OE– – | Open Elective | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **PRACTICAL** | | | | | | | | | |
| 15BEME711 | CAE / CAM Laboratory | 1 | 1,2,3,4,8,9 | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| 15BEME712 | Mechatronics Laboratory | 1 | 1,2,3,4,5,7 | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| **TOTAL** | | | | **18** | **2** | **8** | **23** | **320** | **480** | **800** |
| | **VALUE ADDED COURSE** | | | | | | | | | |
| 15BEME751 | Robotics and Automation (or) Pumps and Motors | - | -- | 1 | 1 | 0 | 1 | 100 | 0 | 100 |
| **TOTAL CONTACT HOURS / WEEK** | | | | **30** | | | | | | |

## SEMESTER VIII

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | | | | |
| 15BEME801 | Total Quality Management | 1 | 1,2,3,4,5,8,9 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E– – | Department Elective VI | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E– – | Department Elective VII | -- | -- | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **PROJECT** | | | | | | | | | |
| 15BEME891 | Project Work and Viva Voce | -- | -- | 0 | 0 | 24 | 12 | 120 | 180 | 300 |
| **TOTAL** | | | | **9** | **0** | **20** | **21** | **240** | **360** | **600** |
| **TOTAL CONTACT HOURS / WEEK** | | | | **33** | | | | | | |

## LIST OF ELECTIVES

### DEPARTMENT ELECTIVES

#### SEMESTER V

#### Elective I

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 15BEME5E01 | Computer Aided Design | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME5E02 | Computer Integrated Manufacturing | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME5E03 | Advanced Manufacturing Processes | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME5E04 | Hydraulics and Pneumatics Power Control | 1 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

#### SEMESTERVI

#### Elective II &III

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 15BEME6E01 | Power Plant Engineering | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E02 | Design of Jigs, Fixtures and Press Tools | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E03 | Computational Fluid Dynamics | 1,3 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E04 | Failure Analysis and Design | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E05 | Renewable Energy Sources | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E06 | Precision Engineering | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E07 | Entrepreneurship Development | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME6E08 | Industrial Engineering | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## SEMESTERVII

### Elective IV &V

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 15BEME7E01 | Design for Manufacture and Assembly | 1,3 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E02 | Gas Dynamics and Jet Propulsion | 1,2 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E03 | Industrial Robotics | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E04 | Design and Analysis of Experiments | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E05 | Advanced I.C. Engines | 1,3 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E06 | Additive Manufacturing | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E07 | Manufacture and Inspection of Gears | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME7E08 | Refrigeration and Air Conditioning | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## SEMESTERVIII

### Elective VI &VII

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 15BEME8E01 | Machine Tool Design | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E02 | Computer Aided Drafting And Cost Estimation | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E03 | Quality Control and Reliability Engineering | 1 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E04 | Composite Materials | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E05 | Production Planning and Control | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E06 | Cogeneration and Waste Heat Recovery Systems | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E07 | Energy Conservation Methods and Energy Audit | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEME8E08 | Non Destructive Testing | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## OPEN ELECTIVES

### COURSES OFFERED BY OTHER DEPARTMENTS

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| | **SCIENCE AND HUMANITIES** | | | | | | | | | |
| 15BESHOE01 | Industrial Mathematics I | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE02 | Industrial Mathematics II | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE03 | Probability and Random Process | 1,3 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE04 | Probability and Statistical Methods | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE05 | Probability and Queuing Theory | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE06 | Fuzzy Mathematics | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE07 | Mathematical Physics | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE08 | Advanced Engineering Mathematics | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE09 | Linear Algebra | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE10 | Transforms and Partial Differential Equations | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE11 | Technical Writing | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE12 | Geophysics | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE13 | Engineering Acoustics | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE14 | Alternate Fuels and Energy Systems | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE15 | Solid Waste Management | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE16 | Green Chemistry | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE17 | Applied Electrochemistry | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BESHOE18 | Industrial Chemistry | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **COMPUTER SCIENCE AND ENGINEERING** | | | | | | | | | |
| 15BECSOE01 | Python Programming | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECSOE02 | Internet Programming | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECSOE03 | Multimedia and Animation | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECSOE04 | PC Hardware and Trouble shooting | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECSOE05 | Game Programming | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **ELECTRICAL AND ELECTRONICS ENGINEERING** | | | | | | | | | |
| 15BEEEOE01 | Electric Hybrid Vehicles | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEEEOE02 | Energy Management & Energy Auditing | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEEEOE03 | Sensors & Transducers | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEEEOE04 | Programmable Logic Controller | 1 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEEEOE05 | Renewable Energy Resources | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEEEOE06 | Advanced Control Systems | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

| ELECTRONICS AND COMMUNICATION ENGINEERING | | PEO | PO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15BEECOE01 | Real Time Embedded Systems | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE02 | Consumer Electronics | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE03 | Fundamentals of Nanotechnology | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE04 | Image &Video Processing | 1 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE05 | VLSI Technology | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE06 | Fundamentals of MEMS | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE07 | Neural Networks and its Applications | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEECOE08 | Fuzzy Logic and its Applications | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **BIOTECHNOLOGY** | | | | | | | | | |
| 15BEBTOE01 | Bioreactor Design | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEBTOE02 | Food Processing and Preservation | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEBTOE03 | Molecular Modeling | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEBTOE04 | Bioremediation | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEBTOE05 | Biophysics | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEBTOE06 | Basic Bioinformatics | 1 | 1,2,3,7,9,12 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEBTOE07 | Fundamentals of Nano Biotechnology | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **AUTOMOBILE ENGINEERING** | | | | | | | | | |
| 15BEAEOE01 | Automobile Engineering | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEAEOE02 | Basics of Two and Three Wheelers | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEAEOE03 | Automobile Maintenance | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEAEOE04 | Introduction to Modern Vehicle Technology | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | **CIVIL ENGINEERING** | | | | | | | | | |
| 15BECEOE01 | Housing, Plan and Management | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE02 | Building Services | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE03 | Coastal Zone Management | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE04 | Experimental Method and Model Analysis | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE05 | Management of Irrigation Systems | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE06 | Computer Aided Design of Structures | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE07 | Pavement Engineering | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE08 | Rock Engineering | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE09 | Storage Structures | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE10 | Wind Engineering | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BECEOE11 | Advanced Construction Technology | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

**COURSES OFFERED TO OTHER DEPARTMENTS**

| SUB. CODE | TITLE OF THE COURSE | PEO | PO | L | T | P | C | CIA | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 15BEMEOE01 | Introduction to MEMS | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEMEOE02 | Robotics | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEMEOE03 | Industrial Safety and Environment | 1 | 1,2,3,7,9,13 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEMEOE04 | Transport Phenomena | 1 | 1,2,3,7,9,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 15BEMEOE05 | Introduction to Biomechanics | 1 | 1,2,3,7,13,15 | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Total number of credits: 187

**L:LectureHour** **T:TutorialHour** **CIA: Continuous Internal**

**Assessment P:PracticalHour** **C: No.ofCredits** **ESE: End SemesterExaminations**

Note:

1. The passing minimum for value added course is 50 marks out of 100 marks. There will be two tests, of which one will be class test covering 50% of syllabus for 50 marks and other for 50 marks.
2. Credits for value added courses are not counted for computation ofCGPA.
3. Interested students can opt one self study course in eighth semester from open electives which will be reflected in the mark sheet only if he / shepasses.

**Programme Educational Objectives (PEO's)**

**1:** Graduates will more conscious about their profession with social awareness and responsibility.

**2:** Graduates will be engineering experts, who would help solve industry's technological problems.

**3:** Graduates will be engineering professionals, consultants or entrepreneurs engaged in technology development.

**4:** Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country.

**Programme Outcomes (PO's)**

**1:** Ability to apply knowledge of mathematics and science in solving engineering problems.

**2:** In-depth knowledge on the fundamental principles, construction and auxiliary systems of mechanical sciences.

**3:** To understand the principles involved in evaluating the structural, functional and safety requirements of mechanical systems.

**4:** Hands on knowledge to develop analytical skills for designing and analyzing various mechanical components and processes.

**5:** To understand and apply appropriate techniques and IT tools for the design and analysis of mechanical systems.

**6:** Understanding the mechanism of pollutant formation and its control techniques.

**7:** Understanding of human and ethical responsibilities towards the profession and society.

**8:** Ability to understand the economics and cost analysis in order to take economically sound decisions.

**9:** Ability to apply modem techniques and tools necessary for engineering practice with appropriate considerations for public health, safety, cultural and environmental limitations.

**10:** Understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development.

**11:** Function effectively as an individual, and as a member or a leader in diverse teams, and in multi-disciplinary situations.

**12:** To recognize the need for, and have the ability to engage in independent and lifelong learning.

**Programme Specific Outcomes (PSO's)**

**13:** Ability to design a mechanical system, component, or process to meet desired needs of the nation, industries, institutions within realistic constraints such as economic, environmental, social, political, ethical, health care, and safety, manufacturability, and sustainability.

**14:** Ability to develop and use of software tools and Information Technology for mechanical engineering domain.

**15:** Ability to perform effectively first level managerial responsibilities for large or medium engineering organizations.

| **Programme Educational Objectives** | **Programme Objectives** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | |
| 2 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | | ✓ | |
| 3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | |
| 4 | | | | | | | | ✓ | | | ✓ | | | | ✓ |

## SEMESTER I

**15BECC101 COMMUNICATIVEENGLISH–I 3 0 0 3100**

### COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professionalcommunication.
2. To make the students to meet the growing demand in the field of Globalcommunication.
3. To help students acquire their ability to speak effectively in real lifesituations.
4. To inculcate the habit of reading and to develop their effective readingskills.
5. To ensure that students use dictionary to improve their active and passivevocabulary.
6. To enable students to improve their lexical, grammatical and communicativecompetence.

### COURSE OUTCOMES

Students undergoing this course will be able to

1. Use English language for communication: verbal & non –verbal.
2. Enrich comprehension and acquisition of speaking & writingability.
3. Ensure students proficiency in professionalcommunication.
4. Developed their active and passivevocabulary.
5. Gain confidence in using English language in real lifesituations.
6. Improve word power: lexical, grammatical and communication competence.

**UNITI** **9**

**Listening** – Types of listening - Listening to class reading - Video tapes/ audio tapes. **Speaking** – Introduction on self - Introduction on one's friend. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative. **Writing** – Free writing on any topic –My favorite place, hobbies, dreams, goals, etc- Writing short messages - To fill in different application forms. **Grammar** – Articles- WH questions – Yes/No Question - Subject Verb agreement. **Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

**UNITII** **10**

**Listening** – Understanding the passage in English –Pronunciation Practice. **Speaking** – Asking and answering questions - Telephone etiquette. **Reading** – Critical Reading – Finding key information in a given text (Skimming - scanning). **Writing** – Coherence and cohesion in writing – Short paragraph writing – Letters to the Editor. **Grammar** – Parts of Speech – Noun – Verb – Adjectives - Adverbs. **Vocabulary** – Compound Nouns/Adjectives – Irregular verbs.

**UNITIII** **10**

**Listening** – Listening for specific task – Fill in the gaps. **Speaking** – Phonemes – Syllables – Role play – Conversation Practice. **Reading** – Reading and Comprehension. **Writing** - Autobiographical writing – Biographical writing - Instruction Writing. **Grammar** – Preposition – Infinitive – Gerund – Tenses. **Vocabulary** – Foreign words used in English – British and American usage.

**UNITIV** **8**

**Listening** – Responding to questions – Reading in class for complete understanding and for better pronunciation. **Speaking** – Debate, Presentations in seminars. **Reading** – Making inference from the reading passage – Predicting the content of reading passages. **Writing** - Interpreting visual materials (tables, graphs, charts, etc) – Formal and Informal letters. **Grammar** – Sentence Pattern – Voice (active and passive voice). **Vocabulary** – One word substitution.

**UNITV** **8**

**Listening** -Listening to different accents, speeches/presentations. **Speaking**- Extemporetalk –Just-a-minute talk. **Reading**-Reading strategies–Intensive reading – Text analysis. **Writing** - Creative writing – Writing circulars andnotices –Writingproposal.**Grammar**–DirectandIndirectspeech–Conditionalsentences-Auxiliaryverbs.**Vocabulary**– Abbreviations & Acronyms.

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

**TOTAL 45 PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Sangeeta Sharma, MeenakshiRaman | Technical Communication: Principles And Practice 2nd Edition | OUP | 2015 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Lakshminarayanan, K.R. & Murugavel, T. | Communication Skills for Engineers | SCITECH Publications, Chennai | 2009 |
| 2 | Rizvi Ashraf, M | Effective Technical Communication | Tata McGraw-Hill, New Delhi. | 2007 |
| 3 | Rutherford Andrea, J. | Basic Communication Skills for Technology | Pearson Education, New Delhi. | 2006 |

**WEB REFERENCES**

1. www.learnerstv.com – Listening/ Speaking/Presentation
2. www.usingenglish.com – Writing/Grammar
3. www.englishclub.com – Vocabulary Enrichment/Speaking

**15BECC102 ENGINEERING MATHEMATICS – I 3 2 0 4 100**

## COURSE OBJECTIVES

The objective of this course is

1. To familiarize the prospective engineers with techniques in calculus, and multivariate analysis.
2. To familiarize the prospective engineers with techniques in linear algebra.
3. To equip the students with standard concepts and tools at an intermediate to advanced level.
4. To equip the students will serve them to wards tackling more advanced level of mathematics.
5. To make the students will serve them to find the useful applications in their disciplines.
6. To make the students to solve the real time problems using standard concepts and tools.

## COURSE OUTCOMES

The students will learn:

1. To apply differential and integral calculus to notions of curvature and to improperintegrals.
2. Apart from some other applications they will have a basic understanding of Beta and Gammafunctions.
3. The tool of power series and Fourier series for learning advanced EngineeringMathematics.
4. To deal with functions of several variables that are essential in most branches ofengineering.
5. The essential tool of matrices and linear algebra in a comprehensivemanner.
6. Students can solve real time problems using standard concepts and tools.

**UNITI MATRICES 12**

Review of Matrix Algebra - Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonalreduction.

**UNITII DIFFERENTIALCALCULUS 12**

Overview of Derivatives - Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes- Evolutes as Envelope of normals – Maxima and Minima of functions of two or more Variables – Method of Lagrangian Multipliers

**UNITIII SEQUENCES ANDSERIES 13**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparision test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional eonvergence.

**UNITIV HYPERBOLIC FUNCTIONS, BETA ANDGAMMAFUNCTIONS 12**

Hyperbolic functions: Hyperbolic functions and Inverse Hyperbolic functions – Identities – Real and imaginary parts – solving problems using hyperbolicfunctions.

Beta And Gamma Functions : Definitions – Properties – Relation between beta and gamma integrals – Evaluation of definite integrals in terms of beta and gamma functions.

**UNITV DIFFERENTIALEQUATIONS 11**

Linear Differentialequations of second and higher order with constant coefficients - Euler's form of Differential equations – Method of variation parameters.

**TOTAL 60PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hemamalini. P.T | Engineering Mathematics | McGraw Hill Education (India) Private Limited, New Delhi | 2014 |
| 2 | Sundaram, V and Balasubramanian,R. | Engineering Mathematics for first year. | Vikas Publishing Home , New Delhi | 2006 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Grewel . B. S. | Higher Engineering Mathematics | Khanna Publications, New Delhi. | 2014 |
| 2 | Bhaskar Rao. P. B, Bhujanga Rao. M | Engineering Mathematics I | BS Publications, India. | 2010 |
| 3 | Ramana. B.V | Higher Engineering Mathematics | Tata McGraw Hill Publishing Company, New Delhi. | 2007 |
| 4 | Shahnaz Bathul | Text book of Engineering Mathematics | PHI Publications, New Delhi. | 2009 |
| 5 | Michael D. Greenberg | Advanced Engineering Mathematics | Pearson Education, India | 2009 |

**WEB REFERENCES**

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants

**15BECC103 ENGINEERING PHYSICS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To introduce the basic physics concepts relevant to different branches of Engineering and Technology.
2. To acquire the knowledge of Electromagnetic field theory.
3. To make the student to learn scientific, mathematical and engineeringprinciples.
4. To make the students to understand the basics of vacuum science.
5. To make the students to understand the process of production and measurement.
6. To make the students to understand the working of Gauges like Pirani, McLeod and Penning

**COURSE OUTCOMES**

1. Formulate potential problems within electrostatics, magneto statics.
2. Formulate stationary current distributions in linear, isotropic media.
3. Acquire knowledge on properties of matter, quantum physics.
4. Understand the basics of vacuum science.
5. Understand the process of production and measurement.
6. Understand the working of Gauges like Pirani, McLeod and Penning.

**UNITI PROPERTIES OF MATTERANDTHERMODYNAMICS 9**

Three types of modulus of elasticity – basic definitions, relation connecting the modulii (Derivation), poison ratio- Torsional pendulum- bending of beams- bending moment – basic assumption of moment – uniform and non uniform bending

Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

**UNITII LASER ANDFIBEROPTICS 9**

Introduction – emission and absorption process- Einstein's coefficients derivation. Types of LASER -CO2, Semiconductor LASER Applications of LASER in industry and Medicine.

Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle –derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (Block diagram)

**UNITIII QUANTUM PHYSICS 9**

Introduction to quantum theory – Compton effect- dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – physical significance of wave function, Schrödinger's wave equation – time dependent and time independent equations – particle in one dimensional box. Scanning electron microscope.

**UNITIV CRYSTALPHYSICS 9**

Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures- crystal defects – point, line and surfacedefects

**UNITV NUCLEARPHYSICS 9**

Introduction – basics about nuclear fission and fusion, nuclear composition – stable nuclei- liquid drop model, Radiation detectors – scintillation counter, semi conductor detector, cloud chamber. Reactors – essentials of nuclear reactor- power reactor, pressurized water reactor, Fast breeder reactor.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ganesan.S and Baskar.T | Engineering Physics I | GEMS Publisher, Coimbatore-641 001 | 2015 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Serway and Jewett | Physics for Scientists and Engineers with Modern Physics | Thomson Brooks/Cole, Indian reprint, New Delhi | 2010 |
| 2 | Gaur, R.K. and Gupta. S.C | Engineering Physics | Dhanpat Rai Publications,New Delhi. | 2011 |

**WEB REFERENCES**

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www.oyc.yale.edu
4. www.physics.org

**15BECC104 ENGINEERING CHEMISTRY 3 0 0 3100**

## COURSEOBJECTIVES

1. To understand the terminologies of atomic and molecularstructure
2. To study the basics of Periodic properties, Intermolecularforces
3. To study about spectroscopictechnique
4. To understand the working of electromagnetic spectrum and spectroscopictechniques
5. To understand the thermodynamicfunctions
6. To comprehend the basic organic chemistry and to synthesis simpledrug.

## COURSEOUTCOMES

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states andelectronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopictechniques.
5. Rationalise bulk properties and processes using thermodynamicconsiderations.
6. List major chemical reactions that are used in the synthesis ofmolecules.

**UNITI WATERTECHNOLOGY 9**

Characteristics – Alkalinity – Types of alkalinity and determination – Hardness – Types and estimation by EDTA method (problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination and Reverseosmosis.

**UNITII ELECTROCHEMISTRY ANDSTORAGEDEVICES 9**

Electrochemicalcells–Reversibleandirreversiblecells–EMF–Measurementofemf–Single electrodepotential – Nernst equation – Reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox - $Fe^{2+}$vs dichromate) –Batteries- Primary batteries-Leclanche cell- Secondary batteries- Lead acid battery.

**UNIT III FUELS ANDROCKETPROPELLANTS 9**

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method - Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking - Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, An introduction to Fuel Cell, H2-O2 Fuel Cell -Rocket engines-Types of rocket engines, Basic principles, Mass fraction.

**UNITIV CORROSIONSCIENCE 9**

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings - Paints - Constituents and functions –- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating and Hot dipping.

**UNITV SURFACECHEMISTRY 9**

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm-Industrial adsorbent materials- Role of adsorbents in catalysis and water softening-Emulsion-Types-water/oil, oil/water- Applications of adsorption.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dr.S.Vairam | Engineering chemistry | Gems publishers | 2014 |
| 2 | Ravikrishnan, A | Engineering Chemistry I & II | Sri Krishna Hi tech Publishing Company Private Ltd., Chennai. | 2012 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Raman Sivakumar | Engineering Chemistry I &II | McGraw-Hill Publishing Co.Ltd., 3rd Reprint NewDelhi. | 2013 |
| 2 | Kuriakose. J.C. and Rajaram | Chemistry in Engineering and Technology. Vol. I & II 5th edition. | Tata McGraw Hill Publishing Company, New Delhi. | 2010 |


**WEB REFERENCES**


1. http://www.studynotes.ie/leaving-cert/chemistry/
2. http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html
3. http://www.learnerstv.com/Free-chemistry-Video-lectures-ltv044-Page1.htm

**15BEME105 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** **3 0 0 3100**

**COURSE OBJECTIVES**

1. To impart the basic knowledge about the Electriccircuits.
2. To understand the working of Electrical Machines andTransformers.
3. To understand the working of Power Converters and components of low-voltage electricalinstallations.
4. To understand and analyze basic electric and magnetic circuits.
5. To study the working principles of electrical machines and power converters.
6. To introduce the components of low-voltage electrical installations.

**COURSE OUTCOMES**

1. Gain the basic knowledge about the Electriccircuits.
2. Understand the working of Electrical Machines andTransformers.
3. Understand the working of Power Converters and components of low-voltage electricalinstallations
4. Understand and analyze basic electric and magneticcircuits.
5. Acquire knowledge on the working principles of electrical machines and powerconverters.
6. Understand the components of low-voltage electricalinstallations.

**UNITI ELECTRIC CIRCUITS&MEASUREMENTS 9**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits WaveformsandRMSValue–PowerandPowerfactor–SinglePhaseandThreePhasebalancedCircuits.

**UNITII ELECTRICALMACHINES 9**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

**UNITIII MEASURINGINSTRUMENTS 9**

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

**UNITIV SEMICONDUCTOR DEVICESANDAPPLICATIONS 9**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics

**UNITV DIGITALELECTRONICS 9**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts).

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Mittle, V.M | Basic Electrical Engineering | Tata McGraw Hill Edition, New Delhi | 2004 |
| 2 | SedhaR.S | Applied Electronics | S. Chand & Co | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Muthusubramanian R, and Muraleedharan K A | Basic Electrical, Electronics and Computer Engineering | Tata McGraw Hill, Second Edition | 2006 |
| 2 | Nagsarkar T K and Sukhija M S | Basics of Electrical Engineering | Oxford press | 2005 |
| 3 | Mahmood Nahvi and Joseph A. Edminister | Electric Circuits | Schaum' Outline Series, McGraw Hill | 2002 |
| 4 | Premkumar N | Basic Electrical Engineering | Anuradha Publishers | 2003 |

**15BECC111 ENGINEERING PHYSICS AND CHEMISTRY LABORATORY** **0 0 3 2100**

**COURSE OBJECTIVES**

1. To learn the basic concepts in physics relevant to different branches of Engineering andTechnology.
2. To study the concept of semiconductor andconductivity.
3. To learn the properties ofmaterials.
4. To understand the working of electromagnetic spectrum and spectroscopictechniques.
5. To understand the thermodynamicfunctions.
6. To comprehend the basic organic chemistry and to synthesis simpledrug.

**COURSE OUTCOMES**

1. Understand the basic concepts in physics relevant to different branches of Engineering andTechnology.
2. Understand the concept of semiconductor andconductivity.
3. Acquire knowledge on the properties ofmaterials.
4. Understand the concept of various spectroscopictechniques.
5. Rationalize bulk properties and processes using thermodynamicconsiderations.
6. List major chemical reactions that are used in the synthesis ofmolecules.

**LIST OF EXPERIMENTS**

**PHYSICS**

1. Determination of velocity of sound and compressibility of liquid – Ultrasonicinterferometer.
2. Determination of wavelength of mercury spectrum – spectrometergrating.
3. Determination of Young's modulus of the material – Non uniform bending or Uniformbending.
4. Determination of Viscosity of liquid – Poiseuille'smethod.
5. Spectrometer Dispersive power of aprism.
6. Torsional pendulum – Determination of Rigiditymodulus.
7. Particle size determination using DiodeLaser
8. Determination of Laser parameters – Wavelength, and angle ofdivergence.
9. Determination of acceptance angle in an opticalfiber.
10. Determination of thickness of a thin wire – Air wedgemethod
11. Determination of Band Gap of a semiconductormaterial.
12. Determination of Specific resistance of a given coil of wire – Carey FosterBridge

**CHEMISTRY**

1. Estimation of alkalinity of Watersample
2. Estimation of hardness of Water byEDTA
3. Estimation of Chloride in Water sample (Argentometricmethod)
4. Determination of corrosion rate by weight lossmethod.
5. Determination of molecular weight and degree of polymerization usingviscometry.
6. Conductometric Titration (Simple acidbase).
7. Conductometric Titration (Mixture of weak and strongacids).
8. Conduct metric Titration using $BaCl_2$ vs $Na_2SO_4$.
9. pH Titration (acid &base).
10. Potentiometric Titration ($Fe^{2+}$ / $KMnO_4$ or$K_2Cr_2O_7$).
11. Determination of water of crystallization of a crystalline salt (Coppersulphate).
12. Estimation of Ferric ion byspectrophotometry.
13. Determination of Chemical OxygenDemand.

**TOTAL 45PERIODS**

**15BEME112 ENGINEERING PRACTICE LABORATORY 0 0 3 2100**

**COURSE OBJECTIVES**

1. To prepare the students to design a system, component, or process.
2. To meet desired needs within realistic constraints such as economic, environmental, social, and ethical.
3. To make the component with health and safety, manufacturability, andsustainability
4. To prepare the students to communicate effectively and to use the techniques, and skills.
5. To make the students to use modern engineering tools necessary for engineeringpractice.
6. To make the students to assemble different components.

**COURSE OUTCOMES**

1. The students will gain knowledge of the different manufacturing processes.
2. To fabricate components using differentmaterials.
3. Students will be able to fabricate components with their ownhands.
4. They will also get practical knowledge of the dimensional accuracies and dimensionaltolerances
5. By assembling different components with different processes.
6. They will be able to produce small devices of theirinterest.

**PART – A (CIVIL & MECHANICAL)**

**1. WELDING** **6**

i. Preparation of arc welding of butt joints, lap joints and teejoints.

**2. BASICMACHINING** **6**

i. Simple Turning and Taperturning
ii. Drilling andTapping

**3. SHEETMETALWORK** **6**

i. Model making – Trays, funnels,etc.

**4. DEMONSTRATIONON** **4**

i. Smithyoperations
ii. Foundryoperations
iii. PlumbingWorks
iv. CarpentaryWorks

**PART –B (ELECTRICAL & ELECTRONICS)**

**5. ELECTRICALENGINEERING** **10**

i. Study of electrical symbols and electricalequipments.
ii. Construct the wiring diagram for Stair case wiring and Fluorescent lampwiring.
iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energymeter.
iv. Measurement of electrical quantities – voltage, current, power & power factor in Rload.
v. Measurement of energy using single phase energymeter.

**6. ELECTRONICSENGINEERING** **13**

i. Study of Electronic components– Resistor (color coding), capacitors andinductors.
ii. Soldering practice – Components Devices and Circuits – Using general purposePCB.
iii. Study of logic gates AND, OR, NOT, NOR andNAND.
iv. Study of HWR andFWR.

TOTAL 45PERIODS

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Jeyachandran, K. and Balasubramanian, S | A Premier on Engineering Practices Laboratory | Anuradha Publications, Kumbakonam | 2007 |
| 2 | Jeyapoovan, T., Saravanapandian, M | Engineering Practices Lab Manual | Vikas Puplishing House Pvt. Ltd, Chennai | 2006 |
| 3 | Bawa, H.S | Workshop Practice | Tata McGraw – Hill Publishing Company Limited, New Delhi | 2007 |

**15BEME113 ENGINEERING GRAPHICS - I 1 0 4 3100**

**COURSE OBJECTIVES**

1. To make the students to design a system, component, or process to meet desired needs.
2. To prepare the students to design the components with realistic constraints.
3. To make the students to consider economic, environmental, ethical, health and safety when they design.
4. To make the students to design the components with considering manufacturability, andsustainability
5. To prepare the students to communicate effectively using the techniques, skills, and modern engineering tools.
6. To make the students to understand to use necessary for engineeringpractice.

**COURSE OUTCOMES**

The student will alsolearn:

1. Introduction to engineering design and its place insociety
2. Exposure to the visual aspects of engineering design and engineering graphicsstandards
3. Exposure to engineeringcommunication effectively.
4. Exposure to 3D free hand sketching.
5. Acquired the knowledge of projections of points, lines and plane surfaces.
6. Understand the basic concept of projection of solids.

**UNITI INTRODUCTION 3 +10**

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

**UNITII SCALES ANDPLANECURVES 3 + 10**

SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

**UNITIII FREEHANDSKETCHING 3 +12**

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

**UNITIV PROJECTION OF POINTS, LINES ANDPLANESURFACES 3 +12**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

**UNITV PROJECTIONOFSOLIDS 3 +12**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

**Introduction to Drafting Software/Package (NotforExam) 0 + 4**

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3Dprimitives.

**TOTAL 15 + 60 = 75PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Venugopal K and Prabhu Raja V | Engineering Graphics | New Age International Publishers | 2007 |
| 2 | VTU | A Primer on Computer Aided Engineering Drawing | Belgaum | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kumar M S | Engineering Graphics | D D Publications, Chennai | 2007 |
| 2 | Bureau of Indian Standards | Engineering Drawing Practices for Schools and Colleges SP 46-2003 | BIS, New Delhi | 2003 |
| 3 | Luzadder W J | Fundamentals of Engineering Drawing | Prentice Hall Book Co., New York | 1998 |


**WEB REFERENCES**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawingsheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation –Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technicaldrawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of TechnicalDrawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – ProjectionMethods.

**COURSE OBJECTIVES**

1. To know the value of being a human being and the value of being a usefulcitizen
2. To develop a critical ability to distinguish between essence and form, or between what is of value and what is superficial, in life.
3. To move from discrimination to commitment.
4. To recognize and determine the role of engineers in the economic and social development of the society.
5. To develop social responsibility &human professional ethics.
6. To develop the knowledge of social impact of economic liberalization and technology.

**COURSE OUTCOMES**

1. Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
2. Identify the multiple ethical interests at stake in a real-world situation or practice
3. Articulate what makes a particular course of action ethically defensible Assess their own ethical values and the social context of problems
4. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
5. Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
6. Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

**UNITI** **4**

Human life on Earth - Concept of Human Values - Value Education - Aim of education and value education - Types of values - Components of values – Attitudes – types of attitudes

**UNITII** **4**

Self Development :Self analysis – Goal Setting - Thought Analysis – Guarding against Anger - Respect to age, experience, maturity, family members, neighbors,co-workers

**UNIT III** **5**

Individual Qualities– Truthfulness – Constructivity – Sacrifice – Sincerity - Self Control – Altruism– Tolerance - Scientific Vision – Regulating Desire

**UNITIV** **4**

Mind Culture - Modern Challenges of Adolescent - Emotions and behavior - Sex and spirituality - Adolescent Emotions - Meditation

**UNITV** **3**

Body and Mind Fitness : (a) Physical Exercises (b) Activities: (i) Moralization of Desires (ii) Neutralization of Anger (iii) Eradication of Worries (iv) Benefits of Blessings

**TOTAL 20PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Subramanian. R | Professional Ethics | Oxford, New Delhi | 2013 |
| 2 | Govindarajan. M, Natarajan. S, | Engineering Ethics | Prentice Hall of India, New Delhi | 2004 |
| 3 | Tripathi. A.N | Human Values | New Age International | 2009 |
| 4 | Pope. G. U. | Thirukkural with English Translation | Uma Publication, Thanjavur. | 2002 |

## SEMESTER II

**15BECC201 COMMUNICATIVEENGLISH–II 3 0 0 3100**

**COURSE OBJECTIVES**

1. To enable students to attain fluency and accuracy to inculcate proficiency in professionalcommunication.
2. To make the students to meet the growing demand in the field of Globalcommunication.
3. To help students acquire their ability to speak effectively in real lifesituations.
4. To inculcate the habit of reading and to develop their effective readingskills.
5. To ensure that students use dictionary to improve their active and passivevocabulary.
6. To enable students to improve their lexical, grammatical and communicativecompetence.

**COURSE OUTCOMES**

Students undergoing this course will be able to

1. Use English language for communication: verbal & non –verbal.
2. Enrich comprehension and acquisition of speaking & writingability.
3. Ensure students proficiency in professionalcommunication.
4. Developed their active and passivevocabulary.
5. Gain confidence in using English language in real lifesituations.
6. Improve word power: lexical, grammatical and communication competence.

**UNITI** **10**

**Listening** - Difference between Hearing & Listening –Listening to informal conversation. **Speaking** - Spoken structures on different situations - Introduction, Greeting, Comments on topics like Films, Games etc, Excuse, Request, Agreement, Disagreement, etc., **Reading** – Extensive and Intensive reading. **Writing** – Report writing - Writing a Covering letter. **Grammar** – Regular & Irregular verbs - Kinds of sentence - Question tags. **Vocabulary** – Homonyms and Homophones.

**UNITII** **8**

**Listening** – Note Taking- Improving grasping ability. **Speaking** – Welcome Address - Vote of thanks - Master of ceremony. **Reading** – Active and Passive reading - Reading for vocabulary- Reading for a purpose. **Writing** - Writing a review (Film review) - Summary of a story. **Grammar** - Modal verbs – Conjunction - Expression of cause and effect. **Vocabulary** - Phrasal verbs - Idioms.

**UNITIII** **9**

**Listening** - Barriers to listening (Physical, Psychological, Linguistic & Cultural). **Speaking** – Stress, Pause and Intonation. **Reading** – Rapid Reading – Skimming, Scanning and Surveying. (SQ3R)**Writing**- Essay writing -Minutes of Meeting - Agenda – **Grammar** - Active and Passive voice - Purpose Expression. **Vocabulary** - Same words used as noun and verb - often misspelt and confusedwords.

**UNITIV** **8**

**Listening** – Listening to telephone conversation - Viewing model interviews. **Speaking** – Group Discussion - Correlation between verbal & non - verbal communication. **Reading** – Reading Comprehension (short & long text) - Reading job advertisements and profile of a company. **Writing** – Job Application - Resume Writing - Checklist Preparation. **Grammar** - Numerical Expressions – Collocations - **Vocabulary** - Singular and Plural (Nouns)

**UNITV** **10**

**Listening** – Types of Listening- Improving listening comprehension**. Speaking** - Oral presentation - Vocal communication techniques - voice, quality, volume, pitch etc., **Reading** -Note Making - Making notes from books/ any forms of writing materials. **Writing** - Describing process & products - Recommendation Writing – Short Essays Writing- **Grammar**- Transformation of sentences (Simple, Compound & Complex). **Vocabulary** - Collection of Technical Vocabulary with their meanings.

**TOTAL 45PERIODS**

Note:Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Sangeeta sharma , Meenakshi Raman | Technical Communication: Principles And Practice 2nd Edition | OUP | 2015 |

# SEMESTER II

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rizvi Ashraf, M | Effective Technical Communication | Tata McGraw-Hill, New Delhi. | 2007 |
| 2 | Rutherford Andrea,J. | Basic Communication Skills for Technology 2nd Edition | Pearson Education, New Delhi. | 2006 |
| 3 | Lakshminarayanan, K.R. & Murugavel, T. | Communication Skills for Engineers | SCITECH Publications, Chennai | 2008 |

**WEB REFERENCES**

1. www.learnerstv.com
2. www.usingenglish.com
3. www.englishclub.com

**15BECC202 ENGINEERING MATHEMATICS – II 3 2 0 4100**

**COURSE OBJECTIVES**

The objective of this course is

1. To familiarize the prospective engineers with techniques in Multivariate integration.
2. To familiarize the concept of ordinary and partial differential equations and complex variables.
3. To equip the students to deal with advanced level of mathematics and applications.
4. To make the students to formulate and solve problems involving random variables.
5. To equip the students to Understand the basic concepts of one- and two-dimensional random variables.
6. To understand the concept of testing of hypothesis for small and large samples in real life problems.

**COURSE OUTCOME**

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and theirusage.
2. The effective mathematical tools for the solutions of differential equations that model physicalprocesses.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineeringProblems.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

**UNITI PARTIALDIFFERENTIALEQUATIONS 11**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

**UNITII MULTIPLEINTEGRALS 11**

Double integral – Cartesian coordinates – Polar coordinates – Change of order of integration – Triple integration in Cartesian co-ordinates – Area as double integrals.

**UNITIII VECTORCALCULUS 13**

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem, Gauss divergence theorem and Stoke's theorems (Statement Only)- Surfaces : hemisphere and rectangular parallelopipeds.

**UNITIV ANALYTICFUNCTIONS 12**

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: $w = z+a$, $az$, $1/z$, $z^2$ and bilinear transformation.

**UNITV COMPLEXINTEGRATION 13**

Complex Integration - Cauchy's integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy's residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi circle (excluding poles on the real axis).

**TOTAL 60PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hemamalini. P.T | Engineering Mathematics I & II | McGraw-Hill Education Pvt.Ltd, New Delhi | 2014 |
| 2 | Grewal, B.S. | Higher Engineering Mathematics | Khanna Publishers, Delhi. | 2011 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Erwin Kreyszig | Advanced Engineering Mathematics. | John Wiley & Sons. Singapore | 2011 |
| 2 | Venkataraman, M. K. | Engineering Mathematics. | The National Publishing Company, Chennai | 2005 |
| 3 | Narayanan. S, and Ramaniah.G | Advanced Mathematics for Engineering Students. | Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai. | 2002 |
| 4 | Michael D. Greenberg | Advanced Engineering Mathematics | Pearson Education, India | 2009 |


**WEB REFERENCES**

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.sosmath.com/diffeq/laplace/basic/basic.html
4. www.mathworld.wolframe.com

**15BECC203 MATERIAL SCIENCE 3 0 0 3100**

**COURSE OBJECTIVES**

1. To impart knowledge on metallurgical aspects ofmetals.
2. To understand heat treatment processes on different grades ofsteel.
3. To familiarize on selection of ferrous and non-ferrous materials for variousapplications.
4. To impart knowledge on non-metallicmaterials
5. To learn about the strengthening mechanisms for Non-ferrousalloys.
6. To comprehend the significance of Non Destructive Testing (NDT)methods.

**COURSE OUTCOMES**

Learners should be ableto

1. Identify the metallurgical aspects ofmetals.
2. Identify suitable heat treatment processes for variousapplications.
3. Select appropriate ferrous and non-ferrous materials for variousapplications.
4. Identify and select suitable non-metallicmaterials.
5. Identify suitable strengthening mechanisms for Non-ferrousalloys.
6. Work with non destructive testingmethods.

**UNITI CONDUCTINGMATERIALS 9**

Conductors–classicalfreeelectrontheoryofmetals–Electricalandthermalconductivity–Wiedemann–Franzlaw–Lorentznumber–Drawbacksofclassicaltheory–Quantumtheory–Fermidistributionfunction – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNITII SEMICONDUCTINGMATERIALS 9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

**UNITIII MAGNETIC ANDSUPERCONDUCTINGMATERIALS 9**

Origin of magnetic moment – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.

Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Temperature superconductors – Applications of superconductors – magnetic levitation.

**UNITIV DIELECTRICMATERIALS 9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials – ferroelectricity and applications.

**UNITV ADVANCEDMATERIALS 9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application. Composite materials, Aircraft materials and non-metallic materials. Nano materials: synthesis – Physical and chemical vapour deposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: structure – properties and applications.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ganesan.S and Baskar.T | Engineering Physics II | GEMS Publisher, Coimbatore-641 001 | 2015 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | William D Callister Jr | Material Science and Engineering-An Introduction | John Wiley ans Sons Inc., , New York, | 2013 |
| 2 | James F Shackelford | Introduction to materials Science for Engineers | Macmillan Publication Company, New York | 2014 |
| 3 | Charles Kittel | Introduction to Solid State Physics | John Wiley & sons, Singapore. | 2005 |


**WEB REFERENCES**

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www.oyc.yale.edu
4. www.physics.org

**15BECC204 ENVIRONMENTAL STUDIES 3 0 0 3100**

**COURSE OBJECTIVES**

1. To create the awareness about environmental problems amongpeople.
2. To develop an attitude of concern for theenvironment.
3. To motivate public to participate in environment protection andimprovement.
4. To demonstrate proficiency in quantitative methods, qualitative analysis, and critical thinking.
5. To develop writing and oral communication needed to conduct high-level work as interdisciplinary scholars and / orpractitioners.
6. To Learn about the systems concepts and methodologies to analyze and understand interactions.

**COURSE OUTCOME**

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problemsolving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies andinstitutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to globalscales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnectedworld.

**UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES ANDNATURAL RESOURCES 9**

Definition, Scope and Importance – Need for public awareness -Forest resources: Use and over-exploitation, deforestation-Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources- role of an individual in conservation of natural resources.

**UNIT II ECOSYSTEM 9**

Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere- Concept of an ecosystem-Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, food web and ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

**UNIT III BIODIVERSITY 9**

Introduction to biodiversity, Definition- Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic Species of India – Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

**UNIT IV ENVIRONMENTALPOLLUTION 9**

Definition – Causes, effects and control Measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-.Causes, effects and control measures of urban and industrial wastes– Role of an individual in prevention of pollution–Disaster management:-earthquake, tsunami, cyclone and landslides.

**UNIT V SOCIAL ISSUES AND ENVIRONMENT 9**

From unsustainable to Sustainable development,Urban problems related to energy sources, water conservation, Rain water harvesting and watershed management, Resettlement and rehabilitation of people, its problems and concerns, Environmental ethics- Issues and possible solutions- Climate change- Green house effect and global warming, acid rain, ozone layer depletion, Wasteland reclamation- Environment Protection Act- Human Rights-Value Education, Role of Information Technology in Environment and human health-Population growth, variation of population among nations-Population explosion.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ravikrishnan, A | Environmental Science | Sri Krishna Hi tech Publishing Company Private Ltd., Chennai | 2012 |
| 2 | Anubhakaushik C.P. Kaushik | Environmental Science and Engineering | New Age International (p) Ltd., New Delhi. | 2010 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Linda D. Williams | Environmental Science Demystified | Tata Mc Graw -Hill Publishing Company Limited, New Delhi. | 2005 |
| 2 | Tyler Miller G. Jr | Environmental Science | Thomson & Thomson Publishers, New Delhi. | 2004 |

**WEB REFERENCES**

1. http://people.eku.edu/ritchisong/envscinotes1.html
2. http://nptel.ac.in/courses.php?disciplineId=1203.www.newagepublishers.com/samplechapter/001281.
3. www.unesco.org/ext/field/beijing/scienceb.htm,
4. www.infinitepower.org/education.htm

**COURSE OBJECTIVES**

1. To know about different materials and theirproperties
2. To know about engineering aspects related tobuildings
3. To know about importance of surveying and the transportationsystems
4. To get exposed to the rudiments of engineering related to dams, water supply, and sewagedisposal
5. To know about importance of drawings
6. To know about importance of electrical fittings.

**COURSE OUTCOMES**

1. Students are able to understand the property, use, advantage and disadvantage of different material used in construction
2. Students are able to understand the component of building with their function
3. Students are able to understand construction procedure of different components
4. After completion of this students will able to understand basic principles of building design and planning.
5. They will explore building drawing as a way of discovering and developing ideas for designing residential, commercial and public buildings.
6. Students will identify suitable method of irrigation and drainage of waterlogged area.

**UNITI BUILDINGMATERILAS 9**

Introduction – Civil Engineering – Materials: Bricks – composition – classifications – properties – uses. Stone – classification of rocks – quarrying – dressing –properties –uses. Timber – properties – uses –ply wood. Cement – grades –types – properties –uses. Steel – types –properties – uses – market forms. Concrete – grade – properties –uses.

**UNITII BUILDINGCOMPONENTS 9**

Building – selection of site – classification – components. Foundations –functions – classifications – bearing capacity. Flooring – requirements – types – cement concrete – marble – terrazzo floorings. Roof – types and requirements.

**UNITIII SURVEYING 9**

Surveying – objectives – classification – principles of survey – survey instruments , their care and adjustments – Ranjing and Chaining .Compass – types –Prismatic Compass. Bearing – types. Levelling –Levels and staves – types. Contouring

**UNITIV WATER SUPPLY ANDSEWAGEDISPOSAL 9**

Dams – purpose – selection of site – types –gravity dam (cross section only). Water supply – objective – quantity of water – sources – standards of drinking water – distribution system. Sewage – classification — septic tank – components andfunctions.

**UNITV BUILDINGDRAWING 9**

Types of drawing with appropriate scale & Uses of index map, key plan, village map, site plan, Layout plan –Types of Projection adopted in Building Drawing – Scales for various types of Drawings– Working drawing, large scale drawing– Symbols, Conventions and Abbreviations for – Electrical fittings , water supply ,sanitary fittings, materials of construction – Sizes of various standardpapers.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Raju K.V.B, Ravichandran P.T | Basics of Civil Engineering | Ayyappa Publications, Chennai | 2012 |
| 2 | V. B. Sikka | Civil engineering drawing | B. D. KatariaSons , Ludhiana | 2009 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Civil Engineering | Ramesh Babu | VRB Publishers, Chennai | 2010 |
| 2 | - | Building Materials | National Building Code of India, Part V | 2005 |
| 3 | Engineering Materials | Rangwala S.C | Charotar Publishing House, Anand | 2012 |

**15BEME206 COMPUTER FUNDAMENTALS AND CPROGRAMMING 3 0 0 3100**

**COURSEOBJECTIVES**

1. Identify and understand the working of key components of a computerprogram.
2. Identify and understand the various kinds of keywords and different data types of Cprogramming
3. Understand, analyze and implement software development tools likealgorithm,
4. pseudo codes and programmingstructure
5. Study, analyze and understand logical structure of a computer program, and different construct to develop a program in "C"language
6. Programming to solve matrix addition and multiplication problems and searching and sorting problems.

**COURSE OUTCOMES**

The course will enable the students

1. To formulate simple algorithms for arithmetic and logicalproblems
2. To translate the algorithms to programs (in C language)
3. To test and execute the programs and correct syntax and logicalerrors
4. To implement conditional branching, iteration andrecursion
5. To decompose a problem into functions and synthesize a complete program using divide and conquerapproach
6. To use arrays, pointers and structures to formulate algorithms andprograms

**UNITI OVERVIEW OFCOMPUTER 8**

What is computer- Computer Components-Generation of Computers- Memory Organization-Memory Types-Input and Output Devices- Concepts of Hardware and Software- What is OS-Windows and Unix OS-Programming Languages- Basics of Computer Networks- LAN, WAN-Concept of Internet- ISP- Basics of word processing- Basics of spreadsheet – Basics of presentation Software

**UNITII OVERVIEW OF'C' 8**

Algorithms-Representation of Algorithms-Flowchart- Introduction to programming Languages-What is C- C Character set- Constants, Variables and Keywords-General form of C Program-The First C Program-Data types-Arithmetic Instructions- Type conversions- Relational and Logical Operators-Hierarchy andassociativity

**UNITIII SELECTIONANDITERATION 9**

Selection Structures- If and nested if - Loops-Definition and types-While loop-for loop- do-while loop- break and continue- Nested loops- Advantages of iteration-Menu driven programs-Switch Case

**UNITIV FUNCTIONS 10**

Functions- Definition-types-Functions without arguments- Functions with Input arguments- Functions with output parameters-local and global variables- advantages of functions- Call by value and Call by reference-Recursion- Function as an argument

**UNITV ARRAYS ANDSTRINGS 10**

Arrays-definition- Declaring and referencing arrays- Array initialization- Using for loops for accessing arrays-Passing array elements as function arguments-2D Array - Matrix Addition and multiplication- Introduction to Strings- declaration and Initialization--String constant -Strings as Array of Characte

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | E. Balagurusamy | Computing Fundamentals and C Programming | TMH Education | 2014 |
| 2 | YashavantKanetkar | Let us C | BPB Publications | 2013 |
| 3 | H. M. Deitel and D. J. Deitel | C: How to Program' | Prentice Hall | 2012 |
| 4 | E. Balagurusamy | Programming in ANSI C | TMH Education | 2012 |

**15BEME211 COMPUTER PRACTICESANDPROGRAMMING LABORATORY** **0 0 3 2100**

**COURSE OBJECTIVES**

1. To provide an awareness to Computing and CProgramming
2. To know the correct and efficient ways of solvingproblems
3. To learn to develop algorithm for simple problemsolving.
4. To Study, analyze and understand logical structure of a computer program
5. To be able to declare pointers of different types and use the mind defining self- referential structures.
6. To be able to create, read and write to and from simple textfiles.

**COURSE OUTCOMES**

1. To formulate the algorithms for simpleproblems
2. To translate given algorithms to a working and correctprogram
3. To be able to correct syntax errors as reported by thecompilers
4. To be able to identify and correct logical errors encountered at runtime
5. To be able to write iterative as well as recursiveprograms
6. To be able to represent data in arrays, strings and structures and manipulate them through a program

**LIST OF EXPERIMENTS**

1. Working with word Processing, Spreadsheet and presentation software inLinux

2. Programming inScratch:
   Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming

3. CProgramming:
   Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and funct

**TOTAL 45PERIODS**

## COURSE OBJECTIVES

1. To prepare the students to make section of solids like Prism, Cylinder, and Pyramid.
2. To prepare true shape of section.
3. To gain the knowledge on lateral surfaces.
4. To acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. To gain the knowledge on 2D drawing using CAD software.
6. To acquire the knowledge on basics of 3D modeling packages.

## COURSE OUTCOMES

1. The students to draw section of solids like Prism, Cylinder, and Pyramid.
2. Students can prepare true shape of section.
3. Students gain the knowledge on lateral surfaces.
4. Students acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. Students gain the knowledge on 2D drawing using CAD software.
6. Students acquire the knowledge on basics of 3D modeling packages.

**UNITI SECTIONOFSOLIDS 3 +12**

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

**UNITII DEVELOPMENTOFSURFACES 3 + 12**

Developmentoflateralsurfacesofsimpleandtruncatedsolids–Prisms,pyramids,cylindersandcones–
Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

**UNITIII ISOMETRICPROJECTIONS 3 +12**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

**UNITIV PERSPECTIVEPROJECTIONS 3 +12**

Perspective projection of prisms, pyramids, cylinders and cone by visual ray method and vanishing point method.

**UNITV COMPUTERGRAPHICS 3 +12**

Introduction to 3D modeling packages. Drafting practices - modeling of simple engineering components, sections and extraction of 2D drawings.

**TOTAL 15 + 60 = 75PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Venugopal K and Prabhu Raja V | Engineering Graphics | New Age International Publishers | 2007 |
| 2 | VTU | A Primer on Computer Aided Engineering Drawing | Belgaum | 2006 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kumar M S | Engineering Graphics | D D Publications, Chennai | 2007 |
| 2 | Bureau of Indian Standards | Engineering Drawing Practices for Schools and Colleges SP 46-2003 | BIS, New Delhi | 2003 |
| 3 | Luzadder W J | Fundamentals of Engineering Drawing | Prentice Hall Book Co., New York | 1998 |

**WEB REFERENCES**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawingsheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation –Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technicaldrawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of TechnicalDrawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – ProjectionMethods.

**15BECC251 ELEMENTARY BIOLOGY 1 1 0 1100**

**COURSE OBJECTIVES**

1. To understand the basics ofbiology
2. To gain knowledge about differentbiomolecules
3. To get familiarize with humandiseases.
4. To learn about DNA & RNA.
5. To learn about different clinicalinvestigations
6. To know the recent advances inbiology

**COURSE OUTCOMES**

At the end of the course

1. Summarize the cell structures and itsfunctions
2. Explain the Biomoleculesfunctions
3. Classify the communicable and non-communicable humandiseases
4. Illustrate the different organ functiontests
5. Tell the applications of biology in environmentalapplications
6. Describe the concept ofbiomechanics

**UNITI BASICS OFCELLBIOLOGY 4**

History, Cell theory, Cell Structure-Prokaryotic and Eukaryotic cells, Animal and Plant Cell. Cell cycle, Mitosis, Meiosis and Reproductive cycle.

**UNITII BIOMOLECULES 4**

Carbohydrates-Classification, Qualitative tests for sugars, Lipids-Definition,Classification; Proteins-classification and functions; Nucleic acids-basic structure; Hormones-definition, importance;Vitamins.

**UNITIII HUMAN ANATOMY ANDPHYSIOLOGY 5**

Levels of Structural organization, the eleven systems of human body, central nervous system- cardiovascular system and immunesystem.

**UNITIV GENETICS ANDGENETICDISORDERS 4**

History of genetics-Scope and Importance of genetics, Mendel and his work, DNA stores genetic information- gene mutation, disorders due to mutant genes.

**UNITV TECHNOLOGICAL ADVANCESINBIOLOGY 3**

Biopharmaceuticals, Gene therapy, genetically modified crops, probiotics.

**TOTAL 20PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Verma, P. S., Agarwal, V. K. | Cell Biology, Genetics, Molecular Biology, Evolution and Ecology | S. Chand & Company Ltd., | 2006 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nelson. D. L. and Cox. M. M | Lehninger Principles of Biochemistry | Freeman, W. H. & Company | 2004 |
| 2 | Tortora, G. J., Derrickson, B | Principles of Anatomy and Physiology, | John Wiley & Sons | 2006 |

**WEB REFERENCE**

1. http://www.biotechonweb.com/Application-of-biotech-in-Medical.html

## SEMESTER III

**15BEME301 METHODS OFAPPLIEDMATHEMATICS 3 2 0 4100**

**COURSE OBJECTIVES**

1. To introduce the basic concepts of PDE for solving standard partial differentialequations
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in varioussituations.
3. To provide an overview of probability and statistics toengineers
4. To introduce the basic concepts of two-dimensional randomvariables
5. To acquaint the knowledge of testing of hypothesis for small and large samples.
6. To apply testing of hypothesis in important role in real lifeproblems.

**COURSE OUTCOMES**

After successfully completing the course, the student will have a good understanding of the following topics and their applications

1. Thefundamentalconceptsofpartialdifferentialequationsandthevarioussolutionproceduresforsolvingthefirst order non-linear partial differentialequations.
2. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional waveequations.
3. Understand the basic concepts of one knowledge of the concepts of probability and have knowledge of standard distribution which can describe real life phenomenon.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineeringapplications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimentaldata
6. Apply the concept of testing of hypothesis for small and large samples in real lifeproblems

**UNITI LAPLACETRANSFORM 13**

Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and final value theorems. Inverse Laplace transforms – Convolution theorem (statement only) – Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms – Transform of periodic functions

**UNITII FOURIERSERIES 12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

**UNITIII FOURIERTRANSFORM 12**

Fourier integral theorem (Statement Only) – Fourier transform pair –Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity – Relation between Fourier and Laplace transforms

**UNITIV APPLICATIONS OF PARTIALDIFFERENTIALEQUATIONS 12**

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded)

**UNITV Z -TRANSFORM ANDDIFFERENCEEQUATIONS 11**

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL 60PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Grewal, B.S. | Higher Engineering Mathematics | Khanna Publishers, Delhi. | 2013 |
| 2 | Erwin Kreyszig | Advanced Engineering Mathematics. | John Wiley & Sons. Singapore | 2014 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Venkateswarlu S | Engineering Mathematics, Vol I | Anuratha Agencies and Publishers, Kumbakonam. | 2007 |
| 2 | Narayanan, S., and Ramaniah, G | Advanced Mathematics for Engineering Students. Volumes II and III, | Viswanathan S Printers and Publishers Pvt. Ltd. Chennai. | 2002 |
| 3 | Bali N P. | A text book of Engineering Mathematics | Laxmi Publications Pvt. Ltd. | 2006 |
| 4 | Ramana B V | Higher Engineering Mathematics | Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. | 2008 |

**WEB REFERENCE**

1. www.sosmath.com
2. http://mathworld.wolfram.com/FourierSeries.html
3. http://www.math.umn.edu/~olver/pdn.html
4. http://tutorial.math.lamar.edu/classes/DE/IntroPDE.aspx

**COURSE OBJECTIVES**

1. To develop capacity to predict the effect of force and motion.
2. To understand the importance of free body diagram for complex machine structure.
3. To perform force analysis using law of mechanics.
4. To introduce the concepts of static equilibrium condition for particles and rigid bodies
5. To Understand the concepts of kinematics of particles and friction.
6. To make the students conversant to solve the problems using equation of motions.

**COURSE OUTCOMES**

At the end of the course the students will be able to

1. Understand the basic concepts of force and laws of mechanics.
2. Develop free body diagram for complex machine structure and to perform force analysis.
3. Apply static equilibrium condition for particles and rigid bodies.
4. Locate the center of gravity and moment of inertia for planes and solids.
5. Understand the concepts of kinematics of particles and friction.
6. Solve the problems using equation of motions.

**UNIT I STATICSOFPARTICLES 9 +3**

Forces – system of forces – concurrent forces in plane and space– resultant – problems involving the equilibrium of a particle–free body diagram–equilibrium of particle in space.

**UNIT II STATICS OF RIGID BODIES INTWODIMENSIONS 9 +3**

Rigid bodies–moment of force about an axis–moments and couples–equivalent system of coplanar forces–Rigid body in equilibrium–problems involving equilibrium of rigid body–types of supports–reactions of beams.

**UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENTOFINERTIA 9 +3**

Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia – radius of gyration – mass moment of inertia of simple solids.

**UNIT IV KINEMATICSOFPARTICLES 9 +3**

Introduction – plane, rectilinear motion – time dependent motion – rectangular coordinates – projectile motion.

IMPULSE AND MOMENTUM: Concept of conservation of momentum – Impulse–Momentum principle–Impact – Direct central impact – Oblique central impact – Impact of elastic bodies.

**UNIT V KINETICS OF PARTICLESANDFRICTION 9 +3**

KINETICS OF PARTICLES: Equations of motion–rectilinear motion–Newton's II law – D'Alembert's principle – Energy – potential energy–kinetic energy–conservation of energy–work done by a force – work energy method.

Laws of friction – coefficient of friction–problems involving dry friction – wedge and ladder friction.

**TOTAL 45 + 15 = 60PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Beer F P and Johnson E.R | Vector Mechanics for Engineers–Statics and Dynamics | Tata Mc–Graw Hill Publishing Co. Ltd., New Delhi | 2012 |
| 2 | Rajasekaran.S and Sankarasubramanian G | Engineering Mechanics–Statics and Dynamics | Vikas Publishing House Pvt. Ltd., New Delhi | 2009 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Bansal R K | Engineering Mechanics | Laxmi Publications Pvt. Ltd., New Delhi | 2006 |
| 2 | Young D H and Timashenko S | Engineering Mechanics | Tata McGraw–Hill, New Delhi | 2006 |
| 3 | JivanKhachane and Ruchi Shrivastava | Engineering Mechanics: Statics and Dynamics | ANE Books, New Delhi | 2006 |

**WEB REFERENCES**

1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT%20Guwahati/engg_mechanics/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=112103108
3. http://web.mit.edu/emech/dontindex–build/index.html
4. http://www.indiabix.com/engineering–mechanics/questions–and–answers/

**COURSE OBJECTIVE**

1. To familiarize the students to apply suitable molding and casting methods for producing components.
2. To develop anunderstanding of types of metal joining processes.
3. To explain types of deformation processes.
4. To understand the concept of sheet metal operations and metal forming processes.
5. To provide an overview of various plastic component manufacturing processes for various applications.
6. To Study and acquire knowledge of process variables to manufacture defect free products.

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Apply suitable molding and casting methods for producing components.
2. Decide the type of metal joining processes.
3. Select the type of deformation processes.
4. Work with various sheet metal operations and metal forming processes.
5. Select the various plastic component manufacturing processes for various applications.
6. Identify the effect of process variables to manufacture defect free products.

**UNITI METALCASTINGPROCESSES 9**

Introduction to Sand casting – Sand moulds – Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Types – $CO_2$ process - Moulding machines – Types of moulding machines – Types of melting furnaces (cupola, induction) – Working principle of Special casting processes – Shell moulding, Investment casting, Pressure die casting, Centrifugal casting – Casting defects – Inspectionmethods.

**UNITII JOININGPROCESSES 9**

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials and properties – Arc welding equipments – Electrodes – Coating and specifications – Principles of Resistance welding – Gas metal arc welding – Submerged arc welding – TIG, MIG welding – Friction Stir Welding – Weld defects – Brazing and soldering process.

**UNITIII BULKDEFORMATIONPROCESSES 9**

Hot working and cold working of metals – Ingots – Forging processes – Open, impression and closed die forging – Types of Forging Machines – Rolling of metals – Types of Rolling mills – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing — Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion — Equipments used.

**UNITIV SHEETMETALPROCESSES 9**

Sheet metal characteristics – Press – Types of press – Principle of punching, blanking, coining, piercing, notching, embossing – Typical shearing operations, bending, drawing and deep drawing operations – Metal spinning, Stretch forming operations – Formability of sheet metal – Test methods.

**UNITV MANUFACTURING OFPLASTICCOMPONENTS 9**

Types of plastics – Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of – Injection moulding – Plunger and screw machines – Compressionmoulding,Transfermoulding–Typicalindustrialapplications–IntroductiontoBlowmoulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

**TOTAL 45 PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | SeropeKalpajian, Steven R.Schmid | Manufacturing Engineering and Technology (Second Indian Reprint) | Pearson Education, Inc., New Delhi | 2002 |
| 2 | S.Gowri, P.Hariharan, and A.Suresh Babu | Manufacturing Technology 1 | Pearson Education, Inc., New Delhi | 2008 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | P.N. Rao | Manufacturing Technology Second Edition | Tata McGraw–Hill Publishing Limited, New Delhi | 2013 |
| 2 | P.C. Sharma | A text book of production technology Fourth Edition | S. Chand and Company, New Delhi | 2007 |
| 3 | Begman | Manufacturing Process Eighth Edition | John Wilely and Sons | 2005 |


**WEB REFERENCES**

1. www.themetalcasting.com
2. www.industrialmetalcastings.com
3. www.purolator–lp.com
4. www.manufacturercompanies.com/manufacturers

**COURSE OBJECTIVES**

1. To enrich the understanding of fluid properties
2. To make the students conversant with types of flow and calculate Major and minor loses in pipes.
3. To acquaint the student with the concepts of Buckingham's π theorem.
4. To explain the working of different pumps
5. To explain the working of different turbines.
6. To equip students with skills to produce analytical solutions to various simple problems

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Demonstrate basic knowledge of fluid properties
2. Find types of flow and calculate Major and minor loses in pipes.
3. Apply Buckingham's π theorem for problem solving.
4. Understand the working of different pumps
5. Understand the working of different turbines.
6. produce analytical solutions to various simple problems

**UNITI FLUID PROPERTIES ANDFLOWCHARACTERISTICS 9 +3**

Fluid properties: Mass density, weight density, specific gravity, viscosity, compressibility, surface tension and capillarity. Buoyancy and floatation– metacentre and metacentric height (definition only)

Flow characteristics: concepts of system and control volume, application of control volume to continuity equation, energy equation, momentum equation and moment ofmomentum equation.

**UNITII FLOW THROUGHCIRCULARPIPES 9 +3**

Hydraulic and energy gradient – Types of fluid flow – Laminar flow through circular conduits – Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor – Moody diagram – commercial pipes – minor losses – Flow through pipes in series and parallel.

**UNITIII DIMENSIONALANALYSIS 9 +3**

Dimension and units, dimensional homogeneity, applications of Buckingham's π theorem, model and similitude, similaritylaws.

**UNITIV HYDRAULICTURBINES 9 +3**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**UNITV HYDRAULICPUMPS 9 +3**

Classification of pumps – centrifugal pump–working principle–head, discharge, efficiencies and losses – performance curves – specific speed. Reciprocating pump–components and working–slip–indicator diagram – air vessel – Jet pump – Gear pump – Submersible pump.

**TOTAL 45 + 15 = 60PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Streeter V.L, Wylie E.B | Fluid Mechanics | McGraw–Hill, New Delhi | 1998 |
| 2 | Kumar K.L | Engineering Fluid Mechanics | S. Chand | 2004 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Bansal. R.K | Fluid Mechanics and Hydraulics Machines | Laxmi publications (P) Ltd, New Delhi | 2005 |
| 2 | White. F.M | Fluid Mechanics | Tata McGraw–Hill, New Delhi | 2008 |
| 3 | Fox and McDonald | Fluid Mechanics | John Wiley | 2006 |


**WEB REFERENCES**

1. www.imeche.org
2. openlibrary.org
3. nptel.iitg.ernet.in
4. www.tecquipment.com

**15BEME305 ELECTRICAL DRIVES AND CONTROLS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the basic concepts of different types of electrical machines and theirperformance.
2. To study the different methods of starting D.C motors and inductionmotors.
3. To study the conventional and solid-statedrives
4. To expose students to the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
5. To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
6. To provide strong foundation to asses performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.

**COURSE OUTCOMES**

1. Examine various applications in industrial and domestic areas where use of electric drives is essential.
2. Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability.
3. Combine concepts of previously learnt courses such as, electrical machines, Control and power electronics to cater to the need of automations in industries.
4. Select most suitable type and specification of motor drive combination for efficient conversion and control of electric power.
5. Identify the critical areas in application levels, and derive typical solutions.
6. Design and justify new control and power conversion schemes for implementing alternative solutions considering the critical and contemporary issues.

**UNITI INTRODUCTION 9**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors. Multi quadrant operation.

**UNITII DRIVEMOTORCHARACTERISTICS 9**

Mechanical and electrical characteristics of various types of load and drive motors – Braking of Electrical motors – DC Shunt, series Motors – Three phase induction motors.

**UNITIII STARTINGMETHODS 9**

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

**UNITIV SPEED CONTROLOFD.C.DRIVES 9**

SpeedcontrolofDCseriesandshuntmotors–Armatureandfieldcontrol,Ward-Leonardcontrolsystem– Using controlled rectifiers and DC choppers –applications.

**UNITV SPEED CONTROL OFA.C.DRIVES 9**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, Rotor resistance control –slip power recovery scheme – Using inverters, Cyclo converter and AC voltage regulators –static slip power recovery schemes – applications.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Vedam Subramaniam | Electric Drives (concepts and applications) | Tata McGraw-Hill, New Delhi. | 2001 |
| 2 | Nagrath I.J. and Kothari D.P, | Electrical Machines | Tata McGraw- Hill, New Delhi | 2004 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Pillai.S.K, | A first course on Electric drives | Wiley Eastern Limited, New Delhi. | 1998. |
| 2 | Singh M.D and Khanchandani K.B, | Power Electronics | Tata McGraw-Hill, New Delhi. | 2003 |
| 3. | Gopal K.Dubey | Fundamentals of Electrical drives | Narosa Publishing House | 2003 |

| 15BEME311 | FLUID MECHANICS AND MACHINERY LABORATORY | 0 0 3 2100 |
|---|---|---|

**COURSE OBJECTIVE**

1. To supplement the theoretical knowledge gained in Fluid Mechanics and Machinery with practical testing
2. To understand the concepts of coefficient of discharge for Orifice meter and Venturi meter.
3. To explain the Calibration of Rotameter.
4. To understand the importance of friction factor for flow through pipes.
5. To impart knowledge on the performance of various pumps.
6. To impart knowledge on the performance of turbines.

**COURSE OUTCOMES**

1. Calculate the coefficient of discharge for Orifice meter and Venturimeter.
2. Calibrate the Rotameter
3. Estimate the friction factor for flow through pipes.
4. Asses the performance of centrifugal pump and submergible pump.
5. Asses the performance of reciprocating pump and gear pump.
6. Asses the performance of turbines.

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orificemeter.
2. Determination of the Coefficient of discharge of givenVenturimeter.
3. Calculation of the rate of flow using Rotameter.
4. Determination of friction factor for a given set ofpipes.
5. Conducting experiments and drawing the characteristic curves of centrifugalpump
6. Conducting experiments and drawing the characteristic curves of submersiblepump.
7. Conducting experiments and drawing the characteristic curves of reciprocatingpump.
8. Conducting experiments and drawing the characteristic curves of Gearpump.
9. Conducting experiments and drawing the characteristic curves of Peltonwheel.
10. Conducting experiments and drawing the characteristics curves of Francisturbine.

**TOTAL 45PERIODS**

**COURSE OBJECTIVES:**

1. To explain the surfaces for sheet metal working applications.
2. To Understand the representation of details in machine drawing.
3. To introduce tolerances and fits of machine elements.
4. To equip them with skills to Construct an assembly drawing using part drawings of machine components.
5. To equip them with skills to Construct an assembly drawing of machine components using 2D drafting.
6. To equip them with skills to develop employability.

**COURSEOUTCOMES:**

Learners should be ableto

1. Express the importance of machine drawing andGD&T.
2. Interpret drawings of machinecomponents.
3. Create assembled machinedrawings.
4. Make part drawings from an assemblydrawing.
5. Interpret the details of complex parts in cross sectionviews.
6. Sketch production drawing from assembly drawing.

**INTRODUCTION** **3**

Introduction to machine drawing. Importance of sectional views. Computer-aided drafting.

**CONVENTIONS** **6**

Code of practice for engineering drawing-conventional representation of details- drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs andflanges.

**FITSANDTOLERANCES** **6**

Limits, fits and tolerances-need, types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances. Geometric tolerance-uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings. Surface finish symbols- methods of indicating the surface roughness. Blue print reading exercises.

**ASSEMBLY DRAWINGPRACTICE** **15**

Making free hand sketches of typical subassemblies-flange coupling, stuffing box, journal bearings, rolling element bearings, keyed joints, cotter joints, C clamp.

**ASSEMBLY USING2DDRAFTING** **15**

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing and Drill jigs and Milling fixture.

**TOTAL 45PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gopalakrishna K R | Machine Drawing | Subhas Stores, Bangalore | 2003 |
| 2 | Bhatt N. D and Panchal V.M | Machine Drawing | Charotar Publishing House, Chennai | 2007 |
| 3 | ASME Y 14.5M-1994 | Dimensioning and Tolerancing | ASME, New York | 1995 |

**15BEME313 ELECTRICAL DRIVES AND CONTROL LABORATORY 0 0 3 2100**

**COURSE OBJECTIVES**

1. To understand the basic concepts of different types of electrical machines and theirperformance.
2. To study the different methods of starting D.C motors and inductionmotors.
3. To study the conventional and solid-statedrives
4. To expose students to the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
5. To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
6. To provide strong foundation to asses performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.

**COURSE OUTCOMES**

1. Examine various applications in industrial and domestic areas where use of electric drives is essential.
2. Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability.
3. Combine concepts of previously learnt courses such as, electrical machines, Control and power electronics to cater to the need of automations in industries.
4. Select most suitable type and specification of motor drive combination for efficient conversion and control of electric power.
5. Identify the critical areas in application levels, and derive typical solutions.
6. Design and justify new control and power conversion schemes for implementing alternative solutions considering the critical and contemporary issues.

**LIST OF EXPERIMENTS**

1. Load Test on DC ShuntMotor
2. Load Test on DC SeriesMotor
3. Load Test on DC CompoundMotor
4. Speed control of D.C. motor. (Armature and Fieldcontrol)
5. Speed control of D.C. motor. (Ward–LeonardMethod)
6. Speed control of three phase Induction motor. (VoltageControl)
7. Speed control of three phase Induction motor. (Voltage / frequencyControl)
8. Load test on single phase InductionMotor.
9. Load test on three phase InductionMotor.
10. Speed control of three phase slip ring Induction Motor.

**TOTAL 45PERIODS**

**15BEME351 APTITUDETRAINING 1 1 0 1100**

**COURSE OBJECTIVES**

1. To understand the basic concepts of QUANTITATIVE ABILITY
2. To understand the basic concepts of LOGICAL REASONING Skills
3. To acquire satisfactory competency in use of VERBAL REASONING
4. To solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. To solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. To compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

**COURSE OUTCOMES**

1. Understand the basic concepts of QUANTITATIVE ABILITY
2. Understand the basic concepts of LOGICAL REASONING Skills
3. Acquire satisfactory competency in use of VERBAL REASONING
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. Solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

**UNITI** **6**

Introduction, Speed Math's, Problems on Numbers, Averages, Ratios and Proportions, Problems on Ages

**UNITII** **6**

Percentage, Data Interpretation, Profit and loss, Simple and Compound Interest

**UNITIII** **8**

Time Speed and Distance, Time and Work, Pipes and Cistern, Geometry, Probability, Permutation and Combination

**TOTAL 20PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Agarwal.R.S | Quantitative Aptitude for Competitive Examinations | S.Chand Limited | 2011 |
| 2 | Abhijit Guha | Quantitative Aptitude for Competitive Examinations | Tata McGraw Hill | 2011 |
| 3 | Edgar Thrope | Test Of Reasoning for Competitive Examinations | Tata McGraw Hill, 4th Edition | 2012 |

## SEMESTER IV

**15BEME401 STRENGTHOFMATERIALS 3 2 0 4100**

**COURSE OBJECTIVES**

1. To understand the concepts of stress and strain on deformation of solids.
2. To introduce the Concepts of safe working stresses and load carrying capacity of beams.
3. To enrich the understanding of deflection in beams and columns in engineering applications.
4. To understand the importance of the effect of torsion on shafts and springs.
5. To provide knowledge on principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. To provide knowledge on components subjected to various loadings with the help of various theories of failures.

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Determine stress and strain on deformation of solids.
2. Compute safe working stresses and load carrying capacity of beams.
3. Estimate the deflection in beams and columns in engineering applications.
4. Analyze the effect of torsion on shafts and springs.
5. Determine principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. Design the components subjected to various loadings with the help of various theories of failures.

**UNIT I STRESS, STRAIN AND DEFORMATIONOFSOLIDS 9 + 3**

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxialloads.

**UNIT II BEAMS – LOADSANDSTRESSES 9 + 3**

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Relationship between load, shear force and bending moment – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shearflow.

**UNIT III BEAM DEFLECTION 9 +3**

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Macaulay Method – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine's formula for columns

**UNIT IV TORSION 9 +3**

Analysis of torsion of circular bars – Torsional Shear stress – Bars of solid and hollow circular section – Stepped shaft – Torsional rigidity – Compound shafts – Fixed and simply supported shafts – Application to close–coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

**UNITV ANALYSIS OF STRESSES INTWODIMENSIONS 9 + 3**

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress – Strain energy in bending and torsion.

**TOTAL 45 + 15 = 60PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Punmia B.C and Jain A.K | Strength of Materials and Theory of Structures – Vol.1 | Laxmi Publications New Delhi | 1992 |
| 2 | Ramamrutham S and Narayan R | Strength of Materials | Dhanpat Rai and Sons., New Delhi | 2008 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Jindal U C | Textbook on Strength of Materials | Asian Books Pvt, Ltd, Chennai | 2007 |
| 2 | Don H Morris, and Leroy D Sturges | Mechanics of Materials | John Wiley and Sons Inc | 2001 |
| 3. | Bedi D S | Strength of Materials | S Chand and Co. Ltd., New Delhi | 1984 |

**WEB REFERENCES**

1. www.engineersedge.com
2. http://en.wikiversity.org
3. www.globalsources.com
4. www.dspace.cusat.ac.in

**15BEME402 MANUFACTURING TECHNOLOGY II 3 0 0 3100**

## COURSE OBJECTIVE

1. To Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. To understand the concept of constructional features of different types of lathe and their operations.
3. To provide knowledge on construction & working of shaping, milling &drilling machines and gear cutting & finishing process.
4. To expose students to various types of grinding machines and broaching machines.
5. To Explain the construction features of different types of CNC machine and manual part programming for a given component.
6. To Perform part programming for CNC machines.

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

1. Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. Discuss about the constructional feature of different types of lathe and their operations.
3. Describe the construction & working of shaping, milling &drilling machines and gear cutting & finishing process.
4. Illustrate the various types of grinding machines and broaching machines.
5. Explain the construction feature of different types of CNC machine and manual part programming for a given component.
6. Perform part programming for CNC machines.

**UNIT I THEORY OF METAL CUTTING ANDCUTTING TOOLS 9**

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, oblique cutting – Cutting tool materials, tool wear, tool life, surface finish, cutting fluids, heat generation, Merchant circle.

**UNIT II CENTRE LATHE AND SEMIAUTOMATIC LATHES 9**

Centre lathe– constructional features, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle – Tool layout for Capstan, Turret and Automats.

**UNIT III RECIPROCATING MACHINE TOOLS &MILLINGMACHINES 9**

Shaper – construction, working, work and tool holding device, quick return mechanism, planer – construction, working, mechanism, operations. Slotter – construction, working.

Milling machine – constructions, types, Indexing mechanism, operations, milling cutter, gear hobbing – principle.

**UNIT IV OTHER MACHINETOOLS 9**

Drilling – types, radial drilling machine, construction, operations, Boring, types, Jig boring machine – construction, operations, Broaching – types, construction, Grinding – grinding wheel, specifications and selection, cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing.

**UNITV CNC MACHINES 9**

CNC Machines – Construction – Types of control systems, Manual Part Programming – Computer assisted part programming – Computer aided part programming, Machining centers – principle, Turning centers – principle, CAD/CAM & Integration, Application of CNC Machines.

**TOTAL 45 PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hajra Choudhury | Elements of Workshop Technology Vol– II | Media Promotors Pvt Ltd., Mumbai | 2002 |
| 2 | HMT | Production Technology | Tata McGraw–Hill | 2001 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | P.C. Sharma | A text book of production technology | S. Chand and Co. Ltd | 2008 |
| 2 | Shrawat N.S. and Narang J.S | CNC Machines | Dhanpat Rai and Co | 2002 |
| 3. | P.N.Rao | CAD/CAM Principles and Applications' | TATA Mc Craw Hill | 2011 |
| 4 | Milton C.Shaw | Metal Cutting Principles Second Edition | Oxford University Press | 2005 |


**WEB REFERENCES**

1. www.steelonline.co.in
2. http://mmu.ic.polyu.edu.hk
3. www.waterjetindiana.com
4. www.teskolaser.com
5. www.cncinformation.com
6. www.cncmachineprogramming.net

## COURSE OBJECTIVES

1. To understand the Model of physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
2. To provide knowledge on entropy change in thermodynamic processes.
3. To Study and acquire knowledge on various thermodynamic properties of pure substances in real time problems.
4. To establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
5. To facilitate the understanding of properties of air using psychometric chart.
6. To acquaint the student with the concepts and applications of the thermodynamics to the various real-life systems.

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

1. Model the physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
2. Determine entropy change in thermodynamic processes.
3. Identify the various thermodynamic properties of pure substances in real time problems.
4. Establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
5. Calculate the properties of air using psychometric chart.
6. Explain the basic principles and applications of the thermodynamics to the various real life systems..

**UNIT I BASIC CONCEPTS ANDFIRSTLAW 9 + 3**

Basic concepts - Classical and Statistical approaches - Thermodynamic systems - closed, open, isolated. Property – State - Process-adiabatic - Quasi-static process – Cycle - Point and Path function – Energy - Work transfer - Concept of temperature and heat- Zeroth law of thermodynamics - Concept of ideal gases - First law of thermodynamics –PMM1, internal energy, specific heat capacities, enthalpy, and its application to closed system and open system-steady flow energyequation.

**UNIT II SECOND LAWANDENTROPY 9 + 3**

Physical description of the second law - Kelvin-Planck and Clausius statements –Equivalence - Reversible processes and cycles- Carnot cycle – Corollaries - Absolute temperature scale – Clausius Theorem, inequality - Entropy- Principle, transfer, generation, balance - Third law of thermodynamics

**UNIT III PROPERTIES OF PURE SUBSTANCE ANDGASMIXTURES 9 +3**

Puresubstance-Phasechangeprocess-Propertydiagrams-PVTsurface-Steam–types,drynessfraction-Avogadro's law - Ideal Gas - Equations of state-Vander Waal's equation - Real Gas - Compressibility and its chart - Mixtures ofGases – Properties.

**UNIT IV THERMODYNAMIC AVAILABILITYANDRELATIONS 9 + 3**

Basics-Dead state, quality of energy, degradation of energy - Reversible processes – Maximum work - Exergy – Closed system - Steady flow system – Irreversibility - Exergy Balance - Second law efficiency – Exact differentials - Tds Relations - Maxwell's Relation – Clausius – Clapeyron Equation - Joule-Thompson Coefficient.

**UNITV PSYCHROMETRY 9 +3**

Psychrometry - Psychrometric charts - Property calculations of air vapour mixtures- Psychrometric process-Adiabatic mixing - Evaporative cooling.

**TOTAL 45 + 15 = 60PERIODS**

*(Permitted to use standard thermodynamic table, Mollier diagram, and Psychometric chart in the examination)*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nag P K | Engineering Thermodynamics | Tata McGraw-Hill, New Delhi | 1998 |
| 2 | Cengel | Thermodynamics-An Engineering Approach | Tata McGraw-Hill, New Delhi | 2003 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Holman J P | Thermodynamics | McGraw-Hill, NewDelhi | 1988 |
| 2 | Venwylen and Sontag | Classical Thermodynamics | Wiley Eastern, New Delhi | 1987 |
| 3. | Kothandaraman C P and Domkundwar S | Engineering Thermodynamics | Dhanpatrai& Sons, New Delhi | 2004 |


**WEB REFERENCES**

1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT%20Guwahati/engg_mechanics/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=112103108
3. http://web.mit.edu/emech/dontindex–build/index.html
4. http://www.indiabix.com/engineering–mechanics/questions–and–answers/

**COURSE OBJECTIVES**

1. To impart knowledge on metallurgical aspects ofmetals.
2. To understand heat treatment processes on different grades ofsteel.
3. To familiarize on selection of ferrous and non-ferrous materials for variousapplications.
4. To impart knowledge on non-metallicmaterials
5. To learn about the strengthening mechanisms for Non-ferrousalloys.
6. To comprehend the significance of Non-Destructive Testing (NDT)methods

**COURSEOUTCOMES**

Learners should be ableto

1. Identify the metallurgical aspects ofmetals.
2. Identify suitable heat treatment processes for variousapplications.
3. Select appropriate ferrous and non-ferrous materials for variousapplications.
4. Identify and select suitable non-metallicmaterials.
5. Identify suitable strengthening mechanisms for Non-ferrousalloys.
6. Work with non-destructive testingmethods.

**UNITI CONSTITUTION OF ALLOYS ANDPHASEDIAGRAMS 9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide equilibrium diagram -Classification of steel and cast Iron, microstructure, properties and applications.

**UNITII HEATTREATMENT 9**

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on TTT diagram,CCT - Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

**UNITIII FERROUS AND NONFERROUS METALS 9**

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti& W) - stainless and tool steels – HSLA - maraging steels – Gray, White malleable, Spheroidal Graphite irons - Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation, strengthening treatment – Bearing alloys.

**UNITIV NON-METALLICMATERIALS 9**

Polymers – types of polymer, commodity and engineering polymers – Properties and Applications of thermoplastics (PP, PVC, ABS, and PMMA) and thermosetting plastics (PF, UF, MF) –Engineering Ceramics.

**UNITV TESTING OF MECHANICAL PROPERTIESANDINSPECTION 9**

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep test, S-N curve.

**Non Destructive Testing:** Non Destructive Testing basic principles and testing method of Radiographic testing, Ultrasonic testing, Magnetic particle test and Liquid penetrant test, Eddy current testing.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kenneth G.Budinski and MichaelK.Budinski | Engineering Materials | Prentice-Hall of India Private Limited, New Delhi | 2010 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | William D. Callister & David G. Rethwisch | Material Science and Engineering | John Wiley and Sons, Delhi | 2010 |

| | | | | |
|---|---|---|---|---|
| 2 | Raghavan.V | Materials Science and Engineering | Prentice Hall of India Pvt., Ltd, New Delhi | 2006 |
| 3. | Shackelford. J.F | Introduction to Materials Science for Engineers | Pearson Edition | 2009 |


**WEB REFERENCES:**

1. www.materials.unsw.edu.au
2. ocw.MIT.edu
3. www.istl.org
4. metalurgy-screw-tutorial.tobyavujo.com

**15BEME405 KINEMATICS OF MACHINERY 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the mobility of mechanismin practice.
2. To understand the mechanism for displacement, velocity and acceleration at any point in a link.
3. To enrich the understanding of cam-follower principles for practical applications.
4. To make the students conversant in selecting appropriate gear trains for engineering applications.
5. To understand the friction concepts in machine parts and assembly.
6. To give exposure to the basic components and layout of linkages in the assembly of a system.

**COURSE OUTCOMES**

1. Compute the mobility of mechanismin practice.
2. Analyze a mechanism for displacement, velocity and acceleration at any point in a link.
3. Apply cam-follower principles for practical applications.
4. Select appropriate gear trains for engineering applications.
5. Analyze friction concepts in machine parts and assembly.
6. Understand the basic components and layout of linkages in the assembly of a system

**UNITI BASICSOFMECHANISMS 9**

Terminology and Definitions–Degree of Freedom – Mobility–Kutzbach criterion–Grashoff's law–Kinematic Inversions of four bar chain and slider crank –Mechanical Advantage–Transmission angle –-Single, double and offset slider mechanisms – Quick return mechanisms – Ratchets and escapements – Indexing Mechanisms – Straight line generators.

**UNITII KINEMATICS 9**

Displacement, velocity and acceleration – analysis in simple mechanisms – Graphical Method –velocity and acceleration polygons – Kinematic analysis by Complex Algebra methods–Vector Approach, Instantaneous center – Coriolis Acceleration.

**UNITIII KINEMATICSOFCAM 9**

Classifications – Displacement diagrams–parabolic, Simple harmonic and Cycloidal motions – Layout of plate cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams – Standard cam motion – Pressure angle and undercutting.

**UNITIV GEARS 9**

Spur gear - Terminology and definitions–Fundamental Law of toothed gearing and involute gearing–Interchangeable gears–gear tooth action – Terminology – Interference and undercutting–Non standard gear teeth– Helical, Bevel, Worm, Rack and Pinion gears (Basics only)–Gear trains–Parallel axis gear trains–Epicyclic gear trains.

**UNITV FRICTIONINDRIVES 9**

Surface contacts–Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches–Belt and rope drives, Friction aspects in Brakes.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rattan S.S | Theory of Machines | Tata McGraw–Hill, New Delhi | 2009 |
| 2 | Shigley J.E, Uicker J J | Theory of Machines and Mechanisms | McGraw–Hill, Inc, New York | 2011 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Thomas Bevan | Theory of Machines | CBS Publishers and Distributors, New Delhi | 2011 |
| 2 | Ghosh A, Mallick A.K | Theory of Mechanisms and Machines | Affiliated East–West Pvt. Ltd., New Delhi | 1994 |
| 3. | Rao J.S, DukkipatiR.V | Mechanics of Machines | Wiley–Eastern Ltd., New Delhi | 2007 |

**STANDARDS**

IS 2458 : 2001, Vocabulary of Gear Terms – Definitions Related to Geometry
IS 3756 : 2002, Method of Gear correction – Addendum modification for External Cylindrical Gears with Parallel Axes.
IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
IS 12328 : Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.
IS 12328 : Part 2: 1988 Bevel Gear Systems Part – 2 Spiral Bevel Gears

**15BEME406 ENGINEERING METROLOGY AND MEASUREMENTS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To provide knowledge on various Metrological equipments available to measure the dimension of the components.
2. To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.
3. To enrich the understanding of principles of measuring instruments and gauges
4. To give exposure to inspection of spur gear and thread elements.
5. To equip them with skills to linear measurements using various measuringinstruments
6. To give exposure toprocedures involved in erectingmachineries

**COURSE OUTCOMES**

Upon completion of this course, the students will able to

1. Understand the basics of measurements and qualitystandards.
2. Perform linear measurements using various measuringinstruments
3. Perform the geometrical measurements of variouscomponents
4. Measure the various dimensions of a screwthread
5. Measure the dimensions of the simple spurgear.
6. Know the procedures involved in erectingmachineries.

**UNITI CONCEPTOFMEASUREMENT 9**

General concept – Generalised measurement systems – units and standards–measuring instruments–sensitivity, readability, range of accuracy, precision–static and dynamic response–repeatability–systematic and random errors – correction, calibration, interchangeability – Basics of Measurement SystemAnalysis.

**UNITII LINEAR ANDANGULARMEASUREMENT 9**

Definition of metrology–Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, limit gauges– Comparators: Mechanical, pneumatic and electrical types,applications – Angular measurements: –Sine bar, auto-collimeter, angle Decker.

**UNITIII FORMMEASUREMENT 9**

Measurement of screw threads – Thread gauges, floating carriage micrometer–measurement of gears–tooth thickness – constant chord and base tangent method – Eccentricity Measurements – radius measurements–surface finish, straightness, flatness and roundness measurements.

**UNITIV LASER AND ADVANCESINMETROLOGY 9**

Precision instruments based on laser–Principles– laser interferometer–application in linear, angular measurements and machine tool metrology - Coordinate measuring machine (CMM) – computer aided inspection - Nano metrology, techniques and applications-TEM,SEM,STM,XRD,AFM.

**UNITV MEASUREMENT OF POWER, FLOW ANDTEMPERATURERELATED PROPERTIES 9**

Force, torque, strain:–mechanical and electrical type – Flow measurement: Venturi, orifice, rotometer, – Electrical pressure transducers, Temperature: Thermocouples, Resistance temperature detectors, bimetallic strip thermometers, thermister,pyrometry

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Jain R.K | Engineering Metrology | Khanna Publishers, Delhi | 2003 |
| 2 | Alan S. Morris | The Essence of Measurement | Prentice Hall of India, New Delhi | 1997 |
| 3 | N.V. Raghavendra and L. Krishnamurthy | Engineering Metrology and Measurements | Oxford University press of India | 2013 |

**15BEME406** **ENGINEERING METROLOGY AND MEASUREMENTS** **3 0 0 3100**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gupta S.V | Engineering Metrology | Dhanpat rai Publications, New Delhi | 2012 |
| 2 | Tayal A.K | Instrumentation and Mechanical Measurements | Galgotia Publications, New Delhi | 2013 |
| 3. | Beckwith T.G and N. Lewis Buck N | Mechanical Measurements | Addison Wesley, New york | 2007 |

**WEB REFERENCES**

1. www.tms.org
2. www.arci.res.in/
3. www.fbh–berlin.com
4. www.lasermetrology.com/
5. www.lasermetrology.com/

**15BEME411 STRENGTH OF MATERIALS AND METALLURGY LABORATORY 0 0 3 2100**

**COURSE OBJECTIVE**

1. To perform different destructivetesting
2. To learn the characteristicmaterials.
3. To understand the stress and strain relationship.
4. To determine the shear force for various materials.
5. To determine the impact load for various materials.
6. To determine the hardness for various materials

**COURSE OUTCOMES**

1. Ability to perform different destructivetesting
2. Ability to characteristicmaterials
3. Understand the stress and strain relationship.
4. Determine the shear force for various materials.
5. Determine the impact load for various materials.
6. Determine the hardness for various materials

**LIST OF EXPERIMENTS**

1. Tensile test on metals–stress straincharacteristics
2. Cupping test on metal sheets–load deformation characteristics, cupping load, cuppingnumber.
3. Hardness test on metals–Brinell and Rockwell Hardnesstests.
4. Impact test on metals–Charpy, Izod impacttests.
5. Shear test on metals–direct shear strength, single shear, doubleshear.
6. Tests on helical springs–compression, tension springs–load deformation characteristics, stiffness, shear stress, modulus of rigidity,energy.
7. Torsion test on beams–torque and angle of twist characteristics, shear stress, modulus of rigidity,energy.
8. Microscopic examination of i) Hardened samples ii) Hardened and temperedsamples.
9. Tempering – Improvement of Mechanical properties –Comparison for i) Unhardenedspecimen ii) Quenched specimen iii) Quenched and tempered specimen.
10. Study of low carbon steel and medium carbonsteel.

**TOTAL 45PERIODS**

**15BEME412 MANUFACTURING TECHNOLOGY LABORATORY 0 0 3 2100**

**COURSE OBJECTIVES**

1. To facilitate the understanding of shaping operation in shaper.
2. To provide practical knowledge on Preparing a flat and contour surface using milling machine.
3. To provide practical knowledge on Preparing holes with higher finish by Drilling / Tapping / Reaming.
4. To facilitate the understanding of surface and cylindrical grinding operations for surface finish.
5. To introduce single and multi-point cutting tools.
6. To impart knowledge on the operations in Capstan and Turret Lathe

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. Perform shapingoperation
2. Perform milling & slottingoperation
3. Perform drilling, tapping and reamingoperation
4. Perform grindingoperations
5. Work with tool grindingmachine
6. Work in a capstan and turretlathe

**LIST OF EXERCISES**

1. Exercises inshaping.
2. Exercises inMilling.
3. Exercises inslotting.
4. Exercises in Drilling / Tapping /Reaming.
5. Exercises in Surface grinding and cylindrical grindingprocess.
6. Exercises in Tool grinding – single point and multi pointtools.
7. Exercises in Capstan and TurretLathe.

**TOTAL 45PERIODS**

**15BEME451 PERSONALITYDEVELOPMENT 1 1 0 1100**

**COURSE OBJECTIVES**

1. To help students comprehend the role of listening skills in effective communication.
2. To familiarize students with verbal and non-verbal communication.
3. To expose students to neutral accent.
4. To develop emotional intelligence skills in them for enhancing their self-esteem.
5. To assist them in setting goals and developing positive attitude.
6. To enable students to acquire decision making skills, problem solving skills and assertive skills.

**COURSE OUTCOMES**

1. Equip students of engineering and technology with effective speaking, writing and listening and reading skills in English.
2. Develop their soft skills and inter personal skills, which will make the transition from college to workplace smoother and help them excel in their job.
3. Equip students of engineering and technology with group discussion and other recruitment exercises.
4. Use both verbal and non-verbal skills cohesively and develop confidence in participating in seminars, conferences, technical and extracurricular activities for lifelong learning.
5. Overall attitude of students will enhanced and know the social responsibilities.
6. Understand the importance of Human values for the betterment of society and nation.

**UNITI** **6**

Overview to communication, self Introduction, Presentation on their own topic, Extempore, Group Activity

**UNITII** **6**

Group Discussion, Do's and Don’ts of Group Discussion, Body language, Grooming and Resume, Resume correction

**UNITIII** **8**

Introduction to HR, HR questions and Do's and Don’t's in HR, HR Interview, Mock GD & HR, Stress Management

**TOTAL 20PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Agarwal.R.S | Quantitative Aptitude for Competitive Examinations | S.Chand Limited | 2011 |
| 2 | Abhijit Guha | Quantitative Aptitude for Competitive Examinations | Tata McGraw Hill | 2011 |
| 3 | Edgar Thrope | Test Of Reasoning for Competitive Examinations | Tata McGraw Hill, 4th Edition | 2012 |

## SEMESTER V

**15BEME501 HEATPOWERENGINEERING 3 0 0 3100**

### COURSE OBJECTIVES

1. To incorporate the concepts and laws in thermodynamic analysis of cyclicprocesses.
2. To impart the mechanisms of combustion offuels.
3. To apply the thermodynamic concepts in steam turbines andnozzles.
4. To learn about the performance ofcompressors.
5. To understand the concept of cogeneration and waste heat recovery in engineeringapplications.
6. To introduce concepts of refrigeration and air conditioning in engineeringapplications

### COURSE OUTCOMES

Learners should be able to

1. Calculate the efficiency of various gas powercycles.
2. Calculate the performance characteristics ofengines.
3. Analyze combustion mechanism in ICengines.
4. Evaluate the characteristic of steam turbines andnozzles.
5. Evaluate the performance characteristics ofcompressors.
6. Identify and utilize the concepts of refrigeration and air conditioning in engineeringapplications

**UNITI GAS POWER CYCLES ANDICENGINES 9**

Otto, Diesel, Dual, Brayton cycles – Calculation of mean effective pressure and air standard efficiency – actual and theoretical PV and TS diagrams of two stroke and four stroke engines–valve timing diagram and port timing diagram – calculation of engine performance, heat balance sheet, retardation – Morse test.

**UNITII BOILER AND STEAMPOWERCYCLES 9**

Generation of steam, Boiler–Classification, fire tube boiler, water tube boiler, comparison, boiler mountings and accessories, performance of steam boilers – dryness fraction, properties of steam, T–S diagram, Mollier diagram, steam tables, Rankine Cycle – incomplete evaporation – superheated steam –modified cycle.

**UNITIII STEAM NOZZLES ANDSTEAM TURBINES 9**

Steam nozzles – flow through steam nozzles, effect of friction, critical pressure ratio, super saturated flow – Steam turbines– impulse and reaction turbine, compounding, velocity diagram, condition for maximum efficiency – multi stage turbines, cycles with reheating and regenerating heating – reheat factor, degree of reaction - governing of turbines.

**UNITIV AIRCOMPRESSORS 9**

Classifications of compressors – Reciprocating air compressor – performance characteristics, effect of clearance volume, free air delivery and displacement, intercooler, after cooler – Rotary compressor – vane type, centrifugal and axial, flow performancecharacteristics.

**UNITV REFRIGERATION ANDAIRCONDITIONING 9**

Fundamentals of refrigeration – COP – Vapour compression refrigeration system – cycle, p–h chart, Vapour absorption system – comparison, properties of refrigerants. Fundamentals of air conditioning system, cycle, controls, air handling and distribution, simple cooling and heat load estimation

**TOTAL 45PERIODS**

*(Permitted to use standard thermodynamic table, Mollier diagram, Psychometric chart and Refrigeration property table in the examination)*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rajput R.K | Thermal Engineering, Sixth edition | Laxmi Publications, New Delhi | 2010 |
| 2 | Arora C.P | Refrigeration and Air conditioning | Tata McGraw–Hill, New Delhi | 2010 |

**REFERENCES**

## SEMESTER V

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kothandaraman C.P, and DomkundwarA.V | A course in Thermal Engineering, Fifth Edition | Dhanpat Rai and Sons, Delhi | 2006 |
| 2 | Ganesan V | Internal Combustion Engines | Tata McGraw–Hill, New Delhi | 2008 |
| 3. | Yunus A Cengel | Thermodynamics' An Engineering Approach | Tata McGraw Hill, New Delhi | 2008 |

**WEB REFERENCES**

1. www.kruse–ltc.com
2. www.grc.nasa.gov
3. www.poweronsite.org
4. www.machinerylubrication.com
5. www.tpub.com

**15BEME502 DESIGN OF MACHINE ELEMENTS 3 2 0 4100**

**COURSE OBJECTIVES**

1. To understand the various types of stresses induced in different machine members.
2. To Study and acquire knowledge on design shaft and couplings for effective transmission of power.
3. To study the features of welded joints and fasteners required for various industrial applications.
4. To give exposure to design springs and flywheels for various engineering applications.
5. To understand the importance design bearings and levers for engineering applications.
6. To make the students conversant to implement design procedure for designing a machine.

**COURSE OUTCOME**

Upon completion of this course, the students will be able to

1. Determine various types of stresses induced in different machine members.
2. Design shaft and couplings for effective transmission of power.
3. Select the type of welded joints and fasteners required for various industrial applications.
4. Design springs and flywheels for various engineering applications.
5. Design bearings and levers for engineering applications.
6. Implement design procedure for designing a machine.

**UNITI STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9 + 3**

Introduction to the design process – factors influencing machine design, selection of materials based on mechanical properties – Factor of safety. Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame – theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

**UNITII DESIGN OF SHAFTSANDCOUPLINGS 9 + 3**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and keyways – Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings – design of knuckle joints.

**UNITIII DESIGN OF FASTENERS ANDWELDEDJOINTS 9 +3**

Threaded fasteners – Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures – theory of bonded joints.

**UNITIV DESIGN OF SPRINGS ANDFLYWHEEL 9 +3**

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs – Belleville springs – Design of flywheels involving stresses in rim and arm.

**UNITV DESIGN OF BEARINGSANDLEVERS 9 + 3**

Selection of bearings – sliding contact and rolling contact types – Cubic mean load – Selection of journal bearings – McKees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of Levers.

**TOTAL 45 + 15 = 60PERIODS**

*(Permitted to use PSG design data book in the examination)*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Juvinall R.C and Marshek K.M | Fundamentals of Machine Component Design Third Edition | John Wiley and Sons, New Delhi | 2011 |
| 2 | Bhandari V.B | Design of Machine Elements | Tata McGraw–Hill Book Co, New Delhi | 2010 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Norton R.L | Design of Machinery | Tata McGraw–Hill Book Co., New Delhi | 2004 |
| 2 | Orthwein W | Machine Component Design | Jaico Publishing Co., New Delhi | 2003 |
| 3. | Ugural A.C | Mechanical Design – An Integral Approach | McGraw–Hill Book Co., New York | 2004 |
| 4 | Spotts M.F, ShoupT.E | Design and Machine Elements | Pearson Education, New Delhi | 2004 |


**WEB REFERENCES:**

1. www.roymech.co.uk
2. www.ncbi.nlm.nih.gov
3. www.engineersedge.com
4. www.bearings.machinedesign.com
5. www.efunda.com

**15BEME503 AUTOMOBILE ENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To make the student acquire sound knowledge on the types of vehicle structures, cooling and lubrication systems required.
2. To acquaint the student with the concepts of type of engines to be used for modern automobiles.
3. To familiarize the students to Distinguish between the manual transmissions systems with automatic transmission systems.
4. To provide knowledge on appropriate transmission systems for the optimal power transmission.
5. To provide knowledge on steering, brakes and suspension systems for effective functioning.
6. To acquaint the student with advanced technologies in automotive Engineering.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. Identify the types of vehicle structures, cooling and lubrication systems required.
2. Determine the type of engines to be used for modern automobiles.
3. Distinguish between the manual transmissions systems with automatic transmission systems.
4. Select appropriate transmission systems for the optimal power transmission.
5. Select steering, brakes and suspension systems for effective functioning.
6. Implement the advanced technologies in automotive.

**UNITI AUTOMOBILE ARCHITECTUREANDPERFORMANCE 9**

Automotive components, subsystems and their positions – Chassis, frame and body, front, rear and four wheel drives – Operation and performance – Traction force and traction resistance, Power required for automobile– Rolling, air and gradient resistance.

**UNITII TYPES OFENGINES 9**

Types of engines – multi valve engine – in–line engine, vee–engine, Petrol engine–direct – single point and multipoint injection, diesel engine–common rail diesel injection, supercharging and turbo charging –

alternate fuels–ethanol and ethanol blend, compressed natural gas, fuel cells, hybrid vehicles.

**UNITIII TRANSMISSIONSYSTEMS 9**

Clutch : Types – coil spring and diaphragm type clutch, single and multi plate clutch, centrifugal clutch, Gear box : Types – constant mesh, sliding mesh and synchromesh gear box, layout of gear box, gear selector and shifting mechanism, overdrive, automatic transmission, Propeller shaft, universal joint, slip joint, differential and real axle arrangement, hydraulic coupling.

**UNITIV WHEEL AND TYRES ANDSUSPENSIONSYSTEM 9**

Types of wheels, construction, wired wheels, Tyres– construction, Radial, bias and belted bias, slip angle, Tread patterns, Tyre retreading - cold and hot, Tubeless tyres, Types–front and rear suspension, conventional and independent type suspension, leaf springs, coil springs, dampers, torsion bars, stabilizer bars, arms, air suspension systems – Balancing of Wheels.

**UNITV STEERING SYSTEM ANDBRAKINGSYSTEM 9**

Types of steering systems, Ackermann principle, Davis steering gear, steering gear boxes, steering linkages, power steering, wheel geometry–caster, camber, toe–in, toe out etc., wheel Alignment. Braking System – Forces on vehicles, tyre grip, load transfer, braking distribution between axles, stopping distance, Types of brakes, Mechanical, Hydraulic, Air brakes, Disc and Drum brakes, Engine brakes and Anti lock braking system.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gupta R.B | Automobile Engineering | Laxmi Publications, Chennai | 2004 |
| 2 | Kirpal Singh | Automobile Engineering Vol–I and II | Standard publishers, Delhi | 2007 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Julian Happian Smith | An introduction to modern vehicle design | Butterworth Heinemann, New Delhi | 2002 |
| 2 | Crouse W H | Automotive transmissions and power trains | McGraw–Hill International Editions, New Delhi | 1976 |
| 3. | Heniz Heisler | Vehicle and Engine Technology | Society of Automotive Engineers | 2002 |


**WEB REFERENCES:**


1. http://en.wikipedia.org/wiki/Automotive_engineering
2. http://www.animatedengines.com/
3. http://www.automotive–online.com/transmission–system/
4. http://www.rqriley.com/suspensn.htm
5. http://en.wikipedia.org/wiki/Transmission_(mechanics)

**COURSE OBJECTIVES**

1. To provide knowledge on the static and dynamic forces in various mechanisms.
2. To study the features of determine the rotating masses in dynamic balancing.
3. To familiarize the students to understand free and forced vibration for practical applications.
4. To understand the importance torsional vibrations in mechanical components.
5. To explain principles and mechanisms used for speed control and stability control.
6. To impart knowledge on type of governors and gyroscopes for different applications

**COURSE OUTCOMES**

1. Analyze the static and dynamic forces in various mechanisms.
2. Determine the rotating masses in dynamic balancing.
3. Calculate free and forced vibration for practical applications.
4. Analyze torsional vibrations in mechanical components.
5. Understand the principles in mechanisms used for speed control and stability control.
6. Select the type of governors and gyroscopes for different applications.

**UNITI FORCEANALYSIS 9 +3**

Rigid Body dynamics in general plane motion – Equations of motion – Dynamic force analysis – Inertia force and Inertia torque – D'Alemberts principle – The principle of superposition – Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses – Bearing loads – Crank shaft Torque – Turning moment diagrams – Fly wheels.

**UNITII BALANCING 9 +3**

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder Engine – Balancing Multi–cylinder Engines – Partial balancing in locomotive Engines.

**UNITIII FREEVIBRATION 9 +3**

Basic features of vibratory systems – idealized models – Basic elements and lumping of parameters – Degrees of freedom – Single degree of freedom – Free vibration – Equations of motion – natural frequency – Damping Types of Damping – Damped vibration, critical speeds of simple shaft.

**UNITIV FORCED VIBRATION ANDTORSIONALVIBRATION 9 +3**

Response to periodic forcing – Harmonic Forcing – Forcing caused by unbalance – Support motion – Force transmissibility and amplitude transmissibility – Vibration isolation.

Torsional systems; Natural frequency of free torsional vibrations, Natural frequency of two and three rotor systems.

**UNITV MECHANISMSFORCONTROL 9 + 3**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling Force – other Governor mechanisms.

Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes

**TOTAL 45 + 15 = 60PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rattan S.S | Theory of Machines | Tata McGraw–Hill Publishing Company Ltd., New Delhi | 2009 |
| 2 | Shigley J.E, UickerJ.J | Theory of Machines and Mechanisms | McGraw–Hill, New York | 2011 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rao J.S., DukkipatiR.V | Mechanism and Machine Theory | Wiley– Eastern Limited, New Delhi | 2007 |
| 2 | John Hannah and Stephens R.C | Mechanics of Machines | Viva Books Pvt Ltd | 2005 |
| 3. | Thomas Bevan | Theory of Machines | CBS Publishers and Distributors, New Delhi | 2011 |

**WEB REFERENCES**

1. http://freevideolectures.com/Course/2364/Dynamics–of–Machines
2. http://en.wikipedia.org/wiki/Balancing_of_rotating_masses
3. http://www.efunda.com/formulae/vibrations/sdof_free_damped.cfm
4. http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html

**15BEME5E - - DEPARTMENT ELECTIVE I 3 0 0 3100**

**15BEME511 SCIENTIFICCOMPUTINGLABORATORY 2 0 2 3100**

**COURSE OBJECTIVES:**

1. The objective of this course is to familiarize the students with statistical techniques.
2. To find the solutions for transcendental equations using different methods
3. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.
4. To introduce students to numerical methods used to solve engineering problems.
5. Fundamentals of numerical methods/algorithms to solve systems of different mathematical equations (e.g. linear/ non-linear algebraic equations, ordinary /partial differential equations), will be introduced.
6. The course would enable students to write their own computer programs using programming languages like C and software like Excel.

**COURSE OUTCOMES:**

1. To solve engineering problems involving Linear and non-linear equations.
2. Hands-on experience will be provided to apply these computer programs to solve problems in different areas of engineering.
3. To acquire skills in handling situations involving linear/ non-linear algebraic equations, ordinary /partial differential equations
4. To solving actual engineering problems through computer programming and coding.
5. To solve ordinary and partial differential equations using programming languages like C and software like Excel.
6. Student will understand procedure-oriented Excel concepts. Student will be capable of writing C and Excel programs efficiently.

**LIST OF EXPERIMENTS**

1. Finding solution of Transcendentalequation
   i) Newton – RaphsonMethod
   ii) Bisectionmethod
   iii) Iterative method by reducing the equation to the form x=f(x)

2. Finding the dominant eigenvalue and eigenvector by powermethod

3. Numericalintegration
   i) Gauss 2 point and 3 pointformulae
   ii) Trapezoidal method
   iii) Simpson's 1/3rule

4. Solution of initial value problems governed byODE
   i) Runge - Kutta $4^{th}$ ordermethod
   ii) Modified Euler'smethod
   iii) Milne'smethod
   iv) Adam – Bashforthmethod

5. Solution of BVP governed byPDE
   i) LaplaceEquation
   ii) One – dimensional heatequation
      a) Explicit method : Bender – Schmidt'smethod
      b) Implicit method : Crank - Nicolson'smethod
   iii) One dimensional wave equation Implicitmethod

**TOTAL 30 + 30 = 60PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Curtis F. Gerald and Patrick O. Wheatley | Applied Numerical Analysis | Pearson Education, South Asia | 2009 |
| 2 | Steven C. Chapra, Raymond P. Canale | Numerical Methods for Engineers | McGraw - Hill Pub. Co. Ltd | 2014 |

## 15BEME512 DYNAMICS AND METROLOGY LABORATORY 0 0 3 2100

**COURSE OBJECTIVES**

1. To Understand the working of various governors.
2. To introduce jump speed and profile of the cam
3. To understand the importance of moment of inertia by oscillation method for connecting rod and flywheel.
4. To introduce the concepts to Characterize and calibrate measuring devices.
5. To expose students to measuring taper angle straightness, flatness, surface finfish and thread parameters.
6. To explain the limits of dimensional tolerances using comparators

**COURSE OUTCOMES**

1. Understand the working of various governors.
2. Determine of jump speed and profile of the cam
3. Determine moment of inertia by oscillation method for connecting rod and flywheel.
4. Characterize and calibrate measuring devices.
5. Measure taper angle straightness, flatness, surface finfish and thread parameters.
6. Examine the limits of dimensional tolerances using comparators.

**LIST OF EXPERIMENTS**

**DYNAMICS**

1. Governors–Determinationofsensitivity,effort,etc.forWatt,Porter,Proell,andspringcontrolled Governors
2. Cam – Determination of jump speed and profile of the cam.
3. Motorized Gyroscope–Verification of laws –Determination of gyroscopiccouple.
4. Whirling of shaft–Determination of critical speed of shaft with concentratedloads.
5. Balancing of rotating and reciprocatingmasses.
6. Determination of moment of inertia by oscillation method for connecting rod andflywheel.
7. Vibrating system – spring mass system – Determination of damping co–efficient of single degree of freedomsystem
8. Determination of torsional frequencies for compound pendulum and flywheel system withlumped moment ofinertia.
9. Transverse vibration –free– Beam. Determination of natural frequency and deflection ofbeam.
10. Strain gauge measurementsystem.

**METROLOGY**

1. Calibration of Vernier / Micrometer / Dialgauge
2. Checking dimensions of part using slipgauges
3. Measurement of gear tooth dimensions – addendum, dedendum, pitch circle diameter and tooththickness
4. Measurement of taper angle using sine bar / tool makers microscope
5. Measurement of straightness andflatness
6. Measurement of threadparameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic /Electrical)
8. Surface finish measurement

**TOTAL 45PERIODS**

**15BEME513 THERMAL ENGINEERINGLABORATORY–I 0 0 3 2100**

**COURSEOBJECTIVES**

1. Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/ steamturbines.
2. To appreciate concepts learnt in fundamental laws of thermodynamics.
3. To learn ideas how to sustain in energy crisis and think beyond curriculum in the field of alternative and renewable sources of energy.
4. To communicate effectively the concepts of internal combustion engines.
5. To make the students to prepare them to carry out experimental investigation and analysis at later stages of graduation.
6. To make the students to think beyond curriculum in alternative sources of energy.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. conduct experiment on IC engine to study the characteristic and performance of ICEngine
2. conduct experiment to find the thermo physical properties of givenfluid.
3. Understand the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.
4. Can formulate power production based on the fundamental laws of thermal engineering.
5. Understand instill upon to envisage appropriate experiments related to heat engines.
6. Understand and investigate the effectiveness of energy conversion process in mechanical power generation for the benefit of mankind.

**LIST OF EXPERIMENTS**

1. Valve Timing and Port TimingDiagrams.
2. Performance Test on 4–stroke DieselEngine.
3. Heat Balance Test on 4–stroke DieselEngine.
4. Load test on 4–stroke DieselEngine.
5. Morse Test on multicylinder PetrolEngine.
6. Retardation Test to find Frictional Power of a DieselEngine.
7. Determination of Viscosity – Red WoodViscometer.
8. Determination of Flash Point and FirePoint.
9. Study of Steam Generators andTurbines.
10. Performance and energy balance test on a steamgenerator

**TOTAL 45PERIODS**

**15BEME551 IN–PLANTTRAINING - - - 1100**

## COURSE OBJECTIVES

1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

## COURSE OUTCOMES

1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

Students will undergo industrial training for four weeks during the vacation at the end of IV semester and a report with the training completion certificate from the industry will be subsequently submitted to the department with in a week after completion. Viva – Voce exam will be conducted at the end of V semester and 100 marks will be awarded.

## 15BEME552 GEOMETRICAL DIMENSIONINGANDTOLERANCE 1 1 0 1100

### COURSE OBJECTIVES

1. To understand the concepts of geometrical dimensioning andTolerancing
2. To study the physical importance of them in industrial point ofview
3. To know the various types of Tolerancing, its measurement anddesign.
4. To translate geometric callouts into plain English with one meaning.
5. To explain the major rules found in ASME Y14.5-2009
6. To understand the hierarchy of geometric tolerancing.

### COURSE OUTCOMES

1. Ability to learn and apply geometric dimensioning and tolerance standards to communicate designintent
2. Ability to Learn how the knowledge of certain processes can affect part design anddocumentation
3. Gain added insight on working in a team designenvironment.
4. Translate geometric callouts into plain English with one meaning.
5. Explain the major rules found in ASME Y14.5-2009
6. Understand the hierarchy of geometric tolerancing.

**UNITI INTRODUCTION TO GDANDT** **6**

Introduction to Geometric dimensioning and Tolerancing – working of geometric system – Terms and definitions – Common symbols and Terminology – Fundamental Rules (Drawing)– Feature definition – With Size and Without Size – Material Condition (Maximum, Least, Regard of Material Condition)– Limit Tolerancing – Dimension Origin –Limits of Size, Rule 1 or Envelope Principle – Go– No Go Gauges.

**UNITII FORM ANDORIENTATIONTOLERANCE** **6**

and design considerations – Flatness and Circularity measurement concepts – Orientation tolerance specification and application design.

**UNITIII POSITION ANDRUNOUTTOLERANCE** **8**

Profile of surface and line tolerance design and application – Location tolerance, Position, applied and material condition consideration – Coaxial controls and design – Concentricity, Symmetry – Measurement and application – Design considerations – Position, Composite tolerance concept, design and Measurement – Runout, Total Runout tolerances – Measurement and considerations.

**TOTAL 20PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Siddeshwar and Kanniah | Machine Drawing | Tata McGraw Hill | 2001 |
| 2 | Gopalakrishna, K.R | Machine Drawing | , Subhas Stores | 2002 |
| 3. | Wade. O | Tolerance Control in design and manufacturing | Industrial Press | 1972 |

**WEB REFERENCE**

1. IS :10714,10715,10716,10717,11669,10719,813,919,2709,8000 pt 1 to 10721,11158 andAWS/ISO

## SEMESTER VI

**15BEME601 OPERATIONSRESEARCH 3 1 0 4100**

**COURSE OBJECTIVE**

1. To Formulate and solve engineering and managerial situations as LPP.
2. To understand the Engineering and Managerial situations in Transportation.
3. To Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
4. To give exposure to inventory in industry.
5. To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
6. To provide an overview of various tools in various sections of industries like marketing, material handling etc.

**COURSE OUTCOMES**

At the end of the course, student will be able to understand the

1. Formulate and solve engineering and managerial situations as LPP.
2. Solve Engineering and Managerial situations in Transportation.
3. Give Engineering and Managerial solutions in Assignment and scheduling problems.
4. Manage inventory in industry.
5. Select better sequence to perform operation among various alternatives.
6. Apply the various tools in various sections of industries like marketing, material handling etc.

**UNITI INTRODUCTION TOOPERATIONSRESEARCH 9 +3**

Operations research and decision–making – types of mathematical models and constructing the model – Role of computers in operations research –Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, graphical method, simplex method – The Big –M method – the two–phase method.

**UNITII TRANSPORTATIONPROBLEMS 9 + 3**

Least cost method, North west corner rule, Vogel's approximation method, modified distributionmethod, optimization models, unbalance and degeneracy in transportation model.

**UNITIII ASSIGNMENT MODELSANDSCHEDULING 9 +3**

Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case in assignment problems, traveling salesman problem. Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing two jobs through 'm' machines, processing n jobs through m machines.

**UNITIV INVENTORY CONTROL ANDQUEUINGTHEORY 9 +3**

Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi item deterministic model.

Queuing Models: Queues – Notation of queues, performance measures, The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns.

**UNITV PROJECT MANAGEMENT, GAME THEORY,REPLACEMENTMODELS 9 +3**

Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing – Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

**TOTAL 45 + 15 = 60PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kanti Swarup, Gupta P.K and Manmohan | Operations Research | Sultan Chand and Sons, New Delhi | 2008 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Viswanathan N and Narahari Y | Performance Modeling of Automated Manufacturing Systems | Prentice Hall Inc, Newyork | 2000 |
| 2 | Prem kumar Gupta and Hira D.S | Operation Research | S Chand and Company Limited, New Delhi | 2008 |

**WEB REFERENCES**

1. http://www.scienceofbetter.org/what/index.htm
2. http://www.informs.org/Pubs/OR
3. http://www.me.utexas.edu/~jensen/ORMM/models/unit/network/subunits/special_cases/transportation.html
4. http://www.projectmanagement.com/

**15BEME602 DESIGN OF TRANSMISSION SYSTEMS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To Study and acquire knowledge on design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. To Study and acquire knowledge on design spurs and parallel axis helical gears.
3. To give exposure to dimensions for bevel and worm gears.
4. To provide an overview of design procedures of gear boxes for industrial applications.
5. To provide an overview of clutches and brakes for engineering applications.
6. To make the student acquire sound knowledge of mechanical system

**COURSE OUTCOMES**

Upon completion of this course, the students will able to

1. Design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. Design spurs and parallel axis helical gears.
3. Estimate the dimensions for bevel and worm gears.
4. Practice the design procedures of gear boxes for industrial applications.
5. Design clutches and brakes for engineering applications.
6. Design a mechanical system

**UNITI DESIGN OF TRANSMISSION SYSTEMS FORFLEXIBLEELEMENTS 9**

Design of V belts and pulleys – Selection of Flat belts and pulleys – Wire ropes and pulleys – Selection of Transmission chains and Sprockets – Design of sprockets.

**UNITII DESIGN OF SPUR ANDHELICALGEARS 9**

Gear Terminology – Speed ratios and number of teeth–Force analysis – Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Module and Face width–power rating calculations based on strength and wear considerations – Parallel axis Helical Gears – Pressure angle in the normal and transverse plane– Equivalent number of teeth–forces and stresses – Estimating the size of the helical gears.

**UNITIII DESIGN OF BEVEL ANDWORMGEARS 9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits– terminology – Thermal capacity, materials–forces and stresses, efficiency, estimating the size of the worm gear pair – Cross helical: Terminology–helix angles–Estimating the size of the pair of cross helical gears.

**UNITIV DESIGN OFGEARBOXES 9**

Geometric progression – Standard step ratio – Ray diagram, kinematics layout –Design of sliding mesh gear box –Constant mesh gear box. – Design of multi speed gear box.

**UNITV DESIGN OF CLUTCHESANDBRAKES 9**

Design of plate clutches –axial clutches–cone clutches–internal expanding rim clutches–internal and external shoe brakes.

**TOTAL 45PERIODS**

*(Permitted to use PSG design data book in the examination)*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | JuvinallR. C, MarshekK.M | Fundamentals of Machine component Design | John Wiley and Sons., London | 2011 |
| 2 | Bhandari, V.B | Design of Machine Elements | Tata McGraw–Hill Publishing Company Ltd, New York | 2010 |

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| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Maitra G.M., Prasad L.V | Hand book of Mechanical Design | Tata McGraw–Hill, New Delhi | 2009 |
| 2 | Shigley J.E, Mischke C.R | Mechanical Engineering Design | McGraw–Hill International Editions, New Delhi | 2011 |
| 3 | Prabhu. T.J | Design of Transmission Elements | Mani Offset, Chennai | 2002 |


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1. http://en.wikipedia.org/wiki/Gear
2. http://www.physicsforums.com/showthread.php?t=292163
3. http://www.seminarprojects.com/Thread–design–and–fabrication–of–gearbox–full–report
4. http://www.cs.cmu.edu/~rapidproto/mechanisms/chpt6.htm

**15BEME603 HEAT AND MASS TRANSFER 3 1 0 4100**

**COURSE OBJECTIVES**

1. To Study and acquire knowledge on heat transfer for conduction.
2. To introduce the concepts of heat transfer coefficients for natural and forced convection for different fluid flows.
3. To understand the performance of heat exchanger.
4. To study the features of radiation heat transfer between the surfaces.
5. To give exposure to mass transfer.
6. To make the students conversant to solve complex problems where heat and mass transfer takes place.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. Determine the rate of heat transfer for conduction.
2. Evaluate heat transfer coefficients for natural and forced convection for different fluid flows.
3. Analyze performance of heat exchanger.
4. Estimate the radiation heat transfer between the surfaces.
5. Calculate the coefficient of mass transfer.
6. Solve complex problems where heat and mass transfer takes place.

**UNITI CONDUCTION 9 +3**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of HeislersChart.

**UNITII CONVECTION 9 +3**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders andSpheres.

**UNITIII PHASE CHANGE HEAT TRANSFER ANDHEATEXCHANGERS 9 +3**

Nusselts theory of condensation–pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors.

**UNITIV RADIATION 9 +3**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation - Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

**UNITV MASS TRANSFER 9 +3**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations

**TOTAL 45 + 15 = 60PERIODS**

*(Permitted to use standard Heat and Mass Transfer Table in the examination)*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Sachdeva R.C | Fundamentals of Engineering Heat and Mass Transfer | New Age International, New Delhi | 2010 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Frank P. Incropera and David P. DeWitt | Fundamentals of Heat and Mass Transfer | John Wiley and Sons, New Delhi | 2011 |
| 2 | OzisikM.N | Heat Transfer | McGraw–Hill Book Co, New Delhi | 1994 |
| 3 | KothandaramanC.P | Fundamentals of Heat and Mass Transfer | New Age International, New Delhi | 2012 |


**WEB REFERENCES**


1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IISc–BANG/Heat%20and%20Mass%20Transfer/New_index1.html
2. http://www.learnerstv.com/Free–Engineering–Video–lectures–ltv084–Page1.htm
3. http://en.wikipedia.org/wiki/Heat_transfer

**15BEME604 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT 3 0 0 3100**

**COURSE OBJECTIVE**

1. To give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam power plant.
3. To make the student acquire sound knowledge of working of nuclear and hydel power plant.
4. To study the features of gas turbine power plant.
5. To make the student acquire sound knowledge of economics of the power plant.
6. To make the student acquire sound knowledge on renewable energy technologies and availability.

**COURSE OUTCOME**

1. Select the accessories and layout required for a steam power plant depending upon the requirements.
2. Compute performance of steam power plant.
3. Explain the working of nuclear and hydel power plant.
4. Compute performance of gas turbine power plant.
5. Calculate the economics of the power plant.
6. Apply appropriate type of renewable energy technologies depending upon the application and availability.

**UNIT1 FUNDAMENTALS OFENGINEERINGECONOMICS 9**

Introduction to Engineering Economics – Definition, Scope and Significance – Demand and supply analysis – Definition – Law of Demand – Elasticity of Demand – Demand Forecasting – Supply – Law of supply – Elasticity of Supply.

**UNITII COMMERCIALBANKING 9**

Law of contracts, negotiable instruments, its types and regulations there on – New Industrial Policy – MSME sector – Development financial institutions and their relevance – Export Promotion - DICGC, ECGCI, EXIM Bank - Import and export concepts - Letter of credit, forward contracts / hedging.

**UNITIII CAPITALMARKET 9**

Stock Exchanges – Functions – Listing of Companies – Role of SEBI – Capital Market Reforms. Money and banking - Money – Functions –Inflation and deflation – Commercial Bank and its functions – Central bank and its functions.

**UNITIV FINANCIALCONCEPTS 9**

Introduction, scope and objectives of basic financial concepts – time value of money – Interest - simple & compound interest, annuity and effective rate of interests. Appraisal of project for profitability, internal rate of return – payback period – net present value. NPV comparison – cost benefit analysis. Sources of finance – internal and external.

**UNITV COST ANALYSIS AND BREAKEVENANALYSIS 9**

Cost analysis - Basic cost concepts – FC, VC, TC, MC – Cost output in the short and long run. Depreciation - meaning – Causes – Methods of computing Depreciation (simple problems in Straight Line Method, Written Down Vale Method). Meaning – Break Even Analysis - Managerial uses of BEA.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | RamachandraAryasri V. V.RamanaMurthy | Engineering Economics & Financial Accounting | Tata McGraw Hill,–,New Delhi | 2007 |
| 2 | Varshney R. L., and K.L Maheshwari | Managerial Economics | Sultan Chand & Sons, New Delhi | 2001 |

## 15BEME604 ENGINEERING ECONOMICS AND FINANCIAL 3 0 0 3100

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | M.L.Jhingan | Principles of Economics | Konark Publications | 2010 |
| 2 | Prasanna Chandra | Fundamentals of Financial Management | Tata McGraw Hill, New Delhi. | 2007 |
| 3 | D.M.Mithani | Money, Banking, International Trade & Public Finance | Himalaya Publishing House | 2004 |

**WEB REFERENCES**

1. http://economictimes.indiatimes.com
2. http://www.economist.com/
3. http://www.managementstudyguide.com/financial-management.htm

**15BEME6E - - DEPARTMENT ELECTIVE II 3 0 0 3100**

**15BEME6E -- DEPARTMENTELECTIVEIII 3 0 0 3100**

**15BEME611 COMPUTER AIDED MODELINGANDSIMULATION LABORATORY 0 0 3 2100**

**COURSE OBJECTIVE**

1. To gain practical experience in handling 2D drafting and 3D modeling softwaresystems.
2. To impart training on SOLID WORKS for modelling
3. To provide knowledge on assembly ofcomponents
4. To facilitate the understanding of manufacturing drawings from the modelscreated
5. To understand the importance of MAT Lab for simulating different systems
6. To acquaint the student with the concepts of mat lab for performing various mathematical operations

**COURSE OUTCOME**

Upon completion of this course, the students can able to

1. use computer and CAD software's for modeling of mechanicalcomponents
2. use various options in SolidWorks for modeling of givencomponents
3. create assembly ofcomponents
4. prepare manufacturing drawings from the modelscreated
5. Use MAT Lab for simulating different systems like hydraulic and pneumaticcircuits
6. Use mat lab for performing various mathematicaloperations

**COMPUTER AIDED DESIGN**

1. 3D modeling of various machine elements using various options like protrusion, cut,sweep, draft, loft, blend,rib.
2. Assembly – creating assembly from parts – assemblyconstraints
3. Conversion of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning.
4. Introduction to SurfaceModeling.
5. Introduction to File Import, Export – DXF, IGES, STL,STEP

**Note:** Any one of the 3D MODELING software's like SOLIDWORKS, CREO, CATIA, NX Software, AutoCADetc.

***COMPUTER AIDED SIMULATION***

1. Simulation of Air conditioning system with condenser temperature and evaporatortemperatures as input to get COP usingSoftware
2. Simulation of Hydraulic / Pneumatic cylinder usingSoftware
3. Simulation of cam and follower mechanism usingSoftware
4. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and twovariables
5. Use of MATLAB to solve simple problems invibration

**TOTAL 45PERIODS**

**15BEME612 THERMAL ENGINEERING LABORATORY II 0 0 3 2100**

**COURSE OBJECTIVE**

1. To ability to conduct experiment on IC engine to study the characteristic and performance of IC design/ steamturbines.
2. To apply Fourier's law to validate the theoretical over all heat transfer coefficient.
3. To apply Stefan-Boltzmann law of radiation and emissivity relation.
4. To determine thermal properties of material by applying 1-D steady state heat transfer equation.
5. To apply non-dimensional numbers to evaluate and validate heat transfer parameters.
6. To ability to understand and solve conduction, convection and radiation problems.

**COURSE OUTCOME**

1. Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/ steamturbines.
2. Apply Fourier's law to validate the theoretical over all heat transfer coefficient.
3. Apply Stefan-Boltzmann law of radiation and emissivity relation.
4. Determine thermal properties of material by applying 1-D steady state heat transfer equation.
5. Apply non-dimensional numbers to evaluate and validate heat transfer parameters.
6. Ability to understand and solve conduction, convection and radiation problems.

**LIST OF EXPERIMENTS HEAT TRANSFER**

1. Heat transfer through a compositewall
2. Thermal conductivity measurement by guarded platemethod
3. Natural convection heat transfer from a verticalcylinder
4. Heat transfer from pin–fin (natural and forced convectionmodes)
5. Effectiveness of Parallel/counter flow heatexchanger
6. Determination of Stefan–Boltzmannconstant
7. Determination of emissivity of a greysurface

**REFRIGERATION AND AIR CONDITIONING**

1. Performance test on single/two stage reciprocating aircompressor.
2. Determination of COP of a refrigerationsystem
3. Experiments on air–conditioningsystem

**TOTAL 45PERIODS**

**15BEME651 MINIPROJECT 0 0 2 1100**

**COURSE OBJECTIVE**

1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

**COURSEOUTCOMES**

1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL 30PERIODS**

**15BEME652 TECHNICALPRESENTATION 1 1 0 1100**

**COURSE OBJECTIVES**

1. To equip the students with effective technicalpresentation
2. To understand the barriers and bridges tocommunication
3. To improve the public speaking capabilities, body language andposture.
4. To improve the literature survey skill.
5. To develop presentation skill using power point presentation
6. To improve skill to face viva voce examination.

**COURSE OUTCOMES**

1. Develop the ability to fabrication skill.
2. Ability to make literature review till the successful solution.
3. Ability to identify specific problems.
4. Gain the knowledge about data collection and conducting experiments.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

**TOTAL 20PERIODS**

## SEMESTER VII

## 15BEME701 PROFESSIONAL ETHICS, PRINCIPLESOFMANAGEMENT AND ENTREPRENEURSHIPDEVELOPMENT 3 0 0 3100

**COURSE OBJECTIVE**

1. To understand objectives, Strategies, Policies and Plan.
2. To introduce pans by directing and controlling.
3. To Understand the need of Engineering Ethics.
4. To Understand the forces that shape culture.
5. To develop the entrepreneurial skills.
6. To make the students conversant to execute an engineering plan with ethics.

**COURSE OUTCOME**

1. Prepare objectives, Strategies, Policies and Plan.
2. Execute plans by directing and controlling.
3. Understand the need of Engineering Ethics.
4. Understand the forces that shape culture.
5. Show the entrepreneurial skills.
6. Execute an engineering plan with ethics.

**UNITI HISTORICAL DEVELOPMENT,PLANNING,ORGANISING 9**

Definition of Management – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies and Planning Premises– Forecasting – Decision–making – Formal and informal organization – Organization Chart –.

**UNITII DIRECTINGANDCONTROLLING 9**

Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment –Process of Communication – System and process of Controlling – Requirements for effective control – Control of Overall Performance – Direct and Preventive Control – Reporting

**UNITIII ENGINEERINGETHICS 9**

Senses of 'Engineering Ethics' – variety of moral issued – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – Models of ProfessionalRoles – theories about right action – Self–interest – customs and religion – uses of ethical theories.

**UNITIV FACTORSOFCHANGES 9**

Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws. Social changes – Meaning and nature – Theories.

**UNITV ENTREPRENEURSHIPANDMOTIVATION 9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth– Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need,Objectives.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Harold Kooritz and Heinz Weihrich | Essentials of Management | Tata McGraw Hill, New Delhi | 2010 |
| 2 | Khanka S.S | Entrepreneurial Development | S.Chand and Co. Ltd., NewDelhi | 2006 |
| 3 | Mike Martin and Roland Schinzinger | Ethics in Engineering | McGraw–Hill, NewYork | 2005 |

## SEMESTER VII

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Tripathy P.C and Reddy P.N | Principles of Management | Tata McGraw Hill, New Delhi | 2008 |
| 2 | Rabindra N Kanungo | Entrepreneurship and innovation | Sage Publications, New Delhi | 1998 |
| 3 | Charles E Harris, and Michael J Rabins | Engineering Ethics – Concepts and Cases | Wadsworth Thompson Learning, New Delhi | 2013 |

**WEB REFERENCES**

1. http://www.managementstudyguide.com/taylor_fayol.htm
2. http://tutor2u.net/business/gcse/people_motivation_theories.htm
3. http://lfkkb.tripod.com/eng24/gilliganstheory.html
4. http://www.developingeyes.com/five–types–of–entrepreneurs/

**15BEME702 FINITE ELEMENT METHODS 3 2 0 4100**

**COURSE OBJECTIVE**

1. To explain the steps involved in FEA and also the types of weight residual methods
2. To impart knowledge to formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. To enrich the understanding of two dimensional thermal and torsion problems.
4. To enrich the understanding of axisymmetric bodies, plate and shell.
5. To develop an understanding of the standard techniques on matrix solution techniques to dynamic problems.
6. To impart knowledge on FE equation for structural, heat transfer and vibration problems.

**COURSE OUTCOME**

1. Explain the steps involved in FEA and also the types of weight residual methods
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Predict finite element equations for two dimensional thermal and torsion problems.
4. Predict finite element equations for axisymmetric bodies, plate and shell.
5. Apply matrix solution techniques to dynamic problems.
6. Formulate FE equation for structural, heat transfer and vibration problems.

**UNITI INTRODUCTION 9 + 3**

Historicalbackground–Matrixapproach–Applicationtothecontinuum–Discretization–Matrixalgebra– Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritzmethod

**UNITII ONEDIMENSIONALPROBLEMS 9 + 3**

Finite element modeling – Coordinates and shape functions– Potential energy approach – Galerkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

**UNITIII TWODIMENSIONALCONTINUUM 9 +3**

Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galerkin approach – Stress calculation – Temperature effects

**UNITIV AXISYMMETRICCONTINUUM 9 +3**

Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures

**UNITV ISOPARAMETRIC ELEMENTS FOR TWODIMENSIONALCONTINUUM 9 +3**

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Stress calculations – Four node quadrilateral element.

**TOTAL 45 + 15 = 60PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rao S.S | The Finite Element Method in Engineering | Butter worth Heinemann imprint, USA | 2011 |
| 2 | Khanka S.S | A First course in the Finite Element Method | Cengage Learning, Stamford, USA | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chandrupatla T.R., and BelegunduA.D | Introduction to Finite Elements in Engineering | Pearson Education, Delhi | 2011 |
| 2 | David V Hutton | Fundamentals of Finite Element Analysis | McGraw–Hill Int. Ed, New York | 2007 |


**WEB REFERENCES**


1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT–KANPUR/mathematics–2/node18.html
2. http://www.me.berkeley.edu/~lwlin/me128/FEMNotes.pdf
3. http://www.rose–hulman.edu/~fine/FE2004/Class2/Notes2.pdf
4. http://www.asiri.net/courses/meng412/m412sm04ex1sol.pdf
5. http://hyperphysics.phy–astr.gsu.edu/hbase/electric/laplace.html

**COURSE OBJECTIVE**

1. To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field ofautomation.
2. To understand the concepts of sensors andtransducers.
3. To provide an overview of actuationsystems.
4. To expose students to controller model for electrical, mechanical and thermalsystems.
5. To provide knowledge about various types ofcontrollers
6. To facilitate the understanding of PLC program using ladderlogic.

**COURSE OUTCOME**

Upon completion of this course, the students can able to
1. Implement the concepts of sensors andtransducers.
2. Design the actuationsystems.
3. Develop the controller model for electrical, mechanical and thermalsystems.
4. Explain about various types ofcontrollers
5. Create the PLC program using ladderlogic.
6. Design Mechatronicssystem.

**UNITI MECHATRONICS SENSORS ANDTRANSDUCERS 9**

Introduction to Mechatronics – Systems – Measurement Systems – Control Systems –Traditional design – Microprocessor based Controllers. Introduction to sensors – Performance Terminology – Static and Dynamic characteristics – Displacement – Position and Proximity – Velocity and Motion – Fluid Pressure – Temperature Sensors – Light Sensors – Selection of Sensors – Signal processing – Servosystems.

**UNITII ACTUATORS ANDSYSTEM MODELS 9**

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors.

Introduction to system models– Building block of Mechanical, Electrical, Fluid and Thermal Systems.

**UNITIII MICROPROCESSORS INMECHATRONICS 9**

Introduction – Architecture – pin configuration Instruction set – Programming of Microprocessors using 8085 instructions – Interfacing. Input and output devices – interfacing D/A converters and A/D converters – Application – Temperature control – Stepper motor control.

**UNITIV CONTROLLERS 9**

Introduction –Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode –Derivative Mode – Integral Mode – PID Controllers –Digital Controllers – Adaptive Control – Digital Logic Control – Micro Processors Control. Introduction to PLC – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Data Handling – Analog Input / Output – Selection of aPLC.

**UNITV DESIGN OFMECHATRONICSYSTEMS 9**

StagesindesigningMechatronicsSystems–TraditionalandMechatronicDesign–PossibleDesignSolutions – Case Studies of Mechatronics Systems, Pick and place robot – automatic Car Park Systems – Engine Management Systems – Introduction to MEMS.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Bolton W | Mechatronics | Pearson Education, Delhi | 2008 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Michael B. Histand David G. Alciatore | Introduction to Mechatronics and Measurement Systems | McGraw–Hill International Editions, New York | 2012 |
| 2 | Bradley D, Buru N.C and Loader A.J | Mechatronics | Chapman and Hall, Pearson Education Asia, New Delhi | 2000 |
| 3 | Ghosh P.K and Sridhar P.R | Introduction to Microprocessors for Engineers and Scientist | Prentice Hall of India, New Delhi | 2009 |


**WEB REFERENCE**

1. www.cs.indiana.edu

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| **15BEME7E --** | **DEPARTMENTELECTIVEIV** | **3 0 0 3100** |

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| **15BEME7E --** | **DEPARTMENTELECTIVEV** | **3 0 0 3100** |

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| **15BEME711** | **CAE /CAMLABORATORY** | **0 0 4 2100** |

**COURSE OBJECTIVES**

1. To study the features of the software tools needed to analyze engineering problems.
2. To introduce the concepts of the different applications of simulation and analysis tools.
3. To familiarize the students to understand the features of CNC Machine Tool.
4. To make the student acquire sound knowledge on part programming for machining a work.
5. Perform operations in CNC machines like CNC lathe,
6. Perform operations in CNC Vertical Machining Centre

**COURSE OUTCOME**

Upon completion of this course, the Students will be able to

1. Perform structural analysis of bars andtrusses
2. Perform structural analysis of beams andframes
3. Perform 2d analysis of plate andshells
4. Perform modal analysis of simplesystems
5. Perform thermal analysis of simplesystems
6. Perform fluid and failure analysis of simplesystems

**LIST OF EXPERIMENTS**

**COMPUTER AIDED ENGINEERING (Simple Analysis using ANSYS Tool)**

1. Stress analysis of rectangular Lbracket
2. Stress analysis of beams (Cantilever, Simply supported, Fixedends)
3. Mode frequency analysis of beams (Cantilever, Simply supported, Fixedends)
4. Harmonic analysis of a 2Dcomponent
5. Thermal stress analysis of a 2Dcomponent
6. Modeling a 3D component. ( Single point cutting tool, I beams,etc.,)

**COMPUTER AIDED MANUFACTURING (CAM)**

1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNCMachine.
2. Part programming for Linear, Circular interpolation, and Contourmotions.
3. Part programming using standard canned cycles for Thread cutting, Drilling, Peck drilling, andBoring.
4. NC code generation using software's like Edge CAM, CREO, etc. CNC Controllers likeFANUC, Siemens, and Hiedenhain etc.

**TOTAL 45PERIODS**

## 15BEME712 MECHATRONICSLABORATORY 0 0 4 2100

**OBJECTIVE**

1. To introduce the program for arithmetic functions and the program for sorting, code conversion functions.
2. To enrich the understanding of the program codes to interface with stepper motor.
3. To understand the importance of set speed with actual speed of DC motor by interfacing suitable speed sensors.
4. To introduce the concepts of all the hydraulic, pneumatic and electro pneumatic circuits by using simulation software.
5. To understand the concept of displacement, force and temperature measurement
6. To understand about the controllers

**OUTCOME**

1. Create the program for arithmetic functions and the program for sorting, code conversion functions.
2. Formulate the program codes to interface with stepper motor.
3. Compare the set speed with actual speed of DC motor by interfacing suitable speed sensors.
4. Integrate all the hydraulic, pneumatic and electro pneumatic circuits by using simulation software.
5. Able to recognize the controllers and their applications
6. Perform the displacement, force and temperature measurement.

**LIST OF EXPERIMENTS**

1. Design and testing of fluid power circuits tocontrol
   (i) Velocity (ii) direction and (iii) force of single and double actingactuators
2. Design of circuits with logic sequence using Electro pneumatic trainerkits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits usingsoftware
4. Circuits with multiple cylinder sequences in Electro pneumatic usingPLC.
5. Servo controller interfacing for openloop
6. PID controller interfacing
7. Stepper motor interfacing with 8051 Microcontroller
   (i) Full step resolution (ii) Half stepresolution
8. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LABVIEW
9. Computerized data logging system with control for process variables like pressure, flow andtemperature
10. Measurement of displace usingLVDT
11. Measurement of temperature usingThermocouples
12. Measurement of Force using StrainGage

**TOTAL 45PERIODS**

## COURSE OBJECTIVES

1. To develop the student's knowledge in various robot structures and their workspace.
2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To develop student's skills in perform kinematics analysis of robot systems.
4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
6. To provide the student with some knowledge and skills associated with robot control.

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

1. Understand the fundamentals of therobots
2. Describe the robot celldesign
3. Know the safety considerations in roboticapplications.
4. The student with knowledge of the singularity issues associated with the operation of robotic systems.
5. The student with some knowledge and analysis skills associated with trajectory planning.
6. The student with some knowledge and skills associated with robot control.

**UNIT I FUNDAMENTALS OFROBOT 6**

Robot – Definition – Robot Anatomy – Co–ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications. Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features. End Effectors – Grippers. Requirements of a sensor, Principles and Applications of sensors – Position of sensors, Proximity Sensors, Touch Sensors – Camera, Frame Grabber, Sensing and DigitizingImage.

**UNIT II ROBOTCELLDESIGN 6**

Robotcelldesign–simulationsoftware(RoboWave).Robotcelllayouts–Multiplerobotsandmachineinterference– robot cell planning – robot cycle time analysis for assembly, welding and painting shop.

**UNIT III SAFETY CONSIDERATIONS 8**

Safety Considerations for Robot Operations, Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

**TOTAL 20 PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Klafter R.D., and Negin M | Robotic Engineering - An Integrated Approach | Prentice Hall | 2003 |
| 2 | Groover M.P | Industrial Robotics -Technology Programming and Applications | McGraw Hill | 2001 |

## COURSE OBJECTIVES

1. To understand the working principles ofpumps
2. To understand the working principles andmotors
3. To develop the system curve
4. To calculate the Net Positive Suction Head
5. To calculate the pump Total Head versus Rate of Flow characteristic
6. To match pumps to variable, parallel and series pumping systems

## COURSE OUTCOMES

1. Understand the working principles ofpumps.
2. Understand the working principles andmotors.
3. Develop the system curve.
4. Calculate the Net Positive Suction Head.
5. Calculate the pump Total Head versus Rate of Flow characteristic.
6. Match pumps to variable, parallel and series pumping systems.

**UNIT I SINGLE PHASEINDUCTION MOTOR 6**

Constructional details of single phase induction motor – Principle of operation – Types – Losses and Efficiency – Performance analysis – Starting methods of single–phase induction motors. – Design aspects of motors for usage in submersible pumps– Motors Rating and selection criteria.

**UNIT II THREE PHASE INDUCTION MOTOR 6**

Constructional details – Types of rotors – Principle of operation – Need for starters – Types of starters – DOL, Stator resistance and reactance, rotor resistance, autotransformer and star–delta starters – Speed control – Change of voltage, torque, number of poles and slip – Losses and Efficiency – Performance analysis – Design aspects of motors for usage in submersible pumps – Motors Rating and selection criteria.

**UNIT III PUMPS 8**

Pumps: definition and classifications – Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves – Reciprocating pump:
classification, working principle, indicator diagram, work saved by air vessels and performance curves – cavitations in pumps – rotary pumps: working principles of gear and vane pumps

**TOTAL 20 PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kothari, D. P., and Nagrath, I. J | Electric Machines | Tata McGraw Hill Publishing Company Ltd., New Delhi | 2002 |
| 2 | Bimbhra, P. S | Electrical Machinery | Khanna Publishers, New Delhi | 2003 |

## SEMESTER VIII

**15BEME801 TOTALQUALITYMANAGEMENT 3 0 0 3100**

### COURSE OBJECTIVE

1. To introduce the concepts of essentiality of quality.
2. To understand the importance of various TQM principles.
3. To introduce the concepts of the various TQM principles.
4. To Understand the techniques for quality management.
5. To introduce the standard quality systems in industries.
6. To familiarize the students to understand the various techniques to improve the quality in industries.

### COURSE OUTCOMES

At the end of the course the student would be able to

1. Understand the essentiality of quality.
2. Summarize various TQM principles.
3. Understand the various TQM principles.
4. Understand the techniques for quality management.
5. Implement standard quality systems in industries.
6. Apply various techniques to improve the quality in industries.

**UNIT I ESSENTIALS OFTQM 9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

**UNIT II TQMPRINCIPLES 9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

**UNIT III TQMTOOLS 9**

The new seven management tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma – APQP.

**UNIT IV TQMTECHNIQUES 9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

**UNITV QUALITY ANDENVIRONMENTSYSTEMS 9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2002 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 and ISO 18001 – Concept, Requirements and Benefits.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dale H.Besterfiled | Total Quality Management | Pearson Education, Delhi | 2011 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Feigenbaum.A.V | Total Quality Control | McGraw Hill, New Delhi | 2004 |
| 2 | Oakland.J.S | Total Quality Management | Butterworth – Hcinemann Ltd., Oxford | 2003 |
| 3 | Narayana V. and SreenivasanN.S | Quality Management – Concepts and Tasks | New Age International Ltd., New Delhi | 2007 |
| 4 | Zairi | Total Quality Management for Engineers | WoodHead Publishers, New Delhi | 1996 |

**WEB REFERENCES:**

1. http://auciello.tripod.com/14tqm.html
2. http://www.fkm.utm.my/~shari/download/toc%20paper%20hilma%20tqm%20dis06.pdf
3. http://www.businessgyan.com/node/5409
4. http://www.accelper.com/pdfs/SS_Measurements_Concepts.pdf
5. http://tutor2u.net/business/strategy/benchmarking.htm
6. http://www.trst.com/iso2a.htm

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| **15BEME8E --** | **DEPARTMENTELECTIVEVI** | **3 0 0 3100** |

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| **15BEME8E --** | **DEPARTMENTELECTIVEVII** | **3 0 0 3100** |

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| **15BEME891** | **PROJECT WORK AND VIVA–VOCE** | **0 0 24 12300** |

**COURSE OBJECTIVE**

1. To understand the concept and basics of thrust areas of Mechanical Engineering.
2. To explain the Review literature to identify gaps and define objectives & scope of the work.
3. To make the student appreciate the purpose of innovative ideas for social benefit.
4. To understand the importance of a prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. To familiarize the students to understand the methods and materials to carry out experiments/develop code.
6. To Reorganize the procedures with a concern for society, environment and ethics

**COURSE OUTCOME**

1. Identify thrust areas of Mechanical Engineering.
2. Review literature to identify gaps and define objectives & scope of the work.
3. Generate and implement innovative ideas for social benefit.
4. Develop a prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. Identify methods and materials to carry out experiments/develop code.
6. Reorganize the procedures with a concern for society, environment and ethics

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of theDepartment.

**TOTAL 360PERIODS**

## DEPARTMENT ELECTIVES

**15BEME5E01 COMPUTERAIDED DESIGN 3 0 0 3100**

**COURSE OBJECTIVE**

1. To apply basic concepts to develop construction (drawing) techniques.
2. To ability to manipulate drawings through editing and plotting techniques.
3. To understand geometric construction and Produce template drawings.
4. To understand and demonstrate dimensioning concepts and techniques.
5. To understand Section and Auxiliary Views.
6. To become familiar with Solid Modelling concepts and techniques.

**COURSE OUTCOMES:**

Upon completion of the course, the students will be able to

1. Apply basic concepts to develop construction (drawing) techniques.
2. Ability to manipulate drawings through editing and plotting techniques.
3. Understand geometric construction and Produce template drawings.
4. Understand and demonstrate dimensioning concepts and techniques
5. Understand Section and Auxiliary Views
6. Become familiar with Solid Modelling concepts and techniques.

**UNITI OVERVIEW OFCADSYSTEMS 9**

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

**UNITII INTERACTIVE COMPUTER GRAPHICS ANDGRAPHICSTRANSFORMATIONS 9**

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives - display transformation in Two- and Three – Dimensional graphics concepts, Graphical input technique, Geometric transpformations, Visual Realism, Computer animation, customizing graphics software.

**UNITIII GEOMETRICMODELING 9**

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

**UNITIV PARAMETRIC DESIGN ANDOBJECTREPRESENTATION 9**

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids - manipulations.

**UNITV PRODUCT DESIGNANDDEVELOPMENT 9**

Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Vera B Anand | Computer Graphics and Geometric Modeling for Engineers | John Wiley & Sons, New York | 2000 |
| 2 | Radhakrishnan P and Subramanyan S | CAD/CAM/CIM | New Age International Pvt. Ltd | 2004 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Radhakrishnan P and Kothandaraman C P | Computer Graphics and Design | Dhanpat Rai & Sons, New Delhi | 2002 |
| 2 | Ibrahim Zeid | CAD/CAM Theory and Practice | McGraw Hill Inc., New York | 2003 |
| 3 | Barry Hawhes | The CAD/CAM Process | Pitman Publishing, London | 1998 |
| 4 | William M Newman and Robert Sproul | Principles of Interactive Computer Graphics | McGraw Hill Inc., New York | 1994 |
| 5 | Sadhu Singh | Computer-Aided Design and Manufacturing | Khanna Publishers, New Delhi | 1998 |
| 6 | Rao S S | Optimisaiton Techniques | Wiley Eastern, New Delhi | 2003 |

**15BEME5E02 COMPUTER INTEGRATED MANUFACTURING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the application of computers in various aspects of Manufacturing viz., Design, proper planning, Manufacturing cost, Layout & Material Handlingsystem.
2. To know the application of principles of group technology in computer aided processplanning.
3. To impart knowledge on working of the shop floorcontrol
4. To Study and acquire knowledge on data collection system in FMS.
5. To familiarize the students to understand CIM architecture for practicalapplication.
6. To expose students to generate database for computer integrated manufacturingprocesses.

**COURSE OUTCOMES**

Upon completion of this course, the student can able to

1. Implement computer integrated manufacturing concepts inindustries.
2. Apply the principles of group technology in computer aided processplanning.
3. Understand the working of the shop floorcontrol
4. Implement automated data collection system in FMS.
5. Develop CIM architecture for practicalapplication.
6. Generate database for computer integrated manufacturingprocesses.

**UNITI INTRODUCTION 9**

The meaning and origin of CIM– the changing manufacturing and management scene – External communication – islands of automation and software–dedicated and open systems–manufacturing automation protocol – product related activities of a company– marketing engineering – production planning – plant operations – physical distribution– business and financial management.

**UNITII GROUPTECHNOLOGY 9**

Group technology– – part families – Classification and coding – Approaches to computer aided process planning –variant approach and generative approaches

**UNITIII SHOP FLOOR CONTROL AND INTRODUCTIONOFFMS 9**

Shop floor control–phases –factory data collection system –automatic identification methods– Bar code technology–automated data collection system. FMS–components of FMS – types –FMS workstation –material handling and storage systems– FMS layout –computer control systems–application and benefits.

**UNITIV CIM IMPLEMENTATION ANDDATACOMMUNICATION 9**

CIM and company strategy – system modeling tools –IDEF models – activity cycle diagram – CIM open system architecture (CIMOSA)– manufacturing enterprise wheel–CIM architecture – Product data management–CIM implementation software. Communication fundamentals– local area networks –topology – LAN implementations – network management and installations –MRP, ERP concepts

**UNITV OPEN SYSTEM AND DATABASEFORCIM 9**

Open systems–open system inter connection – manufacturing automations protocol and technical office protocol (MAP /TOP).

Development of databases –database terminology– architecture of database systems–data modeling and data associations –relational data bases – database operators – advantages of data base and relational database.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Mikell.P.Groover | Automation, Production Systems and computer integrated manufacturing | Pearson Education, Delhi | 2011 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Yoremkoren | Computer Integrated Manufacturing system | McGraw-Hill, New York | 2005 |
| 2 | Kant Vajpayee S | Principles of computer integrated manufacturing | Prentice Hall India, New Delhi | 2003 |
| 3 | Radhakrishnan P and Subramanyan S | CAD/CAM/CIM, 2nd Edition | New Age International (P) Ltd, New Delhi | 2000 |


**WEB REFERENCES**

1. http://en.wikipedia.org/wiki/Computer-integrated_manufacturing
2. http://www.technologystudent.com/rmprp07/intman1.html
3. http://www.computerintegratedmanufacturing.com/

**15BEME5E03 ADVANCED MANUFACTURING PROCESSES 3 0 0 3100**

## COURSE OBJECTIVES

1. To provide knowledge on different aspects of powder metallurgy parameters.
2. To understand the importance of principle of advanced welding processes and its application.
3. To understand the importance of advanced forming processes and its application.
4. To familiarize the students to advanced manufacturing process for processing of different materials.
5. To acquaint the student to apply the suitable rapid prototyping mechanism for industry need.
6. To provide knowledge on optimum parametric for advanced manufacturing process.

## COURSE OUTCOMES

Upon the completion of this course, the students will be able to

1. Understand different aspects of powder metallurgy parameters.
2. Understand basic principle of advanced welding processes and its application.
3. Understand basic principle of advanced forming processes and its application.
4. Select the best suitable advanced manufacturing process for processing of different materials.
5. Apply the suitable rapid prototyping mechanism for industry need.
6. Select the optimum parametric for advanced manufacturing process.

**UNITI POWDERMETALLURGYPROCESS 9**

Introduction to powder metallurgy process – preparation of powders – types and functions of binders – green compaction – sintering process and its effect on the product.

**UNITII ADVANCEDWELDINGPROCESSES 9**

Percussion Welding– Electro Slag Welding, Plasma Arc Welding – Thermit Welding – Electron Beam Welding – Friction and Inertia Welding – Friction Stir Welding – Under Water WeldingProcess.

**UNITIII SHEET METAL ANDFORMINGPROCESS 9**

Working principle and application of special forming process – Hydro Forming– Rubber Pad Forming– Explosive Forming – Magnetic Pulse Forming– Peen Forming – Super Plastic Forming – Deep Drawing Process.

**UNITIV ADVANCEDMACHININGPROCESS 9**

Modern machining process: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, Electro chemical Machining, Electro chemical Grinding, Electro Discharge Machining, wire cut EDM, Electron Beam Machining, plasma arc machining, Laser Beam Machining. Ultrasonic Machining, High speed machining process – deep hole drilling process

**UNITV RAPIDPROTOTYPING 9**

Introduction to Rapid Prototyping – Need for RPT– Stereo–lithography – Selective Laser Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, Solid Ground Curing, Ballistic Particle Manufacturing

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Seropekalpakjian and Steven.R. Schmid | Manufacturing process for engineering materials | Pearson Education, Inc | 2009 |
| 2 | O.P.Khanna | A Textbook OfWWelding Technology | Dhanpat Rai Publications Pvt Ltd | 2012 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | P.N. Rao | Manufacturing technology Volume I | TMH Ltd | 2013 |
| 2 | Singh, M.K | Unconventional Manufacturing Process | New age international | 2008 |
| 3 | Vijay.K Jain | Advanced Machining Processes | Allied Publishers Pvt. Ltd | 2009 |


**WEB REFERENCES**

1. http://mfg.eng.rpi.edu/gmp/WebChapters/ch39.pdf
2. http://web.iitd.ac.in/~pmpandey/MEL120_html/RP_document.pdf
3. http://www.me.psu.edu/lamancusa/rapidpro/rpintro2.pdf
4. http://file.guiacnc.com.br/data/PDF/PrototypeeBook2.pdf

**15BEME5E04 HYDRAULICS AND PNEUMATICS POWER CONTROL 3 0 0 3100**

**COURSE OBJECTIVES**

1. To recognize symbols and fundamentals in fluid power generation anddistribution.
2. To identify power source for hydraulicsystems.
3. To select appropriate components used in various hydraulicsystems.
4. To design hydraulic circuits for givenapplications
5. To distinguish the components used in pneumaticcircuits.
6. To create the logic circuits for controlling electro-hydraulic/ pneumaticsystems.

**COURSE OUTCOMES**

At the end of the course, the students will be able to

1. Recognize symbols and fundamentals in fluid power generation anddistribution.
2. Identify power source for hydraulicsystems.
3. Select appropriate components used in various hydraulicsystems.
4. Design hydraulic circuits for givenapplications
5. Distinguish the components used in pneumaticcircuits.
6. Create the logic circuits for controlling electro-hydraulic/ pneumaticsystems.

**UNITI FLUID POWER SYSTEMSANDFUNDAMENTALS 9**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics–Applications of Pascals Law– Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves andfittings.

**UNITII HYDRAULIC SYSTEMANDCOMPONENTS 9**

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, Pressure boosting pumps, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

**UNITIII DESIGN OFHYDRAULICCIRCUITS 9**

Construction of Control Components : Direction control valve – 3/2 way valve – 4/2 way valve – Shuttlevalve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications ofIntensifier – Intensifier circuit.

**UNITIV PNEUMATIC SYSTEMSANDCOMPONENTS 9**

Pneumatic Components: Properties of air – Compressors – Filter, Regulator and Lubricator UNIT Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascademethod.

**UNITV DESIGN OFPNEUMATICCIRCUITS 9**

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Anthony Esposito | Fluid Power with Applications | Pearson Education, New Delhi | 2013 |
| 2 | Majumdar S.R | Oil Hydraulics | Tata McGraw–Hill, New Delhi | 2002 |

## 15BEME5E04 HYDRAULICS AND PNEUMATICS POWER 3 0 0 3100

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Majumdar S.R | Pneumatic systems – Principles and maintenance | Tata McGraw Hill, New Delhi | 2006 |
| 2 | Anthony Lal | Oil hydraulics in the service of industry | Allied publishers, New Delhi | 1982 |
| 3 | Michael J, Prinches and AshbyJ.G | Power Hydraulics | Prentice Hall of India, New Delhi | 1996 |

**WEB REFERENCES**

1. http://www.g–w.com/PDF/SampChap/60525_0816_Ch02.pdf
2. http://www.engineeringtoolbox.com/classification–pumps–d_55.html
3. http://www.omega.com/auto/pdf/SimpValvesguide.pdf

**15BEME6E01 POWER PLANT ENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam power plant.
3. To make the student acquire sound knowledge of working of nuclear and hydel power plant.
4. To study the features of gas turbine power plant.
5. To make the student acquire sound knowledge of economics of the power plant.
6. To make the student acquire sound knowledge on renewable energy technologies and availability.

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Select the accessories and layout required for a steam power plant depending upon the requirements.
2. Compute performance of steam power plant.
3. Explain the working of nuclear and hydel power plant.
4. Compute performance of gas turbine power plant.
5. Calculate the economics of the power plant.
6. Apply appropriate type of renewable energy technologies depending upon the application and availability.

**UNITI INTRODUCTION TO POWER PLANTSANDBOILERS 9**

LayoutofSteam,Hydel,Diesel,MHD,NuclearandGasTurbinePowerPlants–CombinedPowerCycles– Comparison and Selection, Load Duration Curves.

Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers – Industrial Standards.

**UNITII STEAM POWERPLANT 9**

Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers

**UNITIII NUCLEAR AND HYDELPOWERPLANTS 9**

Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety.

Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines– Micro Hydel developments.

**UNITIV DIESEL AND GAS TURBINEPOWERPLANT 9**

Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant –Fuels – Gas Turbine Material – Open and Closed Cycles – Reheating – Regeneration and Intercooling – Combined Cycle.

**UNITV OTHER POWER PLANTS AND ECONOMICS OFPOWERPLANTS 9**

Geo thermal –OTEC – Tidel – Pumped storage – Solar thermal central receiver system.

Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing, comparison of economics of various power plants.

**TOTAL 45 PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Arora S.C and Domkundwar S | A course in Power Plant Engineering | Dhanpatrai Publishers, New Delhi | 1988 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nag P.K | Power plant Engineering | Tata McGraw Hill, New Delhi | 2007 |
| 2 | Rajput R.K | Power Plant Engineering | Laxmi Publications, Chennai | 2008 |
| 3 | Morse Frederick T | Power Plant Engineering | Prentice Hall of India, New Delhi | 1998 |


**WEB REFERENCES**

1. www.solarpaces.org
2. www.igcar.gov.in
3. ga.water.usgs.gov
4. www.mapsofindia.com

**15BEME6E02 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To impart knowledge on the principles of locating and clamping devices in machining process.
2. To familiarize the students to understand design of jigs for a given component.
3. To Study and acquire knowledge on design fixtures for a given component.
4. To make the student acquire sound knowledge on appropriate type of press tool for a given component.
5. To expose students to drawing die for a given component.
6. To give exposure to the use computer aids for sheet metal forming analysis

**COURSE OUTCOMES**

Upon the completion of this course the students will be able to

1. Summarize the principles of locating and clamping devices in machining process.
2. Design jigs for a given component.
3. Design fixtures for a given component.
4. Design an appropriate type of press tool for a given component.
5. Develop a drawing die for a given component.
6. Use computer aids for sheet metal forming analysis

**UNITI PURPOSE TYPES AND FUNCTIONS OF JIGSANDFIXTURES 9**

Tool design objective – Production devices – Inspection devices – Materials used in Jigs and Fixtures – Types of Jigs – Types of Fixtures–Mechanical actuation–pneumatic and hydraulic actuation–Analysis of clamping force–Tolerance and error analysis.

**UNITII JIGS 9**

Drill bushes –different types of jigs–plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs–Automatic drill jigs–Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

**UNITIII FIXTURES 9**

General principles of boring, lathe, milling and broaching fixtures– Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures– Modular fixtures. Design and development of fixtures for given component.

**UNITIV PRESS WORKING TERMINOLOGIES AND ELEMENTS OFDIESAND STRIP LAY OUT 9**

Press working terminology–Presses and press accessories–Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies:Die block–die shoe. Bolster plate–punch plate–punch holder–guide pins and bushes – strippers – knockouts–stops –pilots–Selection of standard die sets strip lay out–strip lay outcalculations

**UNIT V DESIGN AND DEVELOPMENTOFDIES 9**

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies–forming and drawing dies–Development of drawing dies. Design considerations in forging, extrusion, casting and plasticdies.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Edward G Hoffman | Jigs and Fixture Design | Thomson – Delmar Learning, Singapore | 2004 |
| 2 | Donaldson C | Tool Design | Tata McGraw–Hill, New Delhi | 2012 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kempster | Jigs and Fixtures Design | Tata McGraw–Hill Publishing, New Delhi | 2004 |
| 2 | Joshi P.H | Jigs and Fixtures Second Edition | Tata McGraw–Hill Publishing Company Limited, New Delhi | 2010 |
| 3 | Hiram E Grant | Jigs and Fixture | Tata McGraw–Hill, New Delhi | 2003 |


**WEB REFERENCES**

1. www.wisetool.com
2. www.invert–a–bolt.com
3. www.diemech.com
4. www.schaefertools.com
5. www.steelsmith.com

**15BEME6E03 COMPUTATIONAL FLUID DYNAMICS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To introduce Governing Equations of viscous fluidflows
2. To introduce numerical modeling and its role in the field of fluid flow and heattransfer
3. To enable the students to understand the various discretization methods, solution procedures and turbulencemodeling.
4. To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speedcomputers.
5. To equip them with skills to solve convection and diffusionproblems
6. To understand the importance continuity and momentum equations for different types of fluidflow

**COURSE OUTCOMES**

Upon completion of this course, the students can able

1. Identify, solve engineering problems by computational fluiddynamics.
2. Understand the importance of governing equations involved inCFD
3. Formulate and solve problems in the field of fluid flow and heattransfer.
4. Solve the heat conduction problems using finite differencemethod.
5. Analyze and provide solutions for convection and diffusionproblems.\
6. Develop continuity and momentum equations for different types of fluidflow.

**UNITI GOVERNING EQUATIONS ANDBOUNDARYCONDITIONS 9**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time–averaged equations for Turbulent flow – Turbulence –Kinetic –Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolicequations.

**UNITII DISCRETIZATION ANDSOLUTIONMETHODOLOGIES 9**

MethodsofDerivingtheDiscretizationEquations–TaylorSeriesformulation–Finitedifferencemethod– Control volume Formulation – Spectral method.
Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

**UNITIII HEATCONDUCTION 9**

Finite difference and finite volume formulation of steady/transient one–dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

**UNITIV CONVECTIONANDDIFFUSION 9**

Finite volume formulation of steady one–dimensional convection and Diffusion problems, Central, upwind, hybrid and power–law schemes – Discretization equations for two dimensional convection and diffusion.

**UNITV CALCULATION OFFLOWFIELD 9**

Representation of the pressure – Gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure – Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, two equation (k–ε) models.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Versteeg H.K and Malalasekera.W | An Introduction to Computational Fluid Dynamics | Pearson education ltd, UK | 2008 |
| 2 | GhoshdastidarP.S | Computer Simulation of flow and heat transfer | Tata McGraw–Hill Publishing Company Ltd., New Delhi | 1998 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | PatankarS.V | Numerical Heat Transfer and Fluid Flow | McGraw–Hill book company, New Delhi | 1980 |
| 2 | Muralidhar K and Sundarajan T | Computational Fluid Flow and Heat Transfer | Narosa Publishing House, New Delhi | 2013 |
| 3 | BoseT.K. Jain | Numerical Fluid Dynamics | Narosa publishing House, New Delhi | 2005 |


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1. http://www.ams.org/mcom//.pdf
2. http://www.cham.co.uk/website/new/cfdintro.htm
3. http://www.mechartes.com/
4. http://www.technologystudent.com
5. http://web.njit.edu/topics/Prog_Lang_Docs/html/FLUENT/fluent/fluent5/ug/html/node594.htm

**COURSE OBJECTIVES**

1. To provide an overview of factors affecting the behavior of materials in components.
2. To expose students to understand the mechanism of fracture.
3. To Study and acquire knowledge on Dynamic and Time-dependent fracture.
4. To study the features of fracture toughness values.
5. To provide an overview of life prediction
6. To Study and acquire knowledge on failure analysis tools in industries

**COURSE OUTCOMES**

1. Identify the Factors affecting the behavior of materials in components.
2. Understand the mechanism of fracture.
3. Understand the Dynamic and Time-dependent fracture.
4. Determine the fracture toughness values.
5. Improve the life of product through life prediction
6. Use various failure analysis tools in industries.

**UNITI MATERIALS ANDDESIGNPROCESS 9**

Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, designing for hostile environments, material processing and design, processes and their influence on design, process attributes, systematic process selection, screening, process selection diagrams, ranking, process cost.

**UNITII FRACTUREMECHANICS 9**

Ductile fracture, brittle fracture, Cleavage-fractography, ductile-brittle transition-Fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage. Linear Elastic Fracture Mechanics - Griffith theory, Energy release rate, instability and R-curve, stress analysis of cracks-stress intensity factor, K-threshold, crack growth instability analysis, crack tip stress analysis. Elastic Plastic Fracture Mechanics - Crack tip opening displacement( CTOD), J integral, relationship between J and CTOD,

**UNITIII DYNAMIC ANDTIME-DEPENDENTFRACTURE 9**

Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, Creep crack growth-C Integral, Visco elastic fracture mechanics, viscoelastic Jintegral

**UNITIV DETERMINATION OF FRACTURETOUGHNESSVALUES 9**

Experimental determination of plane strain fracture toughness, K- R curve testing, J measurement, CTOD testing, effect of temperature, strain rate on fracture toughness.

**UNITV FAILUREANALYSIS TOOLS 9**

Reliability concept and hazard function, life prediction, life extension, application of poisson, exponential and Weibull distribution for reliability, bath tub curve, parallel and series system, MTBF,MTTR, FMEA definition-Design FMEA, Process FMEA , analysis causes of failure, modes, ranks of failure modes, fault tree analysis, industrial case studies/projects on FMEA.

**TOTAL 45 PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | John M Barsoom and Stanley T Rolte | Fracture and Fatigue Control in Structures | Prentice Hall, New Delhi | 1987 |
| 2 | Michael F Ashby | Material Selection in Mechanical Design | Butterworth – Heinemann | 2005 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1 | Shigley and Mische | Mechanical Engineering Design | McGraw Hill Inc., New York | 1992 |
| 2 | Mahmoud M Farag | Material Selection for Engineering Design | Prentice Hall, New Delhi | 1997 |
| 3 | Faculty of Mechanical Engineering | Design Data Book | PSG College of Technology, DPV Printers, Coimbatore | 1993 |
| 4 | ASM Metals Handbook | Failure Analysis and Prevention | ASM Metals Park, Ohio, USA, | 1995 |

**15BEME6E05 RENEWABLE ENERGY SOURCES 3 0 0 3100**

**COURSE OBJECTIVES**

1. To explain importance of renewable energy resources.
2. To understand the importance of basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. To understand the importance of principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.
4. To study the features ofdesign principles of biogas plants.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. To give exposure to power plants working with non-conventional energy.

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Understand the importance of renewable energy resources.
2. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.
4. Implement design principles of biogas plants.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. Able to classify and select the best renewable energy sources for the system under analysis.

**UNITI ENERGYANDENVIRONMENT 9**

Primary energy sources – world energy resources–Indian energy scenario–energy cycle of the earth – environmental aspects of energy utilisation, $CO_2$ emissions and Global warming–renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

**UNITII SOLARENERGY 9**

Principles of solar energy collection – solar radiation – measurements – instruments – data and estimation– types of collectors – characteristics and design principles of different type of collectors – performance of collectors – testing of collectors. Solar thermal applications – water heaters and air heaters – performance and applications – simple calculations – solar cooling – solar drying – solar ponds – solar tower concept – solar furnace.

**UNITIII WIND, TIDAL AND GEOTHERMALENERGY 9**

Energy from the wind – general theory of windmills – types of windmills – design aspects of horizontal axis windmills – applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants – power from geothermal energy – principle of working of geothermal power plants.

**UNITIV BIOENERGY 9**

Energy from bio mass and bio gas plants –various types – design principles of biogas plants – applications. Energy from wastes – waste burning power plants – utilization of industrial and municipal wastes – energy from the agricultural wastes.

**UNITV OTHER RENEWABLEENERGYSOURCES 9**

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – thermoelectric generators – thermionic generators – fuel cells – solar cells – types, Emf generated, power output, losses and efficiency and applications. Hydrogen conversion and storage systems

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rai G.D | AnNon conventional Energy sources | Khanna Publishers, New Delhi | 2011 |
| 2 | Duffie and Beckmann | Solar Energy Thermal Processes | John Wiley, London | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | SukhatmeS.P | Solar Energy | Tata McGraw Hill, New Delhi | 2003 |
| 2 | Garg. H. P and Prakash J | Solar Energy - Fundamentals and applications | Tata McGrawHill, New Delhi | 2007 |
| 3 | Ashok V Desai | Non–conventional Energy | Wiley Eastern Ltd, New Delhi | 1990 |


**WEB REFERENCES**


1. http://www.apricus.com/html/solar_typesofsolar.htm
2. http://www.solarserver.de/wissen/sonnenkollektoren–e.html
3. http://earthsci.org/mineral/energy/wind/wind.html
4. http://www.biomassgasification.com/

**COURSE OBJECTIVES**

1. To familiarize the students in the Science of Precision Engineering.
2. To provide and enhance the technical knowledge in precision manufacturing and error control.
3. To create the awareness among students about new trends in manufacturing and its precise control.
4. To learn micro electro mechanical systems.
5. To learn bulk micro machining and Nano technology.
6. To acquire knowledge about accuracy, micro finishing processes and unconventional machining.

**COURSE OUTCOMES**

The students would be able to understand

1. The meaning precision machining and the importance of it.
2. The requirements of machine network elements to achieve precision in the components.
3. The principles of various precision engineering processes and apply them in actual field.
4. Various method of micromachining using LASER and other processes.
5. Learn micro electro mechanical systems.
6. Learn bulk micro machining and Nano technology.

**UNITI ACCURACY 9**

Concept of accuracy – accuracy of numeric control systems, acceptance test for machine tools. Factors Affecting Accuracy - Static stiffness and its influence on machining accuracy, inaccuracies due to thermal effects, influence of forced vibrations on accuracy, dimensional wear of cutting tools and its influence on accuracy.

**UNITII MICROFINISHINGPROCESS 9**

Surface roughness, bearing area curves, surface texture measurement, methods of improving accuracy and surface finish, finish boring, finish grinding, precision cylindrical grinding, micro machining, precision micro drilling.

**UNITIII UNCONVENTIONALMACHINING 9**

Precision, cut in wire, EDM machining, electro mechanical grinding, electron beam machining, laser beam machining.

**UNITIV MICRO ELECTROMECHANICALSYSTEMS 9**

Introduction to silicon processing, wafer cleaning, diffusion and ion implantation, oxidation, photolithography, photo resist, resist strip, electron beam and X-ray lithography, thin film deposition, evaporation, sputtering, molecular beam epitaxy, chemical vapour deposition, electro plating.

**UNITV BULK MICRO MACHINING ANDNANOTECHNOLOGY 9**

Wet etching, isotropic etching, anisotropic etching, dry etching, physical etching, reactive ion etching, Nano Technology, nano-grating system, nano-lithography, fabrication of CCDS, nano processing of materials for super high density ICs, nano-mechanical parts.

**TOTAL 45 PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Murthy R L | Precision Engineering in Manufacturing | New Age International Publishers, Chennai | 1996 |
| 2 | Mark J Madou | Fundamentals of Micro Fabrication | CRC Press, New York | 2002 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Davidson | Handbook of Precision Engineering Vol. 1, 12 | McMillan | 1972 |
| 2 | Jaeger R C | Introduction to Micro Electronics Fabrication | Addison Wesley, England | 1988 |
| 3 | Chang C V, Sze S M | VLSI Technology | Tata McGraw Hill, New Delhi | 2003 |
| 4 | BhartBhusshan | Handbook of Nano Technology | Springer Verlag, Germany | 2004 |
| 5 | Nano Tanigudi | Nanotechnology | Oxford University Press, New York | 2003 |

**15BEME6E07 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand objectives, Strategies, Policies and Plan.
2. To introduce pans by directing and controlling.
3. To Understand the need of Engineering Ethics.
4. To Understand the forces that shape culture.
5. To develop the entrepreneurial skills.
6. To make the students conversant to execute an engineering plan with ethics

**COURSE OUTCOMES**

1. Prepare objectives, Strategies, Policies and Plan.
2. Execute plans by directing and controlling.
3. Understand the need of Engineering Ethics.
4. Understand the forces that shape culture.
5. Show the entrepreneurial skills.
6. Execute an engineering plan with ethics

**UNITI ENTREPRENEURSHIP 9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNITII MOTIVATION 9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNITIII BUSINESS 9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNITIV FINANCINGANDACCOUNTING 9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNITV SUPPORTTOENTREPRENEURS 9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Khanka. S.S | Entrepreneurial Development | S.Chand& Co. Ltd., New Delhi | 2013 |
| 2 | Donald F Kuratko | Entreprenuership – Theory, Process and Practice | Cengage Learning | 2014 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hisrich R D, Peters M | Entrepreneurship | Tata McGraw-Hill | 2013 |
| 2 | Mathew J Manimala | Enterprenuership theory at cross roads: paradigms and praxis | Dream tech | 2005 |
| 3 | Rajeev Roy | Entrepreneurship | Oxford University Press | 2011 |

**15BEME6E08 INDUSTRIAL ENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To Understand and apply the principles of science, technology, engineering, and math to solve industry–related problems.
2. To Understand the concepts and terminologies in Industries
3. To Study and acquire knowledge in creating an industrial design layout
4. To introduce the methods involved in materials handling
5. To understand the knowledge in analysis of work processing happening in industries
6. To equip them with skills to perform work measurement in an industry

**COURSE OUTCOMES**

Upon completion of this course, the student can able to

1. Understand the concepts and terminologies in Industries
2. apply their knowledge in creating an industrial design layout
3. understand the methods involved in materials handling
4. apply their knowledge in analysis of work processing happening in industries
5. perform work measurement in an industry
6. understand the role of human involvement in industrial work system design

**UNITI INTRODUCTION TOINDUSTRIALENGINEERING 9**

for layout study – types of layout. Plant location analysis – factors, costs, location decisions – simple problems in single facility location models, network location problems.

**UNITII LAYOUTDESIGN 9**

Design cycle – SLP procedure manpower, machinery requirements – computer algorithms – ALDEP, CORELAP, CRAFT

**UNITIII QUANTITATIVE METHODS ANDMATERIALSHANDLING 9**

Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing. Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging.

**UNITIV OPERATIONS ANALYSIS ANDWORKMEASUREMENT 9**

Productivity and living standards, Productivity measurement, work design and Productivity – processplanning – types. Total time for a job or operation, total work content and ineffective time, methods and motions, graphic tools. Stop watch time study – time study through video graphy, Standard data, methods time measurement (MTM), Development of Production Standards, learning effect.

**UNITV HUMAN FACTORS IN WORKSYSTEM DESIGN 9**

Human factors Engineering/Ergonomics, human performance in physical work, anthropometry, design of work station, design of displays and controls.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | O.P. Khanna | Industrial Engineering And Management | Dhanpat rai and Co | 2012 |
| 2 | M.Mahajan | Industrial Engineering and Production Management | Dhanpat rai and Co | 2008 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Tompkins .J.A. and J.A. White | Facilities planning | John Wiley | 2010 |
| 2 | James Apple,M.Plant | Material Handling | John Wiley | 1977 |
| 3 | Barnes,R.M | Motion and Time study | John Wiley | 1980 |
| 4 | Bridger R.S | Introduction to Ergonomics | McGraw Hill | 2008 |


**WEB REFERENCES**


1. http://www.websukat.com/PAOM–plant–layout.htm
2. http://www.du.ac.in/fileadmin/DU/Academics/course_material/EP_07.pdf
3. http://www.scribd.com/doc/60109160/8/Rank–Order–Clustering–Method
4. http://www.zalzala.info/IKMA/LinkedDocuments/GAManufacturing/sld006.htm
5. http://www.wrebv.nl/l6.pdf

**15BEME7E01 DESIGN FOR MANUFACTURE AND ASSEMBLY 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the importance of the DFM approach and guidelines
2. To enrich the understanding of the selective assembly and Datum systems
3. To introduce the concepts of demonstrate true Position tolerancing theory.
4. To develop an understanding of the standard techniques and redesigning cast members using weldments and plastic component manufacturing.
5. To equip them with skills on Tolerance Charting Technique.
6. To Study and acquire knowledge of the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to,

1. Understand the DFM approach and guidelines
2. Understand the selective assembly and Datum systems
3. Demonstrate true Position tolerancing theory.
4. Understand redesigning cast members using weldments and plastic component manufacturing.
5. Demonstrate the Tolerance Charting Technique.
6. Know the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

**UNITI DFM APPROACH, SELECTION AND SUBSTITUTION OFMATERIALSIN INDUSTRY 9**

DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka – Yoke principle; 6σ concept; Tolerance Analysis: Process capability, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

**UNITII SELECTIVEASSEMBLY 9**

Interchangeable and selective assembly, deciding the number of groups, Model–I: group tolerances of mating parts equal; Model–II: total and group tolerances of shaft, control of axial play.

Datum Systems: Grouped datum systems–different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, and tongue–slot pair, computation of translational and rotational accuracy.

**UNITIII TRUE POSITIONTOLERANCINGTHEORY 9**

Comparison between co–ordinate and convention method of feature location tolerancing and true position tolerancing, zero true position tolerance, virtual size concept, floating and fixed fasteners, projected tolerance zone, functional gauges, paper layout gauging, compound assembly, examples.

**UNITIV FORM DESIGN OF CASTINGSANDWELDMENTS 9**

Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – design considerations for plastic component manufacturing.

**UNITV TOLERANCECHARTING 9**

Tolerance Charting Technique: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining. Datum features – functional and manufacturing, component design–machining considerations, redesign for manufacture,examples.

**TOTAL 45 PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Harry Peck | Designing for Manufacture | Pitman Publications, London | 1983 |
| 2 | Matousek R | Engineering Design – A Systematic Approach | Blackie and Son Ltd., London | 1974 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Spotts M F | Dimensioning and Tolerance for Quantity Production | Prentice Hall Inc., New Jersey, USA | 1983 |
| 2 | Oliver R Wade | Tolerance Control in Design and Manufacturing | Industrial press Inc., New York | 1967 |
| 3 | James G Bralla | Hand Book of Product Design for Manufacturing | McGraw Hill Publications, New Delhi | 1986 |
| 4 | Creveling C M | Tolerance Design – A Hand Book for Developing Optimal Specifications | Addison Wesley Longman Inc | 1997 |


**WEB REFERENCES**

1. www.dfma.com
2. www.design4manufacturability.com

**15BEME7E02 GAS DYNAMICS AND JET PROPULSION 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the basic difference between incompressible and compressibleflow.
2. To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and RocketPropulsion.
3. To introduce the concepts of various conditions of compressible fluidflows
4. To Study and acquire knowledge on performance analysis of subsonic and supersonicinlets, combustors, afterburners and exhaustnozzles
5. To understand the concept of working of various types of rocketengines
6. To study the features of thrust equation for rocket propulsionsystem

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Analyze various conditions of compressible fluidflows.
2. Calculate mass flow rate in flow through variable areaducts.
3. Carryout simple performance analysis of subsonic and supersonicinlets.
4. Perform performance analysis of combustors, afterburners and exhaustnozzles.
5. Understand the working of various types of rocketengines
6. Use thrust equation for rocket propulsionsystem.

**UNITI BASIC CONCEPTS ANDISENTROPICFLOWS 9**

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Machcone –Effect of Mach number on compressibility – Isentropic flow through variable area ducts – Nozzle and Diffusers –area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles. Use of Gas tables.

**UNITII FLOW THROUGHDUCTS 9**

Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – Variation of flow properties – Isothermal flow with friction in constant area ducts –Use of tables and charts – Generalised gas dynamics.

**UNITIII NORMAL ANDOBLIQUESHOCKS 9**

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

**UNITIV JETPROPULSION 9**

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines – Aircraft combustors.

**UNITV ROCKETPROPULSION 9**

Types of rocket engines – Propellants – Ignition and combustion – Theory of rocket propulsion – solid and liquid propellants, comparison of different propulsion systems .Performance study – Staging – Terminal and characteristic velocity – Applications – Space flights.

**TOTAL 45PERIODS**

*(Permitted to use standard Gas Tables in the examination)*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Yahya.S.M | Fundamentals of Compressible flow | New Age International (P) Ltd., New Delhi | 2009 |
| 2 | Rathakrishnan.E | Gas Dynamics | Prentice Hall of India, New Delhi | 2010 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Patrich.H.Oosthvizen, WillamE.Carscallen | Compressible fluid flow | McGraw–Hill | 1997 |
| 2 | Zucker,R.D. and Biblarz,O | Fundamentals of Gas Dynamics | John Willey | 2002 |
| 3 | Ganesan .V | Gas Turbines | Tata McGraw–Hill, New Delhi | 2010 |
| 4 | P.Hill and C. Peterson | Mechanics and Thermodynamics of Propulsion | Addison –Wesley Publishing Company | 1992 |


**WEB REFERENCES**


1. http://www.adl.gatech.edu/classes/ae3021/ae3021_f06_6.pdf
2. http://www.grc.nasa.gov/WWW/k–12/airplane/isndrv.html
3. http://panoramix.ift.uni.wroc.pl/~maq/papers/PM_Correct_Matyka.pdf
4. http://soliton.ae.gatech.edu/people/jseitzma/classes/ae3450/StudyProblems.pdf
5. http://www.sil.si.edu/smithsoniancontributions/AnnalsofFlight/pdf_lo/SAOF–0001.4.pdf

**15BEME7E03 INDUSTRIAL ROBOTICS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the anatomy, basic concepts and applications ofrobot.
2. To learn the drives and end effectors used inrobot.
3. To study the various types of sensors used inrobot.
4. To familiarize robot kinematics and robotprogramming
5. To provide knowledge on simple offline robot program
6. To impart knowledge on economic analysis ofrobots

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Identify the various types ofrobots.
2. Select appropriate drive systems and end effectors for industrialapplication.
3. Decide the types of sensors required according to the applications ofrobot.
4. To identify the different types of machine visiontechnologies
5. Develop simple offline robot program for differentapplications.
6. Calculate the economic analysis ofrobots.

**UNITI FUNDAMENTALS OFROBOT 9**

Robot – Definition – Robot Anatomy – Co–ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

**UNITII ROBOT DRIVE SYSTEMS ANDENDEFFECTORS 9**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives

End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

**UNITIII SENSORS ANDMACHINEVISION 9**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors

Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

**UNITIV ROBOT KINEMATICS ANDROBOTPROGRAMMING 9**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems.

Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

**UNITV IMPLEMENTATION ANDROBOTECONOMICS 9**

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Groover M.P | Industrial Robotics – Technology Programming and Applications | McGraw–Hill, New Delhi | 2001 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Fu.K.S., Gonzalz.R.C. and Lee C.S.G | Robotics Control, Sensing, Vision and Intelligence | McGraw–Hill Book Co., New Delhi | 1988 |
| 2 | Yoram Koren | Robotics for Engineers | McGraw–Hill Book Co., New Delhi | 1992 |
| 3 | Janakiraman. P.A | Robotics and Image Processing | Tata McGraw–Hill, New Delhi | 1995 |


**WEB REFERENCE**

1. www.learnaboutrobots.com/industrial.htm

**15BEME7E04 DESIGN AND ANALYSIS OF EXPERIMENTS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To provide foundations on design of experiments and statistical analysis of experimental data obtained from laboratory and/or industrialprocesses.
2. To understand the important concepts of single factorial designs
3. To Study and acquire knowledge on various methodologies involved in single factorial designs
4. To know the application of testing of factorial experiment
5. To enrich the understanding of special experimental designs
6. To impart knowledge on basic concepts of Taguchi method in parameter design

**COURSE OUTCOMES**

Upon successful completion of the course, students will be able to:

1. Understand the knowledge of various techniques for experimentalplanning
2. Understand the concepts of single factorialdesigns
3. List the various methodologies involved in single factorialdesigns
4. Apply the concept of testing of factorialexperiment
5. Solve the partial and ordinary differential equations special experimentaldesigns
6. Apply the basic concepts of Taguchi method in parameterdesign

**UNITI INTRODUCTION 9**

Planning of experiments – Steps – Need - Terminology: Factors, levels, variables, experimental error, replication, Randomization, Blocking, Confounding.

**UNITII SINGLEFACTOREXPERIMENTS 9**

ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel‘s test, Duncan‘s Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

**UNITIII FACTORIALEXPERIMENTS 9**

Main and interaction effects –Two and three Factor full factorial Designs, 2 k deigns with Two and Three factors-Unreplicated design- Yate‘s Algorithm

**UNITIV SPECIALEXPERIMENTALDESIGNS 9**

Blocking in factorial design, Confounding of 2k design, nested design-Response Surface Methods.

**UNITV TAGUCHI TECHNIQUES 9**

Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Montgomery, D.C | Design and Analysis of Experiments | John Wiley and Sons | 2002 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hicks. C.R | Fundamental concepts in the Design of Experiments | Holt, Rinehort and Winston | 2000 |
| 2 | Bagchi. T.P | Taguchi Methods explained | PHI | 2002 |
| 3 | Ross. P.J | Taguchi Techniques for quality Engineering | Prentice Hall | 2000 |


**WEB REFERENCES**

1. http://cran.r-project.org
2. http://www.itl.nist.gov/div898/handbook/
3. http://home.ubalt.edu/ntsbarsh/stat-data/Topics.htm

**COURSE OBJECTIVES**

1. To understand the underlying principles of operation of different IC Engines andcomponents.
2. To provide knowledge on pollutant formation, control, alternate fueletc.
3. To Study and acquire knowledge to Identify parts, terminology and fuel supply system of internal combustionengine
4. To introduce the concepts of cooling and lubrication systems of ICengines
5. To make the student acquire sound knowledge on combustion, knocking and super charging of internal combustionengines
6. To expose students to recent trends associated with ICengines

**COURSE OUTCOMES**

Upon completion of this course, the students can able to

1. Explain the construction and operation of internal combustionengine.
2. Identify parts, terminology and fuel supply system of internal combustionengine.
3. Recognize the component used in cooling and lubrication systems of ICengines.
4. Describe the function of combustion, knocking and super charging of internal combustionengines.
5. Implement strategies for pollution control.
6. Know about the recent trends associated with ICengines

**UNITI SPARKIGNITIONENGINES 9**

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

**UNITII COMPRESSIONIGNITIONENGINES 9**

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbocharging.

**UNITIII POLLUTANT FORMATIONANDCONTROL 9**

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Drivingcycles.

**UNITIV ALTERNATIVEFUELS 9**

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - EngineModifications.

**UNITV RECENTTRENDS 9**

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - OnboardDiagnostics.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ramalingam. K.K | Internal Combustion Engine Fundamentals | Scitech Publications | 2002 |
| 2 | Ganesan | Internal Combustion Engines | TMH | 2002 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Mathur. R.B. and R.P. Sharma | Internal Combustion Engines | Dhanpat Rai & Sons | 2007 |
| 2 | Duffy Smith | Auto Fuel Systems | The Good Heart Willcox Company, Inc. | 1987 |
| 3 | Eric Chowenitz | Automobile Electronics | SAE Publications | 1995 |

**15BEME7E06 ADDITIVE MANUFACTURING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturingtechnologies
2. To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
3. To introduce process involved in Additive manufacturingtechnology
4. To understand the importance of knowledge on software's used in additive manufacturingtechnology
5. To enrich the understanding of the working of SLS and othertechniques
6. To provide an overview of additive manufacturing technology in medicalfield and biostream

**COURSE OUTCOMES**

On completion of this course, students will be able to

1. Understand the need for additive manufacturingtechnology
2. Explain the process involved in Additive manufacturingtechnology
3. Get knowledge on software's used in additive manufacturingtechnology
4. Describe the working of SLS and othertechniques
5. Apply the additive manufacturing technology in medicalfield
6. Applications of additive manufacturing technology in biostream.

**UNITI INTRODUCTION 9**

Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling - Applications.

**UNITII CAD & REVERSEENGINEERING 9**

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS,MAGICS.

**UNITIII LIQUID BASED AND SOLID BASED ADDITIVEMANUFACTURINGSYSTEMS 9**

Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing

**UNITIV POWDER BASED ADDITIVEMANUFACTURINGSYSTEMS 9**

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron BeamMelting.

**UNITV MEDICAL ANDBIO-ADDITIVEMANUFACTURING 9**

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chua C.K., Leong K.F., and Lim C.S | Rapid prototyping: Principles and applications | World Scientific Publishers | 2010 |
| 2 | Gebhardt A | Rapid prototyping | Hanser Gardener Publications | 2003 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Liou L.W., LiouF.W | Rapid Prototyping and Engineering applications | CRC Press | 2007 |
| 2 | Kamrani A.K. and Nasr E.A | Rapid Prototyping: Theory and practice | Springer | 2006 |
| 3 | Hilton P.D, Jacobs P.F | Rapid Tooling: Technologies and Industrial Applications | CRC press | 2000 |

**15BEME7E07 MANUFACTURE AND INSPECTION OF GEARS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To gain knowledge in production, gear materialselection
2. To introduce the concepts of gear manufacturing
3. To Study and acquire knowledge on mechanism involve in conicalgears
4. To Study and acquire knowledge on the procedures that involves in gear materialselection
5. To expose students to detailed view of gear finishingmethods
6. To impart knowledge modern gear productionmethods

**COURSE OUTCOMES**

Upon the completion of this course the students will be able to

1. Understand the overview on classification of gears and itterminology
2. Explain the various methods of gear manufacturing
3. Understands the concepts and mechanism involve in conicalgears
4. Understand the procedures that involves in gear materialselection
5. Attain a detailed view of gear finishingmethods
6. Understanding the modern gear productionmethods

**UNITI INTRODUCTIONTOGEARS 9**

Types of gears-classification, application of gears, gearboxes, drawings for gears, gear production method an overview, types of blanks and blank preparation. Production Of Cylindrical Gears: Procedure of cutting gears and obtainable quality in hobbing and gear shaping, cutter selection and work holding methods, setting calculations. Rack type gear shaping machine description and application. Internal gear cutting methods, CNC gear hobbing and gear shapingmachines.

**UNITII PRODUCTION OFCONICALGEARS 9**

Production of straight bevel gears by bevel gear generator, duplex rotary cutter method, Gleason Reva cycle method, spiral and hybrid bevel gear generation. Description of machine, cutter and machine setting.

**UNITIII GEAR MATERIAL SELECTION ANDHARDENINGMETHODS 9**

Properties of gear materials-non-metallic, non-ferrous and plastic gears, selection of material for power transmission, high speed application. Selection of material for worm and wheel. Hardening by through hardening, case hardening, induction hardening, flame hardening, nitriding and tuftriding, hardening defects.

**UNITIV GEARFINISHINGMETHODS 9**

Gear finishing advantages, finishing of gears by grinding, shaving, lapping and honing methods, cold rolling of gears - description of process, machine, cutters and process parameters setting.

Gear Inspection: Type of gear errors-gear quality standards and allowable limits-tooth thickness, base tangent length measurement, pitch error, radial run out, involute profile error measurements methods and analysis, composite error measurement, computerized gear inspection, gear failure reasons and remedies.

**UNITV MODERN GEARPRODUCTIONMETHODS 9**

Gear production by stamping, die casting, powder metal process, injection and compression moulding of plastic gears, cold and hot rolling. Mass production methods, shear speed shaping, gear broaching, Gleayson G-TRAC – gear generation methods. Economical and Quality Production of Gears: Gear production systems – batch production, gear production cells, lean and agile production practices, automobile gear and gear boxes, heavy engineering gear production, gear for instruments and appliances, process and cutter selection for quantity, cost and qualitycriteria.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Watson | Modern Gear Production | Persman Press, Oxford | 1984 |
| 2 | HMT | Production Technology | Tata McGraw Hill Co., New Delhi | 1992 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | SAE | Gear Design Manufacturing Inspection Manual | Persman Press, Oxford | 1990 |
| 2 | Weck .M | Hand Book of Machine Tools Technology and Sun Gear Technology | Magazine Back Volumes | 1984 |


**WEB REFERENCES**

1. www.geartechnology.com
2. www.gearsolutions.com

**15BEME7E08 REFRIGERATION ANDAIRCONDITIONING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the underlying principles of operations in different Refrigeration & Air conditioning systems andcomponents.
2. To provide knowledge on design aspects of Refrigeration & Air conditioningsystems
3. To introduce the concepts on use of unconventional refrigerant system for industrialapplication
4. To expose students to properties of air using psychrometricchart
5. To provide knowledge on cooling load for a givensystem
6. To know the application of air conditioning system for industrial and domestic purpose

**COURSE OUTCOMES**

Learners should be able to

1. Calculate COP of various refrigerationcycles.
2. Choose appropriate refrigerants for variousapplications.
3. Identify the use of unconventional refrigerant system for industrialapplication.
4. Calculate the properties of air using psychrometricchart.
5. Calculate cooling load for a givensystem
6. Select the appropriate air conditioning system for industrial and domesticapplications.

**UNIT I REFRIGERATIONCYCLE 9**

Review of thermodynamic principles of refrigeration. Concept of refrigeration system. Vapour compression refrigeration cycle – use of P–H charts – multistage and multiple evaporator systems – cascade system – COP comparison. Vapor absorption refrigeration system. Ammonia water and Lithium Bromide water systems. Steam jet refrigeration system

**UNIT II REFRIGERANTS, SYSTEM COMPONENTSANDBALANCING 9**

Compressors – reciprocating and rotary (elementary treatment.) – Condensers – evaporators – cooling towers. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Refrigeration plant controls – testing and charging of refrigeration units. Balancing of system components. Applications to refrigeration systems – ice plant – food storage plants – milk –chilling plants – refrigerated cargo ships.

**UNITIII PSYCHROMETRY 9**

Psychrometric processes– use of psychrometric charts – – Grand and Room Sensible Heat Factors – bypass factor – requirements of comfort air conditioning – comfort charts – factors governing optimum effective temperature, recommended design conditions and ventilation standards

**UNITIV COOLINGLOADCALCULATIONS 9**

Types of load – design of space cooling load – heat transmission through building. Solar radiation –infiltration – internalheatsources(sensibleandlatent)–outsideairandfreshairload–estimationoftotalload–
Domestic, commercial and industrial systems – central air conditioning systems.

**UNIT V AIRCONDITIONING 9**

Air conditioning equipments – air cleaning and air filters – humidifiers – dehumidifiers – air washers – condenser – cooling tower and spray ponds – elementary treatment of duct design – air distribution system. Thermal insulation of air conditioning systems. – Applications: car, industry, stores, and public buildings

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Manohar Prasad | Refrigeration and Air Conditioning | New Age International Ltd, New Delhi | 2006 |
| 2 | Arora. C.P | Refrigeration and Air Conditioning | Tata McGraw–Hill, New Delhi | 2010 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Roy.JDossat | Principles of Refrigeration | Pearson Education, New Delhi | 2002 |
| 2 | Jordon and Prister | Refrigeration and Air Conditioning | Prentice Hall of India PVT Ltd., New Delhi | 1981 |
| 3 | StoeckerN.F and Jerold W.Jones | Refrigeration and Air Conditioning | McGraw Hill, New Delhi | 1986 |

**WEB REFERENCES**

1. http://nptel.iitg.ernet.in/Mech_Engg/IIT%20Kharagpur/Refrigeration%20and%20Air%20Conditioning.htm
2. http://www.ashrae.org/
3. http://en.wikipedia.org/wiki/Thermal_comfort

**COURSE OBJECTIVES**

1. To gain knowledge in design and material selection of various machinetools.
2. To provide an overview of regulation of speeds and feeds
3. To study the features of machine toolstructures
4. To understand the importance of constructional features of machine toolstructures
5. To expose students to design in machine tool structures, guide ways, power screws andspindles
6. To expose students to design spindles and spindlesupports

**COURSE OUTCOMES**

Upon the completion of this course the students will be able to

1. Discuss the basics machine tool drives andmechanisms
2. Get knowledge on regulation of speeds and feeds
3. Understand the importance of machine toolstructures
4. Explain the constructional features of machine toolstructures
5. Design in machine tool structures, guide ways, power screws andspindles
6. Design spindles and spindlesupports

**UNITI INTRODUCTION TO MACHINE TOOL DRIVESANDMECHANISMS 9**

Introduction to the course, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission

**UNITII REGULATION OF SPEEDSANDFEEDS 9**

Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design

**UNITIII DESIGN OF MACHINETOOLSTRUCTURES 9**

Functions of Machine Tool Structures and their Requirements, Design for Strength, Design for Rigidity, Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages

**UNITIV DESIGN OF GUIDEWAYS, POWER SCREWSANDSPINDLES 9**

Functions and Types of Guideways, Design of Guideways, Design of Aerostatic Slideways, Design of Anti-Friction Guideways, Combination Guideways, Design of Power Screws.

**UNITV DESIGN OF SPINDLES AND SPINDLESUPPORTS 9**

Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, Antifriction Bearings. Dynamics of Machine Tools - Machine Tool Elastic System, Static and Dynamic Stiffness

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Sen, G.C. and Bhattacharya, A | Principles of machine tools | New Central Book Agency, Calcutta | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chernov N | Machine Tools | Mir publishers Moscow | 1984 |
| 2 | N.K. Mehta | Machine Tool Design and Numerical Control | TMH, New Delhi | 2010 |
| 3 | G.C. Sen and A. Bhattacharya | Principles of Machine Tools | New Central Book Agency | 2009 |
| 4 | D. K Pal, S. K. Basu | Design of Machine Tools | Oxford IBH | 2008 |
| 5 | N. S. Acherkhan | Machine Tool Design | MIR publications | 1968 |

**15BEME8E02 COMPUTER AIDED DRAFTING AND COST ESTIMATION 3 0 0 3100**

**COURSE OBJECTIVES**

1. To gain knowledge in sequence of process planning and cost estimation of variousproducts.
2. To introduce the concepts of dimensional and toleranceanalysis
3. To expose students to manufacturingdrawings
4. To equip them with skills to apply their knowledge in re-dimensioning and tolerancecharting
5. To understand the process chart for a givencomponent
6. To Estimate the cost of a givencomponent

**COURSE OUTCOMES**

Upon completion of this course, the student can able to

1. Apply the various standards and conventions used in a drawingsheet
2. Perform dimensional and toleranceanalysis
3. Understand the manufacturingdrawings
4. Apply their knowledge in re-dimensioning and tolerancecharting
5. Prepare process chart for a givencomponent
6. Estimate the cost of a givencomponent

**UNITI STANDARDS ANDCONVENTIONS 9**

Current international standards (ISO) and Indian Standards (IS)- types of lines - principles of presentation - dimensioning - conventional representation of threaded parts, springs, and gears.

**UNITII DIMENSIONAL ANDFORM TOLERANCES 9**

Limits and fits IT system of tolerances, deviation of fit - geometric tolerance-tolerancing of form, orientation, location and runout - datums and Datum systems-Dimensioning and tolerancing of profiles

**UNITIII MANUFACTURINGDRAWINGS 9**

Surface texture indication on drawing - welds symbolic representation of drawings. Given a sub-assembly/assembly to prepare manufacturing drawings of components, Sample exercises on CAD- preparation of manufacturing Drawings.

**UNITIV RE-DIMENSIONING ANDTOLERANCECHARTING 9**

Introduction to re-dimensioning to suit manufacturing requirements-manufacturing datum-functional datum. Introduction to tolerance charting

**UNITV COSTESTIMATION 9**

Preparation of Process chart for a given component-estimation of setting time and machining time-estimation of material cost, labour cost and overhead cost based on supplieddata.

**TOTAL 45PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Siddeshwar and Kanniah | Machine Drawing | Tata McGraw Hill | 2001 |
| 2 | Gopalakrishna, K.R | Machine Drawing | Subhas Stores | 2002 |
| 3 | Wade. O | Tolerance Control in design and manufacturing | Industrial Press | 1972 |


**WEB REFERENCE**

1. IS :10714,10715,10716,10717,11669,10719,813,919,2709,8000 pt 1 to 10721,11158 andAWS/ISO

**15BEME8E03 QUALITY CONTROL AND RELIABILITY ENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To Understand the concept of SQC.
2. To enrich the understanding of control charts to analyze for improving the process quality.
3. To familiarize the students to understand different sampling plans
4. To Understand the importance of need and types of life testing.
5. To introduce the reliability of a system.
6. To introduce the concepts of quality control and reliability techniques in industries.

**COURSE OUTCOMES**

Upon the completion of this course the students will be able to

1. Understand the concept of SQC.
2. Use control charts to analyze for improving the process quality.
3. Describe different sampling plans
4. Understand the need and types of life testing.
5. Improve the reliability of a system.
6. Implement quality control and reliability techniques in industries.

**UNITI INTRODUCTION AND PROCESS CONTROLFORVARIABLES 9**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost–Variation in process– factors – process capability – process capability studies and simple problems – Theory of control chart– uses of control chart – Control chart for variables – X chart, R chart and $\sigma$ chart.

**UNITII PROCESS CONTROLFORATTRIBUTES 9**

Control chart for attributes –control chart for proportion or fraction defectives – P chart and NP chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

**UNITIII ACCEPTANCESAMPLING 9**

Lot by lot sampling – Types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts–standard sampling plans for AQL and LTPD– uses of standard sampling plans.

**UNITIV LIFE TESTING– RELIABILITY 9**

Life testing – objective: – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

**UNITV QUALITYANDRELIABLITY 9**

Reliability improvements – techniques– use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles – Maintenance.

**TOTAL 45PERIODS**

*Note: Permitted to use approved statistical table in the examination.*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Grant. Eugene .L | Statistical Quality Control | McGraw–Hill, New Delhi | 2008 |
| 2 | Srinath L.S | Reliability Engineering | Affiliated East west press New Delhi | 2002 |

## 15BEME8E03 QUALITY CONTROL AND RELIABILITY 3 0 0 3100

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Manohar Mahajan | Statistical Quality Control | Dhanpat Rai and Sons, New Delhi | 2003 |
| 2 | Besterfield D.H | Quality Control | Prentice Hall, New Delhi | 1993 |
| 3 | Danny Samson | Manufacturing and Operations Strategy | Prentice Hall, New Delhi | 1991 |
| 4 | Connor P.D.T.O | Practical Reliability Engineering | John Wiley, New Delhi | 2011 |

**WEB REFERENCES**

1. http://www.statsoft.com/textbook/stquacon.html
2. http://www.isixsigma.com/library/content/c010806a.asp
3. http://www.statgraphics.com/control_charts.htm
4. http://www.sqconline.com/sampling–plans.html
5. http://reliability.sandia.gov/Maintenance/Data_Failure_Analysis/data_failure_analysis.html
6. http://www.designinindia.net/everywhere/disciplines/product–design/index.html

**15BEME8E04 COMPOSITE MATERIALS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the fundamentals of composite material strength and its mechanicalbehavior
2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of thefiber.
3. Thermo-mechanical behavior and study of residual stresses in Laminates duringprocessing.
4. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronicchips.
5. To introduce the concepts of carbon-carbon composite for different industrialapplication
6. To impart knowledge on various advances incomposites

**COURSE OUTCOMES**

Learners should be able to

1. Select the various types of composite matrix required for anapplication.
2. Choose appropriate manufacturing process for polymer matrix composite.
3. Opt appropriate manufacturing process for metal matrixcomposite.
4. Use the concepts of ceramic composites and its productiontechniques.
5. Identify the type of carbon-carbon composite for different industrialapplication.
6. Explain the various advances incomposites

**UNITI INTRODUCTIONTOCOMPOSITES 9**

Fundamentalsofcomposites-needforcomposites–Enhancementofproperties-classificationofcomposites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types ofcomposites.

**UNITII POLYMERMATRIXCOMPOSITES 9**

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics(GRP).

**UNITIII METALMATRIXCOMPOSITES 9**

Characteristics of MMC, Various types of Metal matrix composites Alloys - MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeezecasting.

**UNITIV CERAMICMATRIXCOMPOSITES 9**

Engineeringceramicmaterials–properties–advantages–limitations–Monolithicceramics-NeedforCMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing(HIPing).

**UNITV ADVANCES INCOMPOSITES 9**

Carbon /carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Mathews F.L and Rawlings R.D | Composite materials Engineering and Science | Wood head publishing Ltd, England | 2006 |
| 2 | Chawla K.K | Composite materials | Springer – Verlag, , New York | 2012 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Clyne T.W and Withers P.J | Introduction to Metal Matrix Composites | Cambridge University Press, New York | 1995 |
| 2 | Strong A.B | Fundamentals of Composite Manufacturing | Society of Manufacturing Engineering | 2008 |
| 3 | Sharma S.C | Composite materials | Narosa Publications, New Delhi | 2000 |


**WEB REFERENCES**


1. http://www.metu.edu.tr/~ckaynak/METE%20470.htm
2. http://www.springerlink.com/content/978–1–4020–8771–4
3. http://www.virginia.edu/bohr/mse209/chapter17.htm
4. http://www.virginia.edu/bohr/mse209/chapter10.htm

**15BEME8E05 PRODUCTION PLANNING AND CONTROL 3 0 0 3100**

**COURSE OBJECTIVES**

1. To impart knowledge of need for planning and control in various aspects.
2. To develop an understanding of the standard techniques in various work study methodologies.
3. To familiarize the students to understand the product and process plan.
4. To introduce the concepts of a production schedule based on different facets.
5. To enrich the understanding of the level of inventory
6. To understand the importance the recent advancements in production planning and control.

**COURSE OUTCOMES**

Student will be able to

1. Indicate the need for planning and control in various aspects.
2. Understand various work study methodologies.
3. Construct product and process plan.
4. Prepare a production schedule based on different facets.
5. Estimate the level of inventory
6. Understand the recent advancements in production planning and control.

**UNITI INTRODUCTION 9**

Objectives: and benefits of planning and control–Functions of production control–Types of production–job–batch and continuous–Product development and design–Marketing aspect – Functional aspects–Operational aspect–Durability and dependability aspect–aesthetic aspect. Profit consideration–Standardization, Simplification and specialization–Break even analysis–Economics of a new design.

**UNITII WORKSTUDY 9**

Method study, basic procedure–Selection–Recording of process – Critical analysis, Development – Implementation – Micro motion and memo motion study – work measurement – Techniques of work measurement – Time study – Production study – Work sampling – Synthesis from standard data – Predetermined motion time standards.

**UNITIII PRODUCT PLANNING ANDPROCESSPLANNING 9**

Product planning–Extending the original product information–Value analysis–Problems in lack of product planning–Process planning and routing–Pre requisite information needed for process planning–Steps in process planning–Quantity determination in batch production–Machine capacity, balancing–Analysis of process capabilities in a multi product system.

**UNITIV PRODUCTIONSCHEDULING 9**

Production Control Systems–Loading and scheduling–Master Scheduling–Scheduling rules–Gantt charts–Perpetual loading–Basic scheduling problems – Line of balance – Flow production scheduling–Batch production scheduling–Product sequencing – Production Control systems–Periodic batch control–Material requirement planning Kanban –Dispatching–Progress reporting and expediting–Manufacturing lead time–Techniques for aligning completion times and due dates.

**UNITV INVENTORY CONTROL AND RECENT TRENDSINPPC 9**

Inventory control–Purpose of holding stock–Effect of demand on inventories–Ordering procedures.
Two bin system –Ordering cycle system–Determination of Economic order quantity and economic lot size–ABC analysis–Recorder procedure–Introduction to computer integrated production planning systems–elements of JIT Systems–Fundamentals of MRP and ERP.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | MartandTelsang | Industrial Engineering and Production Management | S.Chand and Company, New Delhi | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Samson Eilon | Elements of production planning and control | Macmillan, India | 1981 |
| 2 | Elwood S.Buffa, and Rakesh K.Sarin | Modern Production Operations Management | John Wiley and Sons, New Delhi | 2007 |
| 3 | Jain C.K and Aggarwal L.N | Production Planning Control and Industrial Management | Khanna Publishers, New Delhi | 1997 |


**WEB REFERENCES**

1. http://envfor.nic.in/divisions/iwsu/iwsu.html
2. http://src.edu/work–study
3. http://thequalityportal.com/articles/value.htm

**15BEME8E06 COGENERATION AND WASTE HEAT RECOVERY SYSTEMS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To study the significance of waste heat recovery systems and carry out its economicanalysis
2. To know the concepts of cogeneration, its types and probable areas ofapplications
3. To enrich the understanding of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of thisemerging technology.
4. To impart knowledge on operational issues and challenges cogenerationtechnologies.
5. To Understand the impact of this technology in waste heat recoverysystems
6. To introduce the concepts of various systems involved in waste heat recoveryprocess

**COURSE OUTCOMES**

The student will be able to

1. Understand the various methods ofcogeneration.
2. Apply knowledge of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of thisemerging technology.
3. Have thorough understanding, operational issues and challenges cogenerationtechnologies.
4. Understand the impact of this technology in waste heat recoverysystems
5. Get the knowledge over various systems involved in waste heat recoveryprocess
6. Begin a career as an engineer in an organization economicanalysis

**UNITI INTRODUCTION 9**

Introduction – principles of thermodynamics – cycles – topping - bottoming – combined cycle - organic rankine cycles – performance indices of cogeneration systems – waste heat recovery – sources and types – concept of trigeneration.

**UNITII COGENERATIONTECHNOLOGIES 9**

Configuration and thermodynamic performance – steam turbine cogeneration systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems – combined cycles cogeneration systems – advanced cogeneration systems: fuel cell, Stirling enginesetc.,

**UNITIII ISSUES AND APPLICATIONS OFCOGENERATIONTECHNOLOGIES 9**

Cogeneration plants electrical interconnection issues – utility and cogeneration plant interconnection issues – applications of cogeneration in utility sector – industrial sector – building sector – rural sector – impacts of cogeneration plants – fuel, electricity and environment

**UNITIV WASTE HEATRECOVERYSYSTEMS 9**

Election criteria for waste heat recovery technologies - recuperators - Regenerators - Economizers - plate heat exchangers - thermic fluid heaters - Waste heat boilers classification, location, service conditions, design Considerations - fluidized bed heat exchangers - heat pipe exchangers - heat pumps – sorption systems.

**UNITV ECONOMICANALYSIS 9**

Investment cost – economic concepts – measures of economic performance – procedure for economicanalysis – examples – procedure for optimized system selection and design – load curves - sensitivity analysis– regulatory and financial frame work for cogeneration and waste heat recovery systems.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | R.Kehlhofer, B. Rukes, F. Stirnimann | Combined-cycle gas & steam turbine power plants | PennWell Books | 2009 |

## 15BEME8E06 COGENERATION AND WASTE HEAT RECOVERY 3 0 0 3100

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Steve Doty, Wayne C. Turner | Energy management handbook | The Fairmont Press, Inc | 2009 |
| 2 | A.Thumann, D. Paul Mehta | Handbook of energy engineering | The Fairmont Press Inc | 2008 |
| 3 | B.F.Kolanowski | Small-scale cogeneration handbook | Fairmont Press | 2003 |
| 4 | M.P. Boyce | Handbook for cogeneration and combined cycle power plants | ASME Press | 2002 |
| 5 | Educogen | The European Educational tool for cogeneration | Fairmont Press | 2001 |

**15BEME8E07 ENERGY CONSERVATION METHODS AND ENERGY AUDIT** **3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand and analyze the energy data ofindustries
2. To carryout energy accounting andbalancing
3. To conduct energy audit and suggest methodologies for energysavings
4. To utilize the available resources in optimalways
5. To make the students conversant with concepts of industrialfurnaces
6. To equip them with skills to perform Energyaudit

**COURSE OUTCOMES:**

At the end of the course, student will be able to

1. Understand the Environmental aspects of energyutilization
2. Perform combustionanalysis
3. Explain the concepts of industrialboiler
4. understand how to work with the steam generated from the boilers in the industrial point ofview
5. Explain the concepts of industrialfurnaces
6. Perform Energyaudit

**UNITI ENERGYSCENARIO** **9**

Present status, rate of growth, energy utilization (sector wise), concept of energy conservation, energy economics.

COMBUSTION: Fuel analysis, combustion calculations, air requirements, theoretical and excess air requirements, excess air control, flue gas analysis and measurement, types of draught, draught calculations, chimney size calculations. F.D and I.D fan draught requirements and power requirements, furnace pressure requirements.

**UNITII INDUSTRIALBOILERS** **9**

Types and characteristics of industrial boilers, heat balance in boilers, efficiency trials in boilers, energy conservation opportunities in boilers operation and maintenance, water treatment requirements, soot blowing requirements, super heaters and superheat controls, waste heat recovery systems.

STEAM: Distribution requirements of steam and streamlines, efficient utilization of steam, steam trapping and air venting, flash steam recovery, condensate recovery, thermal insulation for systems including HVAC, stream balancecalculations.

**UNITIII INDUSTRIALFURNACES** **9**

Furnace types and characteristics, heat balance in furnaces, furnace efficiency calculations, energy conservation opportunities in furnaces, refractories types and properties, waste heat recovery system, insulating refractories, ceramic fibers, heat loss reduction calculations, wall and stored heat lossreduction.

**UNITIV DRYING** **9**

Principle of drying and types of driers, mass and heat balance in driers, energy conservation opportunities in drying operations.

EVAPORATION: Principle of evaporation and types of evaporations, mass and heat balance, single and multiple effect evaporation, capacity and steam economy calculations, vapour recompression system.

**UNITV ENERGY AUDIT ANDAPPLICATIONS** **9**

Types, methodology, questionnaire development, specific energy consumption (unitwise/section wise), identification of energy conservation measures/ technologies, economic and cost benefit analysis, case studies.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Turner, W. C., Doty, and Truner, W. C | Energy Management Hand book | Fairmont Press | 2009 |
| 2 | De. B. K. | Energy Management audit & Conservation | Vrinda Publication | 2010 |

## 15BEME8E07 ENERGY CONSERVATION METHODS AND ENERGY 3 0 0 3100

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Trinks M.H, W.Mawhinney | Industrial Furnaces | John Wiley Publications, London | 2004 |
| 2 | Prabir Basu, Cen Kefa, Louis Jestin | Boilers and Burners Design and Theory | Springer Publications, New Delhi | 2012 |

**WEB REFERENCES**

1. www.energyconservation.co.in
2. www.energymanagertraining.com\
3. www.nrel.gov
4. www.aerfindia.org
5. www.gvepinternational.org

**15BEME8E08 NON DESTRUCTIVE TESTING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To provide in-depth knowledge on various techniques of non-destructive testing
2. To provide an overview of destructive and non destructive tests and state theirapplications
3. To study the features of NDT techniques for variousproducts.
4. To expose students to skills needed for selection of appropriate NDT technique(s) for new inspectionjobs
5. To understand the established NDE techniques and basic familiarity of emerging NDE techniques.
6. To facilitate the understanding of standard application area ofNDET

**COURSE OUTCOMES**

Student will be able to

1. Understand the codes, standards and specifications related toNDT
2. Classify the destructive and non destructive tests and state theirapplications
3. Develop NDT techniques for variousproducts.
4. Acquire skills needed for selection of appropriate NDT technique(s) fornew inspectionjobs
5. Acquire sound knowledge of established NDE techniques and basicfamiliarity of emerging NDE techniques.
6. Make use of standards application area ofNDET

**UNITI BASIC CONCEPTS ANDVISUALINSPECTION 9**

Concepts of Non-Destructive Testing - Relative merits and limitations - NDT versus mechanical testing, Unaided and aided visual inspection testing.

**UNITII LIQUIDPENETRANTINSPECTION 9**

Principle,applications,advantagesandlimitations,dyes,developersandcleaners,fluorescent,penetranttest.

**UNITIII MAGNETICPARTICLEINSPECTION 9**

Principles, applications, magnetisation methods, magnetic particles, dry technique and wet technique, demagnetization, advantages and limitations.

**UNITIV EDDY CURRENT ANDULTRASONICTESTING 9**

Principle, applications and instrumentation of eddy current testing. Types of ultrasonic waves, principles of wave propagation, characteristics of ultrasonic waves, Attenuation, couplants. Inspection methods - pulse echo, Transmission and resonance techniques, thickness measurement. Types of scanning, test block, IIW - referenceblocks.

**UNITV RADIOGRAPHYTESTING 9**

X- rays and Gamma rays, properties of X-rays relevant to NDE, absorption of rays, scattering, types and use of filters and screens, characteristics of films - graininess, density, speed, contrast, characteristic curves, penetrameters, exposure charts, radiographic equivalence. Fluoroscopy- Xero-Demerits ofRadiography.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Barry Hull and Vernon John | Non Destructive Testing | ELBS / Macmillan | 1989 |
| 2 | Mc Gonnagle W T | Non-Destructive Testing | McGraw Hill Book Co | 1988 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Louis Cartz | Non-Destructive Testing | ASM International, Metals Park Ohio, US | 1995 |
| 2 | ASM Metals Handbook | Destructive Evaluation and Quality Control | American Society of Metals, Metals Park, Ohio, USA | 2001 |

## OPEN ELECTIVES
## (COURSES OFFERED BY OTHER DEPARTMENTS)
## SCIENCE AND HUMANITIES

**15BESHOE01 INDUSTRIALMATHEMATICSI 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To develop analytical skills for solving engineering problems
2. To teach the students the basic concepts of LPP,
3. To learn the techniques to solve transportation problems
4. To learn the techniques to solve Assignment problems
5. To make the students to study about the Integer Programming and Network Analysis
6. Analyse the results and propose recommendations to the decision-making processes in Management Engineering

**COURSE OUTCOMES:**

1. To define and formulate linear programming problems and appreciate their limitations.
2. To solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. To be able to build and solve Transportation Models, Assignment Models,
4. To construct linear integer programming models and discuss the solution techniques.
5. To formulate and solve problems as networks and graphs.
6. To be able to solve problems in different environments and develop critical thinking

**UNITI LINEARPROGRAMMINGPROBLEM 9**

Formulation of LPP - Graphical Method - Simplex Method - Artificial variable technique and two phase simplex method. Duality - Dual and simplex method - Dual Simplex Method.

**UNITII TRANSPORTATIONPROBLEM 9**

Transportation Model, finding initial basic feasible solutions, moving towards optimality, Degeneracy.

**UNITIII ASSIGNMENTPROBLEM 9**

Solution of an Assignment problem, Multiple Solution, Hungarian Algorithm, Maximization in Assignment Model, Impossible Assignment.

**UNITIV INTEGERPROGRAMMING 9**

Integer Programming Problem – Gromory's fractional cut Method – Branch Bound Method

**UNITV NETWORKANALYSIS 9**

PERT & CPM- network diagram-probability of achieving completion date- crash time- cost analysis.

**TEXT BOOKS**

**TOTAL 45PERIODS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hamdy Taha. A. | Operations Research | Prentice – Hall of India Private Limited, New Delhi . | 2013 |
| 2 | Kanti Swarup, Manmohan, Gupta | Operations Research | Sultan Chand & Sons | 2010 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Natarajan A.M., Balasubramani P., | Operations Research | Pearson Education, | 2005 |
| 2 | Srinivasan G | Operations Research | Eastern Economy Edition | 2007 |
| 3 | Winston | Operations Research, Applications and Algorithms | Cengage Learning | 2004 |

**WEB REFERENCES**

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.mit.edu

**15BESHOE02 INDUSTRIAL MATHEMATICS II 3 0 0 3100**

**COURSE OBJECTIVES**

1. To kindle analytical skills for solving engineering problems
2. To impact the knowledge about inventory models
3. To learn replacement models
4. To learn about simulation models
5. To provide techniques for effective methods to solve nonlinear programming and decision making.
6. To analyse the results and propose recommendations to the decision-making processes in Management Engineering

**COURSE OUTCOMES**

The students will

1. To be able to solve simple models in Inventory problems and Replacement problems.
2. To understand different queuing situations and find the optimal solutions using models for different situations.
3. Simulate different real life probabilistic situations using Monte Carlo simulation technique.
4. To be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
5. **Convert** and **solve** the practical situations into replacement models.
6. To understand how to model and solve problems using non integer programming.

**UNITI INVENTORYMODELS 9**

Economic order quantity models-techniques in inventory management-ABC analysis.

**UNITII NONLINEARPROGRAMMING 9**

Khun-tucker conditions with non-negtive constraints- Quadratic programming- Wolf's modified simplex method.

**UNITIII SIMULATIONMODELS 9**

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\M\1): (∞\FIFO) , (M\M\c): (∞\FIFO) Models.

**UNITIV DECISIONMODELS 9**

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk– Decision – Tree Analysis.

**UNITV REPLACEMENTMODELS 9**

Models based on models that gradually detoriate with time-whose maintenance cost increase with time-Replacement of items that fail suddenly and completely.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Hamdy Taha. A. | Operations Research | Prentice – Hall of India Private Limited, New Delhi . | 2013 |
| 2 | Kanti Swarup, Manmohan, Gupta | Operations Research | Sultan Chand & Sons | 2010 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Natarajan A.M., Balasubramani P., | Operations Research | Pearson Education, | 2005 |
| 2 | Srinivasan G | Operations Research | Eastern Economy Edition | 2007 |
| 3 | Winston | Operations Research, Applications and Algorithms | Cengage Learning | 2004 |

**WEB REFERENCES**

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.mit.edu

**15BESHOE03 PROBABILITY AND RANDOM PROCESS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communicationengineering.
2. To understand the basic concepts of probability, one- and two-dimensional random variables
3. To introduce some standard distributions applicable to engineering which can describe real lifephenomenon.
4. To understand the basic concepts of random processes which are widely used in ITfields.
5. To understand the concept of correlation and spectraldensities.
6. To understand the significance of linear systems with randominputs.

**COURSE OUTCOMES**

Upon successful completion of the course, students should be able:

1. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real lifephenomenon.
2. To understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
3. To apply the concept random processes in engineeringdisciplines.
4. To understand and apply the concept of correlation and spectraldensities.
5. The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
6. To analyze the response of random inputs to linear time invariantsystems.

**UNITI MEASURES OF CENTRAL TENDENCYANDPROBABILITY 9**

Measures of central tendency – Mean, Median, Mode - Standard Deviation Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem.

**UNITII STANDARDDISTRIBUTIONS 9**

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – Chebyshev'sinequality.

**UNITIII TWO DIMENSIONAL RANDOM VARIABLES 9**

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

**UNITIV CLASSIFICATION OFRANDOM PROCESS 9**

Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

**UNITV CORRELATION ANDSPECTRALDENSITIES 9**

Autocorrelation-Crosscorrelation-Properties–Powerspectraldensity–Crossspectraldensity–Properties

– Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input andoutput.

**TEXT BOOK** **TOTAL 45PERIODS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Peebles Jr, P.Z | Probability Random Variables and Random Signal Principles | Tata McGraw-Hill Pubishers, New Delhi. | 2002 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Henry Stark and John W. Woods | Probability and Random Processes with Applications to Signal Processing | Pearson Education, Third edition, Delhi | 2002 |
| 2 | Ross, S | A first Course in Probability | Pearson Education, New Delhi (Chap 2 to 8) | 2012 |
| 3 | Gupta, S.C. and Kapur, V.K | Fundamentals of Mathematical Statistics | Sultan Chand and Sons, New Delhi. | 2014 |
| 4 | Veerarajan,T. | Probabilitiy, Statistics and Random process | Tata McGraw-Hill Publications, Second Edition, New Delhi | 2012 |

**WEB REFERENCES**

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com

**15BESHOE04 PROBABILITY AND STATISTICAL METHODS 3 0 0 3100**

**COURSE OBJECTIVES**

1. This course aims at providing the required skill to apply the statistical tools in engineering problems.
2. To introduce the basic concepts of probability and random variables.
3. To introduce about the concepts of random distributions
4. To introduce the basic concepts of two dimensional random variables.
5. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
6. To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

**COURSE OUTCOMES**

1. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. To understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
3. To apply the concept of testing of hypothesis for small and large samples in real life problems.
4. To apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
5. To have the notion of sampling distributions and statistical techniques used in engineering and management problems.
6. To make the student acquire sound knowledge of techniques in quality control that model engineering problems.

**UNITI MEASURES OF CENTRAL TENDENCYANDPROBABILITY 9**

Measures of central tendency – Mean, Median, Mode and Standard Deviation – SPSS Software Demonstration.

Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem - Probability mass function - Probability density functions.

**UNITII STANDARDDISTRIBUTIONS 9**

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma, and Normal distributions - Moment generating functions, Characteristic function and their properties.

**UNITIII TWO DIMENSIONALRANDOMVARIABLES 9**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

**UNITIV TESTINGOFHYPOTHESIS 9**

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness offit.

**UNITV DESIGNOF EXPERIMENTS 9**

Analysis of variance – One way classification – CRD – Two way classification – RBD - Latin square.

**TOTAL 45PERIODS**

*Note: Use of approved statistical tables permitted in the examination.*

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gupta. S.C. and Kapur. V.K | Fundamentals of Mathematical Statistics | Sultan Chand and Sons, New Delhi. | 2014 |
| 2 | Athanasios Papoulis and S Pillai | Probability Random variables and Stochastic Processes | McGraw-Hill Publications, New Delhi. | 2002 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Walpole. R.E., Myers. R.H., and Ye. K | Probability and Statistics for Engineers and Scientists | Pearsons Education, Delhi. | 2007 |
| 2 | Lipschutz. S. and Schiller. J | Schaum's outlines - Introduction to Probability and Statistics | McGraw-Hill, New Delhi. | 1998 |
| 3 | Ross. S | A first Course in Probability | Pearson Education, Delhi | 2014 |
| 4 | Johnson. R.A | Miller & Freund's Probability and Statistics for Engineers | Pearson Education, Delhi | 2014 |


**WEB REFERENCES**

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com

## 15BESHOE05 PROBABILITY AND QUEUING THEORY 3 0 0 3100

**COURSE OBJECTIVES**

1. To understand the fundamental knowledge of probability theory.
2. To introduce the concept of random variable and functions of random variables.
3. To introduce the basic concepts of two dimensional random variables.
4. To introduce the concepts of random processes and Markov chain
5. To understand the different Queuing models
6. To understand how to solve problems using various models

**COURSE OUTCOMES**

1. The student gain the knowledge in measures of central tendency and probability
2. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
3. Understand the basic concepts of two dimensional random variables and apply in engineering applications.
4. Understand the concepts of random process and markov chains
5. They will be able to solve the Queuing models
6. The students understand and characterize phenomena which evolve with respect to time in a probabilistic manner.

**UNITI PROBABILITY AND RANDOM VARIABLE 9**

Axioms of probability - Conditional probability - Total probability – Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functions and theirproperties.

**UNITII STANDARDDISTRIBUTIONS 9**

Functions of a random variable - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties.

**UNITIII TWO DIMENSIONAL RANDOM VARIABLES 9**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

**UNITIV RANDOM PROCESS ANDMARKOVCHAINS 9**

Classification - Stationary process - Markov process - Poisson process - Birth and death process - Markov chains - Transition probabilities - Limiting distributions.

**UNITV QUEUEINGTHEORY 9**

Markovian models - M/M/1, M/M/C, finite and infinite capacity - M/M/∞ queues - Finite source model - M/G/1 queue (steady state solutions only) - Pollaczek - Khintchine formula - Specialcases.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ross.S | A first course in probability | Pearson Education, Delhi | 2014 |
| 2 | Medhi.J | Stochastic Process | New Age Publishers ,New Delhi | 2014 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Veerarajan.T | Statistics and Random Processes | Tata McGraw-Hill, 2nd Edition, New Delhi. | 2008 |
| 2 | Allen.O | Probability, Statistics and Queuing Theory | Academic press, New Delhi. | 1999 |
| 3 | Gross.D. and Harris. C.M | Fundamentals of Queuing theory | John Wiley and Sons, New York. | 2008 |
| 4 | Taha.H.A | Operations Research - An Introduction | Pearson Education Edition Asia, Delhi. | 2006 |

**WEB REFERENCES**

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.mit.edu

**15BESHOE06 FUZZYMATHEMATICS 3 0 0 3100**

**COURSE OBJECTIVES**

Students should

1. Be able to understand basic knowledge of fuzzy sets and fuzzy logic
2. Be able to apply basic knowledge of fuzzy operations.
3. Able to know the basic definitions of fuzzy relations
4. Be able to know about the fuzzy measures
5. Be able to apply basic fuzzy inference and approximate reasoning
6. To know the applications of fuzzy Technology.

**COURSE OUTCOMES**

1. To gain the main subject of fuzzy sets.
2. To understand the concept of fuzziness involved in various systems and fuzzy set theory.
3. To gain the methods of fuzzy logic.
4. To comprehend the concepts of fuzzy relations.
5. To analyze the application of fuzzy logic control to real time systems.
6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

**UNITI FUZZYSETS** **9**

Fuzzy Sets: Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – F u z z y functions - Zadeh's Extension Principle

**UNITII OPERATIONS ONFUZZYSETS** **9**

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

**UNITIII FUZZYRELATIONS** **9**

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

**UNITIV FUZZYMEASURES** **9**

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

**UNITV FUZZYINFERENCE** **9**

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | George J Klir and Bo Yuan | Fuzzy Sets and Fuzzy Logic : Theory and Applications | Prentice Hall NJ | 2003 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | H.J. Zimmermann | Fuzzy Set Theory and its Applications | Allied Publishers, New Delhi | 2001 |
| 2 | Kevin M Passino and Stephen Yurkovich | Fuzzy Control | Addison Wesley Longman | 1998 |
| 3 | Michal Baczynski and Balasubramaniam | Fuzzy Implications | Springer Verlag, Heidelberg | 2008 |

**WEB REFERENCES**

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.doc.ic.ac.uk
4. www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm

**COURSE OBJECTIVES**

1. To know the fundamentals of Tensors
2. To know the series solutions to differential equations
3. To introduce the concepts of special functions
4. To study about Calculus of variations
5. To study about the integral equations
6. To know how to solve problems for above functions and equations

## COURSE OUTCOMES

1. Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
2. Learn about special type of matrices that are relevant in physics and then learn about tensors.
3. Get introduced to Special functions like Bessel, Legendre , Hermite and Laguerre functions and their recurrence relations
4. Learn different ways of solving second order differential equations and familiarized with singular points and Frobenius method.
5. Students will master in calculus of variations and linear integral equations.
6. The students will have the knowledge on Mathematical Physics and that knowledge will be used by them in different engineering and technology applications.

**UNITI TENSORS 8**

Definition of tensor - rank, symmetric tensors, contraction, quotient rule - tensors with zero components, tensor equations, metric tensors and their determinants - pseudotensors

**UNITII DIFFERENTIALEQUATIONS-SERIES SOLUTIONS 8**

Series Solution : Classification of singularities of an ordinary differential equation - Series solution-Method of Frobenius - indicial equation -examples

**UNITIII SPECIALFUNCTIONS 8**

Basic properties (Recurrence and Orthogonality relations, series expansion) of Bessel, Legendre , Hermite and Laguerre functions – Generating Function

**UNITIV CALCULUS OFVARIATIONS 9**

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functional dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric Problems – Direct methods – Ritz and Kantorovich methods.

**UNITV LINEARINTEGRALEQUATIONS 12**

Introduction – conversion of a linear differential equation to an integral equations and vice versa – conversion of boundary value problem to integral equations using Green's function – solution of a integral equation – integral equations of the convolution type – Abel's integral equations –integro–differential equations – integral equations with separable kernels – solution of Fredholm equations with separable kernels.

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dr. Grewal B.S. | Higher Engineering Mathematics | 40th edition, , Khanna Publishers | 2013 |
| 2 | Stephenson, G, Radmore. P.M | Advanced Mathematical Methods for Engineering and Science students | Cambridge University Press | 1990 |
| 3 | Andrews, Larry C. | Special Function for Engineers and Applied Mathematicians | Macmillan, New York | 1997 |
| 4 | Murray R Spiegel, Dennis Spellman | Vector Analysis | Tata Mc Graw Hill Education Pvt. Ltd., New Delhi | 2010 |

**WEB REFERENCES**

1. http://www.doitpoms.ac.uk/
2. www.phys.uu.nl/~thooft/lectures/specialfct.pdf
3. http://www.math.umn.edu/~olver/pdn.html
4. http://tutorial.math.lamar.edu/classes/DE.aspx

## 15BESHOE08 ADVANCED ENGINEERING MATHEMATICS 3 0 0 3100

**COURSE OBJECTIVES**

1. To introduce the concepts of special functions.
2. To find the solutions to partial differential equations and their applications
3. To study about mathematical physics and perturbation techniques
4. To learn replacement models and simulation models
5. To provide techniques for effective methods to solve nonlinear programming
6. To provide techniques for decision making

**COURSE OUTCOMES**

1. Students know the concepts of improper integrals, Beta and Gamma functions.
2. The students acquire sound knowledge of techniques in solving PDE that model engineering problems.
3. Identify the situations where singular perturbations are needed. They will be able to use various modifications of matched asymptotic expansions techniques to derive asymptotic solutions.
4. To be able to understand the characteristics of different types of decision-making environments and the appropriate decision-making approaches and tools to be used in each type.
5. **Convert** and **solve** the practical situations into replacement models.
6. To understand how to model and solve problems using non-integer programming.

**UNITI INTRODUCTION TO SOMESPECIALFUNCTIONS 9**

Gamma function, Beta function, Bessel function, Error function and complementary Error function, Heaviside's function, pulse unit height and duration function, Sinusoidal Pulse function, Rectangle function, Gate function, Dirac's Delta function, Signum function, Saw tooth wave function, Triangular wave function, Half wave rectified sinusoidal function, Full rectified sine wave, Square wave function.

**UNITII PARTIAL DIFFERENTIAL EQUATIONSANDAPPLICATIONS 9**

Formation PDEs, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Nonlinear PDEs first order, Some standard forms of nonlinear PDE, Linear PDEs with constant coefficients, Equations reducible to Homogeneous linear form, Classification of second order linear PDEs. Separation of variables use of Fourier series, D'Alembert's solution of the wave equation, Heat equation: Solution by Fourier series and Fourier integral

**UNITIII PERTURBATIONTECHNIQUES 9**

Singular perturbations (algebraic example). Notion of the boundary layer. Inner and outer solutions. Overlap region. Matching of the asymptotic expansions. Ordinary differential equations with singular perturbations. Methods to determine location of the boundary layer.

**UNITIV SIMULATIONMODELS 9**

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\M\1): (∞\FIFO) , (M\M\c): (∞\FIFO) Models.

**UNITV DECISIONMODELS 9**

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk– Decision – Tree Analysis.

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kreyszig. E | Advanced Engineering Mathematics | John Wiley & Sons, New Delhi. | 2014 |
| 2 | Gupta. A.S. | Calculus of Variations with Applications | Prentice Hall of India Pvt. Ltd., New Delhi | 2008 |
| 3 | Sankara Rao. K. | Introduction to Partial Differential Equations | Prentice Hall of India Pvt. Ltd., New Delhi | 2010 |
| 4 | Ali H Nayfeh | Perturbation Methods | John Wiley & Sons, New Delhi. | 2008 |
| 5 | Hamdy Taha. A. | Operations Research | Prentice – Hall of India Private Limited, New Delhi. | 2010 |

**WEB REFERENCES**

1. www.phys.uu.nl/~thooft/lectures/specialfct.pdf
2. www.maths.manchester.ac.uk/~bl/teaching/math34011/
3. pubsonline.informs.org/journal/opre

**15BESHOE09 LINEAR ALGEBRA 3 0 0 3100**

**COURSE OBJECTIVES**

1. To introduce the basic concepts of vector space
2. To know the fundamentals of linear Algebra
3. To solve system of linear equations
4. To study about the linear transformations
5. To study about the eigen values and eigen vectors
6. To introduce the concepts of inner product spaces

**COURSE OUTCOMES**

The student will be able to

1. To explain the fundamental concepts of advanced algebra
2. To explain their role in modern mathematics and applied contexts.
3. To apply the fundamental concepts in their respective engineering fields
4. To visualize linear transformations as matrix form
5. To recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
6. To articulate the importance of Linear Algebra and its applications in branches of Mathematics

**UNITI VECTORSPACES 9**

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space

**UNITII EIGEN VALUES ANDEIGENVECTORS 9**

Eigen values and Eigen vectors - diagonalization - Power method - QR decomposition

**UNITIII SYSTEM OF LINEAREQUATIONS 9**

Direct methods, Gauss elimination method, Gauss Jordan method, Crout's method, iterative methods, Gauss- Jacobi method, Gauss–Seidel method, convergence criteria.

**UNITIV LINEARTRANSFORMATIONS 9**

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

**UNITV INNERPRODUCTSPACES 9**

The Dot Product on $R^n$ and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kreyszig,E | Advanced Engineering Mathematics | John Wiley & Sons, New Delhi. | 2014 |
| 2 | Anton and Rorres | Elementary Linear Algebra, Applications version | Wiley India Edition | 2012 |
| 3 | Jim Defranza, Daniel Gagliardi | Introduction to Linear Algebra with Application | Tata McGraw-Hill | 2008 |

**WEB REFERENCES**

1. www.sosmath.com
2. www.linear.ups.edu
3. www.mathworld.wolfram.com
4. www.tutorial.math.lamar.edu

**15BESHOE10 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
3. To acquaint the student with Fourier, transform techniques used in wide variety of situations.
4. To introduce the basic concepts of PDE for solving standard partial differential equations
5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
6. To develop Z transform techniques for discrete time systems.

**COURSE OUTCOMES**

1. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
2. The learners can equip themselves in the transform techniques and solve partial differential equations
3. Understand how to solve the given standard partial differential equations.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
5. Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
6. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

**UNITI FOURIERSERIES 9**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

**UNITII FOURIERTRANSFORM 9**

Fourierintegraltheorem(withoutproof)–Fouriertransformpair–SineandCosinetransforms–Properties–
Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNITIII PARTIALDIFFERENTIALEQUATIONS 9**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

**UNITIV APPLICATIONS OF PARTIALDIFFERENTIALEQUATIONS 9**

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

**UNITV Z -TRANSFORM ANDDIFFERENCEEQUATIONS 9**

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

**TEXT BOOKS** **TOTAL 45PERIODS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Grewal, B.S. | Higher Engineering Mathematics | Khanna Publishers, Delhi. | 2013 |
| 2 | Erwin Kreyszig | Advanced Engineering Mathematics. | Wiley India (P) Ltd, New Delhi. | 2014 |

## 15BESHOE10 TRANSFORMS AND PARTIAL DIFFERENTIAL 3 0 0 3100

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Venkateswarlu S | Engineering Mathematics, Vol I | Anuratha Agencies and Publishers, Kumbakonam. | 2007 |
| 2 | Narayanan, S., and Ramaniah, G | Advanced Mathematics for Engineering Students. Volumes II and III, | Viswanathan S Printers and Publishers Pvt. Ltd. Chennai. | 2002 |
| 3 | Bali N P. | A text book of Engineering Mathematics | Laxmi Publications Pvt. Ltd. | 2006 |
| 4 | Ramana B V | Higher Engineering Mathematics | Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. | 2008 |

**WEB REFERENCES**

1. www.sosmath.com
2. http://mathworld.wolfram.com/FourierSeries.html
3. http://www.math.umn.edu/~olver/pdn.html
4. http://tutorial.math.lamar.edu/classes/DE/IntroPDE.aspx

## COURSE OBJECTIVES

1. Develop abilities to write technically and expressively,
2. Recognize writing as a constructive, meaningful process,
3. Practice using reading strategies for effective writing.
4. Design effective technical documents for both print and digital media
5. Identify the qualities of good technical writing
6. To lean avoiding similarity index.

## COURSE OUTCOMES

1. Construct simple sentences, correct common grammatical errors in written English.
2. Develop confidence in English language by imbibing lexical and syntax rules.
3. Enrich their reading ability for effective writing.
4. Elevate them to minimize word, sentence, and paragraph length without sacrificing clarity or substance
5. Familiarize with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
6. Demonstrate the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

**UNITI BASICSOFWRITING 9**

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing– Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer's block – Prioritizing for effective writing– Avoiding plagiarism.

**UNITII PARAGRAPHS ANDESSAYS 9**

Expressing Ideas – Paragraph construction – Cohesion and Coherence – Adequate development – Kinds of paragraphs – Writing drafts – Paragraph length and pattern – Types of Essays – Characteristics of Essays – Salient point of sentence constructions.

**UNITIII LETTERS, MEMOS ANDEMAIL 9**

Formal written correspondence – Types of messages – Business letters – Structure of letters – Language in letters – Tense in letters – Cover letters – Resumes – Curriculum vitae – Memos – Emails – Email Etiquette – Effectiveness and purpose.

**UNITIV THE ART OF CONDENSATION ANDTECHNICALPROPOSALS 9**

StepstoEffectivepréciswriting–Guidelines–TechnicalProposals–TypesofProposals–Characteristics–
Body of the Proposals – Style and appearance – Evaluation of proposals – Proof Reading – Book /FilmReview – Travelogue – DialogueWriting.

**UNITV REPORTS ANDRESEARCHARTICLES 9**

Discussion of newspaper articles -Objectives of Reports – Characteristics of Reports – Structure of Reports – Types of Reports – Writing an article – Writing research articles – Essential features of Dissertation – Organizing the structure of thesis and articles – Writing technical description.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | V.N. Arora and Lakshmi Chandra | Improve Your Writing: Revised First Edition | OUP | 2014 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Crème, P. and M. Lea. | Writing at University: A guide for students. | OUP | 2003 |
| 2 | Graham King | Collins Improve Your Writing | Collins; First edition | 2009 |
| 3 | David Morley | The Cambridge Intro. To Creative Writing | Cambridge | 2010 |

**15BESHOE12 GEOPHYSICS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To inculcate the basics of brief history of Earth sciences
2. To divulge knowledge on the basics of structure of earth and earth's gravitational field.
3. To disseminate the fundamentals of magnetic field and thermal distribution of earth.
4. To introduce the concepts of seismology and seismic waves .
5. To impart the basic knowledge of oceans
6. To Apply the knowledge gained from this course to solve the relevant problems in engineering stream.

**COURSE OUTCOMES**

1. Gain knowledge on the basics of history of Earth sciences.
2. Acquire knowledge on concepts of structure of earth and earth's gravitational field.
3. Have adequate knowledge on the concepts of magnetic field and thermal distribution of earth
4. Obtain knowledge on the basics of seismic waves.
5. Understand the basics of oceans and properties of sea water.
6. Apply the knowledge gained from this course to solve the relevant problems in engineering stream.

**UNITI ORIGINOFEARTH 9**

A brief history of the development of Earth Sciences and of Geophysics in particular, An overview of Geophysical methods and their essential features, Problems of inversion and non-uniqueness in Geophysics, Origin & evolution of Solar system, Earth and Moon structure,. Kepler's law of planetary motion, A review of the Earth's structure and composition

**UNITII STRUCTUREOFEARTH 9**

Chemical composition of Earth, Rheological behavior of crust and upper mantle, viscoelasticity and rock failure criteria, Geochronology: Radiometric dating and their advantages, meaning of radiometric ages, Major features of the Earth's gravitational field and relationship with tectonic processes in the crust and upper mantle, concept of isostasy, mathematical concept of Airy and Pratt hypotheses of isostasy

**UNITIII MAGNETIC FIELD AND THERMAL DISTRUBUTIONOFEARTH 9**

Origin of geomagnetic field, polar wandering, secular variations and westward drift, reversals of geomagnetic field, sun spot, solar flares, geomagnetic storms, sea-floor spreading, Paleomagnetism and its uses, Thermal history of the Earth, sources of heat generation and temperature distribution inside the earth, convection in the mantle

**UNITIV SEISMOLOGY 9**

Earthquake seismology, Earthquakes and its classifications, Global seismicity and tectonics, Earth's internal structure derived from seismology, Earthquake mechanism and Anderson's theory of faulting, Continental drift and plate tectonics: its historical perspective and essential features, present day plate motions, Triple junctions, oceanic ridges, Benioff zones, trenches and island arcs, hot spots, Mantle Plume, Mountain building, origin of Himalaya, Geodynamics of Indian subcontinent.

**UNITV OCEANS 9**

Physical properties of seawater and methods of determination, distribution of salinity in the oceans, factors affecting salinity, water masses and water type, TS Diagram, Circulation of currents in major ocean waves. Tides: Dynamical and equilibrium theory of tides. Marine pollution, steps to control marine pollution, Laws of seas, Coastal zone management

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | B.F. Howell | Introduction to Geophysics | McGraw-Hill | 2007 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | W. Lowrie | Fundamentals of Geophysics | Cambridge University Press, | 2007 |
| 2 | J.A.Jacobs, R.D.Russel | Physics and Geology | McGraw-Hill | 2002 |


**WEB REFERENCES**

1. www.ocw.mit.edu
2. www.physicsclassroom.com
3. www.nptel.ac.in
4. www.physics.org

**15BESHOE13 ENGINEERING ACOUSTICS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To disseminate the fundamentals of acoustic waves.
2. To inculcate the characteristics of radiation and reception of acoustic waves.
3. To teach the concepts of radiation and reception of acoustic waves
4. To divulge knowledge on the basics of pipe resonators and filters.
5. To introduce the features of architectural acoustics.
6. To impart the basic knowledge of transducers and receivers.

**COURSE OUTCOMES**

1. Develop the idea of the fundamentals of acoustic waves.
2. Apply the concepts of radiation and reception of acoustic waves.
3. Explain the basic ideas of pipe resonators and filters.
4. Illusrate the basics of architectural acoustics.
5. Illustrate the transducers and receivers and its applications in various electronic devices.
6. Apply the knowledge inputs of the course for engineering applications.

**UNITI INTRODUCTION 9**

Acoustics waves – Linear wave equation – sound in fluids – Harmonic plane waves -Energy density – Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales. Reflection and Transmission: Transmission from one fluid to another normal and oblique incidence –method of images.

**UNITII RADIATION AND RECEPTION OFACOUSTICWAVES 9**

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation impedance - Fundamental properties of transducers. Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

**UNITIII PIPES RESONATORS ANDFILTERS 9**

Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters – low pass, high pass and band pass. Noise, Signal detection, Hearing and speech. Noise, spectrum level and band level – combing band levels and tones – detecting signals in noise – detection threshold – the ear – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

**UNITIV ARCHITECTURALACOUSTICS 9**

Sound in endosure – A simple model for the growth of sound in a room – reverberation time - Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design. Environmental Acoustics: Weighted sound levels speech interference – highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

**UNITV TRANSDUCTION 9**

Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker – loudspeaker cabinets – horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

**TOTAL 45PERIODS**

**TEXTBOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | LawerenceE.Kinsler, Austin R.Frey, | Fundamentals of Acoustics | 4ht edition, John Wiley & Sons | 2000 |

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | F. AltonEverest& Ken Pohlmann | Master Handbook of Acoustics | McGraw Hill Professional | 2014 |

**WEB REFERENCES**

1. www.acousticalsociety.org
2. www.acoustics-engineering.com
3. www.nptel.ac.in
4. www.ocw.mit.edu

## 15BESHOE14 ALTERNATE FUELS AND ENERGY SYSTEMS 3 0 0 3100

**COURSE OBJECTIVES**

1. To understand about the fuel
2. To study about the alcohols
3. To study importance of alcohols in engine
4. To gain knowledge on the fuel gas and oils
5. To get the information on fuel cell
6. To understand electric, hybrid and solar cars

**COURSE OUTCOMES**

**1.** Students will know about the basic concepts of alternate fuels
**2.** Students will know about the basic concepts of alcohols.
**3.** Students will understand about fuel gas and oils
**4.** Students can enrich their knowledge about the alternate fuels and energy systems
**5.** Develop their knowledge in studies of vegetable oils
**6.** Students knows about the importance of electric, hybrid and solar cars

**UNITI INTRODUCTION 9**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources and significance.

**UNITII ALCOHOLS 9**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engines, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

**UNITIII NATURAL GAS, LPG, HYDROGENANDBIOGAS 9**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG & LPG in SI & CI engines, performance and emission of LPG. Hydrogen storage and handling, performance and safety aspects. Production of Biogas and its applications

**UNITIV VEGETABLEOILS 9**

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, biodiesel and its characteristics.

**UNITV ELECTRIC, HYBRID, FUEL CELL ANDSOLARCARS 9**

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Richard.L.Bechfold | Alternative Fuels Guide Book | SAE International Warren dale | 2002 |
| 2 | Jain, P.C. and Monika Jain | Engineering Chemistry. | Dhanpat Rai Publishing Company (P) Ltd., New Delhi. | 2009 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nagpal G R | Power Plant Engineering | Khanna Publishers | 2002 |
| 2 | Saeid Mokhatab<br>William A Poe | Hand book of Natural Gas Transmission and Processing | Gulf Professional Publisher, USA | 2012 |


**WEB REFERENCES**


1. www.fao.org/docrep/t4470e/t4470e08.htm
2. http://www.exergy.se/goran/hig/ses/06/alternative%20fuels
3. http://www.alternative-energy-news.info/technology/transportation/hybrid-cars/

**15BESHOE15 SOLID WASTE MANAGEMENT 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To make the students conversant with basics of Solid wastes and its classification.
2. To make the student acquire sound knowledge of different treatments of solid wastes.
3. To acquaint the student with concepts of waste disposals.
4. To develop an understanding of the basic concepts of Hazardous waste managements.
5. To acquaint the students with the basics of energy generation from waste materials.
6. To get the information on energy conservation.

**COURSE OUTCOMES:**

1. Outline the basic principles of Solid waste and separation of wastes (K)
2. Identify the concepts of treatment of solid wastes (S)
3. Identify the methods of wastes disposals. (S)
4. Examine the level of Hazardousness and its management. (S)
5. Examine the possible of the energy production using waste materials. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

**UNITI SOLIDWASTE 9**

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

**UNITII WASTETREATMENT 9**

Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

**UNITIII WASTEDISPOSAL 9**

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfillRemediation

**UNITIV HAZARDOUS WASTEMANAGEMENT 9**

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, riskassessment.

**UNITV ENERGY GENERATION FROM WASTE 9**

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, energy recovery systems. Biological & chemical conversion technologies – Aerobic composting, low solids. Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dara.S.S, Mishra.D.D | A Text book of Environmental chemistry and pollution control | S.Chand and company Ltd | 2011 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nagpal H.Theisen, S. Vigil | Integrated Solid Waste management- Engg. Principles and management issues | George Tchobanoglous, McGraw Hill | 2013 |
| 2 | Frank Kreith, George Tchobanoglous | Hand Book of Solid Waste Management- 2ndedition | McGraw Hill Publishing Ltd., Newyork | 2002 |
| 3 | Shah, L Kanti | Basics of Solid & Hazardous Waste Management Technology | Prentice Hall | 1999 |


**WEB REFERENCES**


1. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
2. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
3. www.alternative-energy-news.info/technology/garbage-energy/
4. nzic.org.nz/ChemProcesses/environment/

**15BESHOE16 GREEN CHEMISTRY 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To make the students conversant about the green chemistry
2. To make the student acquire sound knowledge of the atom efficient process
3. Able to synthesis elaborately the atom efficient process.
4. To acquaint the student with concepts of green technology.
5. To develop an understanding of the basic concepts of renewable energy resources.
6. To acquaint the students with the basic information on catalysis.

**COURSE OUTCOMES:**

1. Outline the basic principles of green chemistry (K)
2. Examine the different atom efficient process and synthesis elaborately (S)
3. Apply the concepts combustion of green technology (S)
4. Identify and apply the concepts of renewable energy (S)
5. Apply the concepts of green catalysts in the synthesis (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

**UNITI INTRODUCTION TO GREENCHEMICALPRINCIPLES 9**

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

**UNITII ATOM EFFICIENTPROCESSES 9**

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis

**UNITIII BIOTECHNOLOGY AND GREENCHEMISTRY 9**

Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

**UNITIV RENEWABLERESOURCES 9**

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomassconversion

**UNITV CATALYSIS INGREENCHEMISTRY 9**

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | V. K. Ahluwalia and M.Kidwai | New Trends in Green Chemistry | Anamaya publishers.Newdelhi. Second Edition | 2007 |
| 2 | Sanjay K. Sharma, AckmezMudhoo | Green Chemistry for Environmental Sustainability | CRC Press | 2010 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | K. R. Desai | Green Chemistry | Himalaya Publishing House, Mumbai. | 2005 |
| 2 | Dr. Sunita Ratan | A Textbook of Engineering Chemistry | S.K. Kataria and Sons | 2012 |
| 3 | A. S.Matlack | Introduction to Green Chemistry | Marcel Dekker: New York | 2001 |
| 4 | Mukesh Doble | Green Chemistry and Engineering | Academic Press | 2007 |


**WEB REFERENCES**


1. http://www.organic-chemistry.org/topics/green-chemistry.shtm
2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
4. http://www.epa.gov/research/greenchemistry/
5. http://www.amazon.in/Green-Chemistry-Catalysis

**15BESHOE17 APPLIED ELECTROCHEMISTRY 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To make the students conversant with **the information on electrochemical material**.
2. To make the student acquire sound knowledge of **conducting polymers**.
3. To acquaint the student with concepts of Energy storage devices.
4. To develop energy storage devices.
5. To impart knowledge on basic principles of solar cells
6. To know the applications of energy storage

**COURSE OUTCOMES:**

1. Outline the basic principles of chemistry in electrochemical material (K)
2. Examine the properties of conducting polymers (S)
3. Apply the concepts of electrochemistry in storage devices. (S)
4. Identify the concepts of storage devices and its applications. (S)
5. Apply the suitable materials for the manufacturing of storage devices. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

**UNITI METALFINISHING 9**

Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating- Electro less plating of nickel- anodizing – Electroforming – Electro winning

**UNITII CONDUCTING POLYMERSANDELECTROCHEMICALS 9**

Electropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers-poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

**UNITIII BATTERIES ANDPOWERSOURCES-I 9**

Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types ofelectrolytes.

**UNITIV BATTERIES ANDPOWERSOURCES-II 9**

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

**UNITV ELECTROCHEMICALMATERIALSCIENCE 9**

Solar cells- Preparation of CdS/Cu2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | D.Pletcher and F.C.Walsh | Industrial electrochemistry | Chapman and Hall, London | 1990 |
| 2 | Cynthia G. Zoski | Hand Book of Electrochemistry | Academic Press, Elesevier., UK | 2007 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | M.M.Baizer | Organic electrochemistry | Dekker Inc. New York | 1983 |
| 2 | M. Barak | Electrochemical power sources | I.EEE series, Peter Peregrinius Ltd, Steverage, U.K. | 1997 |
| 3 | K.L. Chopra and I. Kaur | Thin film devices and their application | Plenum Press, New York. | 1983 |
| 4 | Bruno Scrosati | Applications of Electroactive polymers | Chapman & Hall, London | 1993 |


**WEB REFERENCES**


1. http://www.anoplate.com/finishes/
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
3. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

**15BESHOE18 INDUSTRIAL CHEMISTRY 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To make the students conversant with **cement and lime** and its uses.
2. To make the student acquire sound knowledge of abrasives
3. To make the student acquire sound knowledge of refractories.
4. To acquaint the student with concepts of inorganic chemicals.
5. To develop an understanding of the basic concepts of**explosives**.
6. To acquaint the students with the basics of **agriculture chemicals**.

**COURSE OUTCOMES:**

1. Outline the basic chemistry of **cement and lime (K)**
2. Examine the uses of abrasives and refractories (S)
3. Identify the usage of the inorganic chemicals. (S)
4. Identify the concepts of explosives and smoke screens (S)
5. Identify the usage of the **agriculture** chemicals (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

**UNITI CEMENTANDLIME 9**

Manufacture of Portland cement – settling of hardening of Portland cement – regauging cement – effect of fineness on setting and hardening – freezing – high early strength cement – high alumina cement Lime – raw materials- manufacture – slaking – lime mortar – types of lime – high – calcium or fat lime – calcium lime or lean lime – magnesian lime – dolomitic lime – hydraulic lime.

**UNITII ABRASIVES ANDREFRACTORIES 9**

Abrasives–hardabrasives–siliceousabrasives–softabrasives –artificialabrasives–uses.Refractories– definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

**UNITIII INORGANICCHEMICALS 9**

Common salt and soda ash – Manufacture – Different grades – products – alkalis – Na2CO3, Caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture–absorption–uses,Sulphurandsulphuricacid–extractionofsulphur–manufactureofH2SO4 – chamber – contact processes – industrialuses.

**UNITIV EXPLOSIVES 9**

Explosives–uses–propertiesandtests–explosivesforwar–nitrocellulose–picricacidandT.N.T.– industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gasmask.

**UNITV AGRICULTURECHEMICALS 9**

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | B.K. Sharma | Industrial Chemistry | Goel Publishing House, Meerut | 2000 |
| 2 | D.Pletcher and F.C.Walsh | Industrial electrochemistry | Chapman and Hall, London | 1990 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | B.N.Chakrabarty | Industrial Chemistry | Oxford and IBH Publishing CO. New Delhi. | 1998 |
| 2 | R.N. Sherve | Chemical process industries | McGraw-Hill, Kugakuisha Ltd., Tokyo. | 1984 |
| 3 | James A. Kent | Hand Book of Industrial Chemistry, 9th edition | New York, Van Nostrand Reinhold. | 1992 |
| 4 | S.D. Shukla and G.N. Pandy | A text book of chemical technology | Vikas publishing house pvt. Ltd, New Delhi. | 1979 |


**WEB REFERENCES**

1. http://en.wikipedia.org/wiki/Cement
2. http://www.hon.ch/HONselect/Selection/D01.html
3. http://fas.org/man/dod-101/navy/docs/fun/part12.htm
4. http://toxics.usgs.gov/topics/agchemicals.html

## COMPUTER SCIENCE AND ENGINEERING

**15BECSOE01 PYTHONPROGRAMMING 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To learn how to use and manipulate several core data structures: Lists, Dictionaries, Tuples, and Strings
2. To study decision structures and loops
3. To understand the process and skills necessary to effectively deal with problem solving in relation to writing programs
4. To understand the process and skills necessary to effectively deal with problem solving
5. To discuss in relation to writing programs
6. To study various program object and graphics based on python

**COURSE OUTCOMES:**

Upon completion of the course, students will be able to:

1. Develop algorithmic solutions to simple computational problems Read, write, execute by hand simple Python programs
2. Structure simple Python programs for solving problems
3. Decompose a Python program into functions.
4. Represent compound data using Python lists, tuples, dictionaries
5. Read and write data from/to files in Python Programs
6. Understand various program object and graphics based on python

**UNITI FUNDAMENTALS 9**

The Universal Machine-Program power- What is Computer Science?-Hardware Basics- Programming Languages-Python-Inside Python program-Software Development Process- Example program-Elements of programs- Output statements- Assignment Statements- Data types-Type conversions

**UNITII DECISION STRUCTURESANDLOOPS 9**

Simple Decisions-Two-way decisions-Multi-way decisions-Exception handling-for loops-indefinite loops-common loop patterns-Booleans

**UNITIII FUNCTIONS 9**

Function of functions-Functions and Parameters-Function that returns values-Function that modifies parameters-Functions and program structures

**UNITIV SEQUENCES 9**

String data type- String Processing - List as sequences-String Representation-String Methods-I/O as String manipulation-File Processing

**UNITV OBJECTS ANDGRAPHICS 9**

Overview - Object of Objects - Simple Graphics Programming - Using Graphical Objects - Choosing Coordinates - Interactive Graphics-Graphics module reference

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | John Zelle | Python Programming: An Introduction to Computer Science | Franklin & Associates | 2009 |
| 2 | Mark Lutz | Learning Python | OReily | 2013 |
| 3 | David Beazly& Brian K. Jones | Python Cookbook | OReily | 2013 |

**15BECSOE02 INTERNET PROGRAMMING 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To study concepts of Internet, IP addresses and protocols
2. To explain the concept of web page development through HTML
3. To introduce the PERL and explore its current strengths and Weaknesses
4. To write working Java code to demonstrate the use of applets for client-side programming
5. To study Internet telephony and various multimedia applications
6. To Elaborate on the principles of web page development

**COURSE OUTCOMES:**

Upon completion of this course, the student will be able to:

1. Learn the advanced concepts& techniques of Internet and Java.
2. Analyze the requirements for and create and implement the principles of web page development
3. Understand the concepts of PERL
4. Implement client-side programming using java applets
5. Generate internet telephony based upon advanced concepts
6. Develop applications on internet programming based on java applets and scripts

**UNITIINTRODUCTION** **9**

Introduction - Network of Networks, Intranet, Extranet and Internet. World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing- Classful and Classless Addressing,Subnetting

**UNITIIHTML** **9**

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction- Environment Variable, GET and POST Methods.

**UNITIIIPERL** **9**

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets- Container Class, Components, Applet Life Cycle, Update method,Applications.

**UNIT IVCLIENT-SERVERPROGRAMMING** **9**

Client-Server programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

**UNIT VINTERNETTELEPHONY** **9**

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview ofSEO.

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | N.P. Gopalan and J. Akilandeswari | Web Technology: A Developer's Perspective | PHI Learning, Delhi | 2013 |
| 2 | Rahul Banerjee | Internetworking Technologies, An Engineering Perspective | PHI Learning, Delhi | 2011 |

**15BECSOE03 MULTIMEDIA AND ANIMATION 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To impart the fundamental concepts of Computer Animation and Multimedia
2. To study the graphic techniques and algorithms using flash
3. Explain various concepts available in 3D animation
4. Explain various devices available for animation
5. To study the multimedia concepts and various I/O technologies for concept development
6. To understand the three-dimensional graphics and their transformations

**COURSE OUTCOMES**

Upon completion of this course, the student will be able to:

1. Develop their creativity using animation and multimedia
2. Understand the concepts of Flash and able to develop animation using it
3. Understand about various latest interactive 3D animation concepts
4. Know the various devices and software available in motion capture
5. Understand the concept development process
6. Develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

**UNITI INTRODUCTION 9**

What is mean by Animation – Why we need Animation – History of Animation– Uses of Animation – Types of Animation – Principles of Animation – Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -CreatingAnimation.

**UNITII CREATING ANIMATIONINFLASH 9**

Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers - Action script.

**UNITIII 3D ANIMATION &ITSCONCEPTS 9**

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.

**UNITIV MOTIONCAPTION 9**

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different Language of Script Animation Among the Software.

**UNITV CONCEPTDEVELOPMENT 9**

Story Developing –Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

**TOTAL 45PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ranjan Parekh | Principles of Multimedia | TMH | 2007 |
| 2 | Ashok Banerji, Ananda Mohan Ghosh | Multimedia Technologies | McGraw Hill Publication | 2007 |
| 3 | Malay K. Pakhira | Computer Graphics, Multimedia and Animation | PHI Learning | 2010 |
| 4 | Pankaj Dhaka | Encyclopedia of Multimedia and Animations | Anmol Publications | 2011 |

**15BECSOE04 PC HARDWARE AND TROUBLE SHOOTING 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To study the basic parts of computer in detail
2. Introduce various peripheral devices available for computer and its detailed working concepts
3. Overview of various interfaces and other hardware overview
4. Assemble/setup and upgrade personal computer systems and discuss about power supplies and the skills to trouble-shoot various power-related problems.
5. To study basic concepts and methods in troubleshooting
6. To study the installation/connection and maintenance of computer and its associated peripherals.

**COURSE OUTCOME:**

Upon completion of this course, the student will be able to:

1. Identify the main components for the PC, familiarize themselves with PC memories such as RAM and ROM devices and so on.
2. Identify various peripheral devices available and its working
3. Understand various concepts of hardware and its interface and control
4. Perform basic installation of PC. Importance of maintenance is understood
5. Understand Various faults and failures are identified and troubleshooting in detail
6. Understand overall PC hardware, interfacing, maintenance and troubleshooting

**UNITI INTRODUCTION 9**

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC andUser.

**UNITII PERIPHERALDEVICES 9**

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

**UNITIII PCHARDWAREOVERVIEW 9**

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

**UNITIV INSTALLATION ANDPREVENTIVEMAINTENANCE 9**

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – DataRecovery.

**UNITV TROUBLESHOOTING 9**

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROMProblems.

**TOTAL 45PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | B. Govindarajalu | IBM PC Clones Hardware, Troubleshooting and Maintenance | TMH | 2002 |
| 2 | Peter Abel, Niyaz Nizamuddin | IMB PC Assembly Language and Programming | Pearson Education | 2007 |
| 3 | Scott Mueller | Repairing PC's | PHI | 1992 |

**15BECSOE05 GAME PROGRAMMING 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To understand the basic requirements, installation and structure of gaming using Java
2. Discuss various aspects of safe cracker projects
3. Discuss various aspects of match game projects
4. Discuss various aspects of pizza delivery projects
5. Discuss various aspects of moon landing projects
6. Discuss the process of development of gaming using Java

**COURSE OUTCOMES:**

Upon completion of the course, students will be able to:

1. Interpret various concepts of gaming based on Java
2. Design the frame and code to develop safe cracker project
3. Design the frame and code to develop match game project
4. Design the frame and code to develop pizza delivery project
5. Design the frame and code to develop moon landing project
6. Design and develop various games using Java

**UNITI INTRODUCTION 9**

Introducing Games with Java- Requirements-Installing Netbeans IDE-Structure of Java Program-Structure of Java GUI-Swing controls-Stopwatch Project-Creating Frames-Adding Controls-Adding Event methods-WritingCode

**UNITII SAFECRACKERPROJECT 9**

Frame design-Grid Bag Layout Manager-Code Design-Adding Sounds-Tic Tac Toe Project-Frame Design-Code Design-Adding Events-Adding Sounds

**UNITIII MATCHGAMEPROJECT 9**

Preview-Frame Design-Photo Selection-Code Design-Timer Objects- Adding Delays-one player Solitaire game-Computer Moves

**UNITIV PIZZADELIVERYPROJECT 9**

Preview- Frame Design-Adding Clock-Game Design-Multiple Frames GUI- Leap Frog Project-Preview Frame Design-Code Design- Introduction to OOP-Sprite Class-Collision detection between objects-UpdatingScores

**UNITV MOONLANDINGPROJECT 9**

Preview-Frame Design- Code Design- Graphics Methods- Graphics 2D Objects-Stroke and Paint Objects-Shapes and Drawing Methods-Line, Rectangle and Ellipse-Scrolling Background-Sprite Animation

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Philip Conrod, Lou Tylee | Programming Games with Java | Cengage Learning PTR | 2013 |
| 2 | Timothy M.Right | Fundamental 2D Game Programming with Java | Cengage Learning PTR | 2015 |
| 3 | Wayne Holder,Doug Bell | Java Game Programming for Dummies | Cengage Learning PTR | 2013 |

**15BEEEOE01 ELECTRICHYBRIDVEHICLES 3 0 0 3100**

**Course Objectives**

1. To understand the basic concepts of electric hybrid vehicle.
2. To gain the knowledge about electric propulsion unit.
3. To gain the concept of Hybrid Electric Drive-Trains.
4. To gain the different Energy Management Strategies.
5. To study about the efficiency manipulation in drives
6. To understand and gain the knowledge about various energy storage devices

**Course Outcomes:**

1. Summarize the basic concepts in bioprocess Engineering.
2. Explain the concept of Hybrid Electric Vehicles.
3. Understand the concept of Hybrid Electric Drive-Trains.
4. Identify the different Energy Management Strategies.
5. Understand the concept of different Energy Storage devices.
6. Analyze the different motor drives used in Hybrid Electric Vehicles.

**UNITI INTRODUCTION 9**

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

**UNITII HYBRIDELECTRICDRIVE-TRAINS 9**

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

**UNITIII ELECTRICPROPULSIONUNIT 9**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

**UNITIV ENERGYSTORAGE 9**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

**UNITV ENERGYMANAGEMENTSTRATEGIES 9**

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Iqbal Hussein | Electric and Hybrid Vehicles: Design Fundamentals | CRC Press | 2010 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Mehrdad Ehsani, Yimi Gao, Gay, Ali Emadi | Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design | CRC Press | 2009 |
| 2 | James Larminie, John Lowry | Electric Vehicle Technology Explained | Wiley | 2012 |

## 15BEEEOE02 ENERGY MANAGEMENT & ENERGY AUDITING 3 0 0 3100

**COURSE OBJECTIVES:**

1. To gain the knowledge about energy management.
2. To understand the basic concepts in economic analysis in energy management.
3. To understand the basic principles of energy audit.
4. To gain the knowledge about the basic concept of types of Energy Audit
5. To gain and Evaluate the different energy efficient motors
6. Understand the concept of Energy conservation.

**COURSE OUTCOMES:**

At the end of this course, students will demonstrate the ability to

1. Understand the concept of Energy Management.
2. Analyze the different methods for economic analysis
3. Knowledge about the basic concept of Energy Audit and types.
4. Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. Investigate the different methods to improve power factor.

**UNITI ENERGYMANAGEMENT 9**

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

**UNITII ECONOMIC ASPECTSANDANALYSIS 9**

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

**UNITIII BASIC PRINCIPLES OFENERGYAUDIT 9**

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

**UNITIV ENERGYEFFICIENTMOTORS 9**

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

Energy conservation: Importance-energy saving measures in DG set-fans and blowers pumps- air conditioning system-energy efficient transformers.

**UNITV POWER FACTOR IMPROVEMENT, LIGHTING ANDENERGYINSTRUMENTS 9**

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice- lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application ofPLCs.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Murphy W.R. and G.Mckay Butter worth | Energy Management | Heinemann Publications | 2007 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | John.C.Andreas | Energy Efficient Electric Motors | Marcel Dekker Inc Ltd – 3rd edition | 2005 |
| 2 | W.C.Turner Steve Doty | Energy Management Handbook | John Wiley and Sons, 7th Edition | 2013 |
| 3 | Paul o' Callagham | Energy Management | Mc-Graw Hill Book Company – 1st edition | 1998 |

**15BEEEOE03 SENSORS & TRANSDUCERS 3 0 0 3100**

**COURSE OBJECTIVES**

1. It deals with various types of Sensors & Transducers and their working principle
2. It deals with resistive transducers
3. It deals with capacitive transducers
4. It deals with inductive transducers
5. It deals with some of the miscellaneous transducers
6. It deals with characteristics of transducers

**COURSE OUTCOMES**

At the end of the course the student will be able to

1. understand all types of sensors and transducers.
2. Justify the concept and working principle of different transducers and sensors
3. 3 Justify the transducers that will be utilised in the electrical industries
4. Identify recent developments in transducer domain
5. Discover the knowledge for small technology up gradations in it
6. Analysis the real time application.

**UNITI INTRODUCTIONOFTRANSDUCERS 9**

Transducer – Classification of transducers – Basic requirement of transducers.

**UNITII CHARACTERISTICS OFTRANSDUCERS 9**

Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs.

**UNITIII RESISTIVETRANSDUCERS 9**

Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer.

**UNITIV INDUCTIVE ANDCAPACITIVETRANSDUCER 9**

Self inductive transducer – Mutual inductive transducers– LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

**UNITV MISCELLEANEOUS TRANSDUCERS 9**

Piezoelectrictransducer–HallEffecttransducers–Smartsensors–Fiberopticsensors–Filmsensors–
MEMS – Nano sensors, Digital transducers.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Sawhney A.K | A Course in Electrical and Electronics Measurements and Instrumentation | 18th Edition, Dhanpat Rai & Company Private Limited | 2007 |
| 2 | Renganathan. S | Transducer Engineering | Allied Publishers, Chennai | 2003 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Doebelin. E.A | Measurement Systems – Applications and Design | Tata McGraw Hill, New York | 2003 |
| 2 | Patranabis. D | Sensors and Transducers | Prentice Hall of India | 2003 |
| 3 | John. P, Bentley | Principles of Measurement Systems | III Edition, Pearson Education | 2004 |
| 4 | Murthy.D.V.S | Transducers and Instrumentation | Prentice Hall of India | 2010 |

**15BEEEOE04 PROGRAMMABLE LOGIC CONTROLLER 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the basic principles of PLC systems.
2. To gain the knowledge about data handling functions.
3. To gain the knowledge of storage techniques in PLC
4. To acquire the knowledge about how to handle the data and functions
5. To study about flow charts of ladder and spray process system
6. To understand the principles of PID.

**COURSE OUTCOME**

1. At the end of the course the student will be able to understand the registers and functions in PLC and they are able to do the program.
2. To acquire the knowledge of storage techniques in PLC
3. Students know how to handle the data and functions
4. Students known about advanced controller in PLC applications
5. Students gather real time industrial application of PLC
6. Students gathered and evaluate the flow charts of ladder and spray process system

**UNITI INTRODUCTION 9**

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

**UNITII PLCPROGRAMMING 9**

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

**UNITIII REGISTERS ANDPLCFUNCTIONS 9**

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

**UNITIV DATAHANDLINGFUNCTIONS 9**

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

**UNITV PIDPRINCIPLES 9**

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | JR Hackworth and F.D Hackworth – Jr | Programmable Logic Controllers – Programming Method and Applications | Pearson | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | John Webb and Ronald A Reiss | Programmable Logic Controllers – Principle and Applications | Fifth edition, PHI | 2004 |
| 2 | W.Bolton | Programmable Logic controller | Elsevier Newnes Publications, Fourth Edition | 2009 |


**WEB REFERENCE**


1. http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm,- Introduction to programmable Logiccontroller

**15BEEEOE05 RENEWABLE ENERGY RESOURCES 3 0 0 3100**

**COURSE OBJECTIVES**

1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geo thermal power plants.
6. To gain the knowledge about hydro energy.

**COURSE OUTCOMES**

At the end of this course, students will demonstrate the ability to

1. Analyze the Energy Scenario in India
2. Understand the concept of Solar Energy
3. Understand the concept of Wind Energy
4. Understand the concept of Hydro Energy
5. Analyze the different energy sources
6. Students gathered the real time inter connected system modelling in wind power

**UNITI INTRODUCTION 9**

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

**UNITII SOLARENERGY 9**

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

**UNITIII WINDENERGY 9**

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

**UNITIV HYDROENERGY 9**

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

**UNITV OTHERSOURCES 9**

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rai.G.D | Non-conventional resources of energy | Khanna publishers ,Fourth edition | 2011 |
| 2 | Khan.B.H | Non-Conventional Energy Resources | The McGraw Hills, Second edition | 2009 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rao.S. &Parulekar | Energy Technology | Khanna publishers, Fourth edition | 2013 |
| 2 | Godfrey Boyl | Renewable Energy: Power sustainable future | Oxford University Press, Third edition | 2012 |
| 3 | John W Twidell and Anthony D Weir | Renewable Energy Resources | Taylor and Francis | 2015 |
| 4 | Mittal K.M | Non-Conventional Energy Systems | Wheeler Publishing Co. Ltd | 1997 |


**WEB REFERENCE**

1. www.energycentral.com
2. 2. www.catelelectricpowerinfo.com

**COURSE OBJECTIVES:**

1. To study the state variable analysis
2. To provide adequate knowledge in the phase plane analysis and also describing function analysis.
3. To study the analysis discrete time systems using conventional techniques.
4. To analyze the stability of the systems using different techniques.
5. To study the design of optimal controller.
6. To study the types of compensators

**COURSE OUTCOMES:**

At the end of the course the student will be able to

1. understand the state variable analysis, Z- transform, state equation
2. Construct the frequency response of the system using various plots
3. Correlate the time and frequency domain specifications and
4. Correlate the effect of compensation
5. Design the different types of compensators using frequency response plots to stabilize the control system
6. Explain the state variable representation of physical systems with the effects of state feedback its assessment for linear-time invariant systems.

**UNITI STATEVARIABLEANALYSIS 9**

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability - Pole Placement –State observer Design of Control Systems with observers

**UNITII PHASE PLANE AND DESCRIBINGFUNCTIONANALYSIS 9**

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non- linear systems - Construction of phase portraits – Singular points – Limit cycles Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

**UNITIII Z-TRANSFORM AND DIGITALCONTROLSYSTEM 9**

Z transfer function – Block diagram – Signal flow graph – Discrete root locus – Bode plot.

**UNITIV STATE-SPACE DESIGN OF DIGITALCONTROLSYSTEM 9**

State equation – Solutions – Realization – Controllability – Observability – Stability – Jury's test.

**UNITV OPTIMALCONTROL 9**

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Optimal estimation – Multivariable control design.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | I.J. Nagrath and M. Gopal | Control Systems Engineering | New Age International Publishers | 2003 |
| 2 | Ashish Tewari | Modern control Design with Matlab and Simulink | John Wiley, New Delhi | 2002 |
| 3 | Benjamin C. Kuo | Digital Control Systems | Oxford University Press | 1992 |
| 4 | George J. Thaler | Automatic Control Systems' | Jaico Publishers | 1993 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | George J. Thaler | Automatic Control Systems | Jaico Publishers | 1993 |
| 2 | M.Gopal | Modern control system theory | New Age International Publishers | 2002 |
| 3 | Gene F. Franklin, and Abbasemami-Naeini | Feedback Control of Dynamic Systems | Fourth edition, Pearson Education, Low price edition | 2002 |
| 4 | Raymond T. Stefani & Co | Design of feedback Control systems | Oxford University | 2002 |

## 15BEECOE01 REAL TIMEEMBEDDEDSYSTEMS 3 0 0 3100

**COURSE OBJECTIVES**

1. To introduce students to the embedded systems, its hardware and software.
2. To introduce devices and buses used for embedded networking.
3. To study about task management
4. To learn about semaphore management and message passing
5. To study about memory management
6. To imparts knowledge on

**COURSE OUTCOMES**

At the end of the course the students will be able to

1. Understand overview of embedded systems architecture
2. Acquire knowledge on embedded system, its hardware and software.
3. Gain knowledge on overview of Operating system
4. Discuss about task Management
5. Gain knowledge about semaphore management and message passing.
6. Gain knowledge about memory management.

**UNITI INTRODUCTION TO EMBEDDEDSYSTEM 9**

Introduction - Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture (CISC and RISC) - Categories of Embedded Systems - embedded processor selection &tradeoffs - Embedded design life cycle - Product specifications - hardware/software partitioning - iterations and implementation - hardware software integration - product testing techniques – ARM 7

**UNITII OPERATINGSYSTEMOVERVIEW 9**

Introduction –Advantage and Disadvantage of Using RTOS – Multitasking – Tasks - Real Time Kernels – Scheduler - Non-preemptive Kernels - Preemptive Kernels – Reentrancy- Reentrant Functions – Round Robin Scheduling - Task Priorities - Static Priorities – Mutual Exclusion – Deadlock – Intertask Communication – Message Mailboxes – Message Queues - Interrupts - Task Management – Memory Management - Time Management – Clock Ticks.

**UNITIII TASKMANAGEMENT 9**

Introduction - µC/OS-II Features - Goals of µC/OS-II - Hardware and Software Architecture – Kernel Structures: Tasks –Task States – Task Scheduling – Idle Task – Statistics Task – Interrupts Under µC/OS-II – Clock Tick - µC/OS-II Initialization. Task Management: Creating Tasks – Task Stacks – Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: Delaying a Task – Resuming a Delayed Task – System Time. Event Control Blocks- Placing a Task in the ECB Wait List – Removing a Task from an ECB wait List .

**UNITIV SEMAPHORE MANAGEMENT ANDMESSAGEPASSING 9**

Semaphore Management: Semaphore Management Overview – Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox – Deleting Mailbox – Waiting for a Message box – Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue – Deleting a Message Queue – Waiting for a Message at a Queue – Sending Message to a Queue – Flushing a Queue.

**UNITV MEMORYMANAGEMENT 9**

Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memory Block – Returning a Memory Block .Getting Started with µC/OS-II – Installing µC/OS-II – Porting µC/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with µC/OS-II - µC/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Analyze the Multichannel ADC with help ofµC/OS-II.

**TOTAL 45PERIODS**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Jean J. Labrosse | MicroC/OS – II The Real Time Kernel | CMP BOOKS | 2009 |
| 2 | David Seal | ARM Architecture Reference Manual. | Addison-Wesley | 2008 |
| 3 | Steve Furbe, | ARM System-on-Chip Architecture, | Addison-Wesley Professional, California | 2000 |

**15BEECOE02 CONSUMER ELECTRONICS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To study about various speakers and microphone
2. To learn the fundamental of television systems and standards
3. To learn the process of audio recording and reproduction
4. To study various telephone networks
5. To discuss about the working of home appliances
6. To familiarize with TV services like ISDN.

**COURSE OUTCOMES**

At the end of the course the students will be able to

1. Understand working of various type of loud speakers
2. Acquire knowledge on various types of picture tubes
3. Demonstrate the working of various optical recording systems
4. Distinguish various standards for color TV system
5. Acquire knowledge on various telecommunication networks
6. Demonstrate the working of various home appliances

**UNITI LOUDSPEAKERS ANDMICROPHONES 9**

Dynamic Loudspeaker, Electrostatic loudspeaker,Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics,Carbon Microphones, Dynamic Microphones and Wireless Microphones.

**UNITII TELEVISION STANDARDSANDSYSTEMS 9**

Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL, SECAM - Components of a RemoteControl.

**UNITIII OPTICAL RECORDINGANDREPRODUCTION 9**

AudioDisc–ProcessingoftheAudiosignal–readoutfromtheDisc–Reconstructionoftheaudiosignal–
Video Disc – Video disc formats- recording systems – Playback Systems.

**UNITIV TELECOMMUNICATIONSYSTEMS 9**

Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellularmodems

**UNITV HOMEAPPLIANCES 9**

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | S.P.Bali | Consumer Electronics | Pearson Education | 2005 |

## 15BEECOE03 FUNDAMENTALS OF NANOTECHNOLOGY 3 0 0 3100

**COURSE OBJECTIVES**

1. Tofamiliar withtheimportant conceptsapplicable tosmall electronic devices, theirfabrication, characterizationandapplication
2. To have a solid understanding of Nanotechnology concepts.
3. To introduce the basic concepts of Nanotechnology and its applications in various domain
4. To understand the molecular structure of carbon nano tube
5. To educate how to use Nanotechnology to solve real-world problems
6. To familiar with the structure and application of carbon nano tube

**COURSE OUTCOMES**

At the end of the course the students will be able to

1. Understand the basic concepts of Nanotechnology and its applications in various domain
2. Ability to develop how to use Nanotechnology to solve real- world problems
3. Understand solid understanding of Nanotechnology concepts
4. Understandtheimportantconceptsapplicableto smallelectronicdevices,their fabrication,characterizationandapplication
5. Understand the molecular structure of carbon nano tube
6. Familiar with the structure and application of carbon nano tube

**UNITI LIMITATIONSOFCMOS** **9**

FundamentalsofMOSFETdevices-ScalingofCMOS–Limitations–Alternativeconceptsinmaterials– Structures of MOS devices: SOI MOSFET, FINFETS, Dual Gate MOSFET, Ferro electric FETs.

**UNITII MICRO AND NANOFABRICATION** **9**

Optical Lithography – Electron beam Lithography – Atomic Lithography – Molecular beam epitaxy - Nano lithography.

**UNITIII CHARACTERIZATIONEQUIPMENTS** **9**

Principles of Electron Microscopes – Scanning Electron Microscope – Transmission Electron Microscope - Atomic Force Microscope – Scanning Tunneling Microscope.

**UNITIV NANO DEVICES – I** **9**

Resonant tunneling diodes – Single electron devices – Josephson junction – Single Flux Quantum logic– Molecular electronics.

**UNITV NANO DEVICES – II** **9**

Quantum computing: principles – Qbits – Carbon nanotubes (CNT): Characteristics, CNTFET, Application of CNT - Spintronics: Principle, Spin valves, Magnetic Tunnel Junctions, SpinFETs, MRAM

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rainer Waser (Ed) | Nano electronics and information technology | Wiley- VCH. 3rd Edition | 2012 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Thomas Heinzel | A Microscopic Electronics in Solid State Nanostructure | Wiley- VCH | 2008 |
| 2 | Mick Wilson, | Nanotechnology – (Basic Science and Emerging Technologies | Overseas Press | 2002 |
| 3 | Mark Ratner, Daniel Ratner | Nanotechnology: A Gentle introduction to the Next Big idea | Pearson education | 2003 |

**15BEECOE04 IMAGE &VIDEO PROCESSING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To stud y the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study the image compression procedures.
4. To study the image segmentation and representation techniques.
5. To study the video processing fundamentals
6. To know the concepts of motion estimation

**COURSE OUTCOMES:**

1. Understand the image fundamentals and mathematical transforms necessary for image processing.
2. Understand the image enhancement techniques
3. Understand the image compression procedures.
4. Understand the image segmentation and representation techniques.
5. Understand the video processing fundamentals
6. Understand motion estimation concepts

**UNITI FUNDAMENTALS OF IMAGE PROCESSING ANDIMAGETRANSFORMS 9**

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet transforms.

**UNITII IMAGEPROCESSINGTECHNIQUES 9**

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters,Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.

**UNITIII IMAGE SEGMENTATIONANDCOMPRESSION 9**

Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.

**UNITIV BASICS OFVIDEOPROCESSING 9**

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filteringoperations.

**UNITV 2-DMOTIONESTIMATION 9**

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gonzaleze and Woods | Digital Image Processing | Pearson | 2012 |
| 2 | Yao wang, and Ya – quinZhang | Video processing and communication | PHI | 2013 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | M. Tekalp | Digital video Processing | Prentice ll International | 2011 |
| 2 | Aner ozdemi R | Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms | JohnWiley& Sons | 2012 |
| 3 | Chris Solomon, Toby Breckon | Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab | JohnWiley& Sons | 2000 |

**Course Objectives**

1. To learn the processing steps in fabrication of VLSI devices.
2. To learn the concepts of assembling and packaging for VLSI devices.
3. To imparts a good knowledge in reactive plasma etching techniques and equipment.
4. To familiarize the students with the NMOS and CMOS IC technology.
5. To make the student acquire reactive Plasma Etching techniques and Equipment.
6. To acquaint the student with the VLSI assembly technology and package fabrication technology

**Course outcomes**

After completing this course, the students will be able to

1. List out various fabrication techniques
2. Understand the etching principle in IC fabrication
3. Gain knowledge on deposition and diffusion methods
4. Understand the process simulation and integration.
5. Assembling and packing techniques
6. various technologies used for fabricating VLSI devices

**UNIT 1 INTRODUCTION TOMOS TECHNOLOGIES 9**

MOS, CMOS, BiCMOS Technology, Trends and Projections. Basic Electrical Properties of MOS, CMOS &BiCMOS Circuits: Ids-Vds relationships, Threshold Voltage Vt, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

**UNIT II LAYOUT DESIGNANDTOOLS 9**

Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. Logic Gates & Layouts: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

**UNIT III COMBINATIONALLOGICNETWORKS 9**

Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Networktesting.

**UNIT IVSEQUENTIALSYSTEMS 9**

Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.

**UNIT V FLOOR PLANNING &ARCHITECTUREDESIGN 9**

Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | K. Eshraghian, Eshraghian. D | Essentials of VLSI Circuits and Systems | PHI | 2005 |
| 2 | Wayne Wolf | Modern VLSI Design | Pearson Education | 1997 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | N.H.EWeste, K.Eshraghian | Principals of CMOS VLSI Design | Adisson Wesley | 2005 |

**15BEECOE06 FUNDAMENTALS OF MEMS 3 0 0 3100**

**Course Objectives**

1. To study materials used for MEMS and its working
2. To study the fabrication process used for MEMS
3. To study the packaging process used for MEMS
4. To familiarize the students with various micro actuators and micro sensors.
5. To learn the survey of materials central to micro engineering.
6. To imparts good knowledge in micro system packaging materials

**Course Outcomes**

At the end of the course the students will be able to

1. Appreciate the underlying working principles of MEMS devices.
2. Understand the working of Micro sensors and actuators
3. Explain the IC fabrication processes
4. Gain knowledge on bulk manufacturing
5. Understand the Design of Micro systems.
6. Design and model MEMS devices.

**UNITI INTRODUCTION TO MEMS ANDMICROFABRICATION 9**

History of MEMS Development, Characteristics of MEMS-Miniaturization - Microelectronics integration - Mass fabrication with precision. Sensors and Actuators- Energy domain. Sensors, actuators Micro fabrication - microelectronics fabrication process- Silicon based MEMS processes- New material and fabrication processing- Points of consideration for processing. Anisotropic wet etching, Isotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), and Surface micromachining process- structural and sacrificial material.

**UNITII ELECTRICAL AND MECHANICAL CONCEPTSOFMEMS 9**

Conductivity of semiconductors, crystal plane and orientation, stress and strain - definition - Relationship between tensile stress and strain- mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam- longitudinal strain under pure bending -deflection of beam- Spring constant, torsional deflection, intrinsic stress, resonance and qualityfactor.

**UNITIII ELECTROSTATIC AND THERMAL PRINCIPLE SENSINGANDACTUATION 9**

Electrostatic sensing and actuation-Parallel plate capacitor - Application- Inertial, pressure and tactile sensor parallel plate actuator- comb drive Thermal sensing and Actuations-Thermal sensors-Actuators- Applications Inertial, flow and infraredsensors.

**UNITIV PIEZORESISTIVE, PIEZOELECTRIC AND MAGNETICPRINCIPLESENSORS AND ACTUATOR 9**

Piezoresistive sensors- piezoresistive sensor material- stress in flexural cantilever and membrane- Application- Inertial, pressure, flow and tactile sensor.Piezoelectric sensing and actuation- piezoelectric material properties- quartz- PZT-PVDF - ZnO- Application-Inertial, Acoustic, tactile, flow-surface elastic waves Magnetic actuation- Micro magnetic actuation principle- Deposition of magnetic materials-Design and fabrication of magneticcoil.

**UNIT V POLYMER ANDOPTICALMEMS 9**

Polymers in MEMS- polymide-SU-8 Liquid crystal polymer(LCP )- PDMS – PMMA – Parylene - Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMS-passive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.

**TOTAL 45PERIODS**

**TEXT BOOK**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chang Liu | Foundations of MEMS | Pearson Indian Print, 1st Edition | 2012 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Gaberiel M. Rebiz | RF MEMS Theory, Design and Technology | John Wiley & Sons | 2003 |
| 2 | Charles P. Poole and Frank J. Owens | Introduction to Nanotechnology | John Wiley & Sons | 2003 |
| 3 | Julian W.Gardner and Vijay K Varadhan | Microsensors, MEMS and Smart Devices | John Wiley & sons | 2001 |

## 15BEECOE07 NEURAL NETWORKS AND ITS APPLICATIONS 3 0 0 3100

**Course Objectives**

1. To introduce the basic concepts of neural networks and its applications in various domain
2. To educate how to use Soft Computing to solve real-world problems
3. To have a solid understanding of Basic Neural Network.
4. To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
5. To gain exposure in the field of neural networks and relate the human neural system into the digital world
6. To provide knowledge of computation and dynamical systems using neural networks

**Course Outcomes**

At the end of the course the students will be able to

1. Understand the basic concepts of neural networks and its applications in various domains
2. Gain knowledge about learning process in Neural Networks
3. Apply perception concept in design
4. Design using ART phenomena
5. Gain knowledge on SOM concepts
6. Ability to develop the use of Soft Computing to solve real-world problems

**UNITI INTRODUCTION TO NEURALNETWORKS 9**

Introduction - biological neurons and their artificial models - learning, adaptation and neural network's learning rules - types of neural networks- single layer, multiple layer- feed forward, feedback networks

**UNITII LEARNINGPROCESS 9**

Error – correction learning – memory based learning - hebbian learning-competitive learning-Boltzmann learning- supervised and unsupervised learning-adaptation-statistical learning theory.

**UNITIII PERCEPTION 9**

Single layer perception-Adaptive filtering-unconstrained optimization-Least-mean square algorithm-Leaning curve-Annealing Technique-perception convergence theorem-Relationship between perception and Baye's classifier-Back propagation algorithm

**UNITIV ATTRACTOR NEURAL NETWORKANDART 9**

Hopfield model-BAM model-BAM stability-Adaptive BAM -Lyapunov function-effect of gain-Hopfield design-Application to TSP problem-ART- layer 1-layer 2-orienting subsystem- ART algorithm-ARTMAP

**UNITV SELFORGANIZATION 9**

Self organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical vector Quantization. Applications of self-organizing maps: The Neural Phonetic Typewriter Learning Ballistic Arm Movements

**TOTAL 45PERIODS**

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Simon Haykin | Neural Networks and Learning Machines | Pearson/ Prentice Hall | 2009 |
| 2 | Satish Kumar | Neural Networks - A Classroom Approach | TMH | 2008 |
| 3 | Freeman J.A., Skapura D.M | Neural networks, algorithms, applications, and programming techniques | Addition Wesley | 2005 |
| 4 | Laurene Fausett | Fundamentals of Neural Networks: Architectures, Algorithms, and Applications | Pearson/ Prentice Hall | 1997 |

## 15BEECOE08 FUZZY LOGIC AND ITS APPLICATIONS 3 0 0 3100

**COURSE OBJECTIVES**

1. To introduce the basic concepts of Fuzzy logic and its applications in various domain
2. To educate how to use Fuzzy computation to solve real-world problems
3. To have a solid understanding of Basic fuzzy models.
4. Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
5. To learn about applications on Fuzzy based systems
6. To familiarize with fuzzy fiction and de fuzzy fiction procedures

**COURSE OUTCOMES**

At the end of the course the students will be able to

1. Understand the basic concepts of Fuzzy logic and its applications in various domain
2. Gain knowledge on theory of Reasoning
3. Develop fuzzy controllers
4. Understand concepts of adaptive fuzzy control
5. Ability to develop how to use Fuzzy computation to solve real- world problems
6. Design fuzzy based model for any application

**UNITI BASICS OFFUZZYLOGIC 9**

Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

**UNITII THEORY OF APPROXIMATEREASONING 9**

Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference-fuzzy models

**UNITIII FUZZY KNOWLEDGE BASEDCONTROLLERS(FKBC) 9**

Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures – Design of Fuzzy Logic Controller

**UNITIV ADAPTIVEFUZZYCONTROL 9**

Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

**UNITV FUZZYBASEDSYSTEMS 9**

Simple applications of FKBC -washing machines- traffic regulations -lift control-fuzzy in medical applications-Introduction to ANFIS.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | D. Diankar, H. Hellendoom | An Introduction to Fuzzy Control | Narosa Publishers India | 1996 |
| 2 | G. J. Klir and T. A. Folger | Fuzzy Sets Uncertainty and Information | PHI IEEE | 1995 |

## BIOTECHNOLOGY

**15BTBTOE01 BIOREACTORDESIGN 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To impart basic knowledge in bioprocessEngineering
2. To design the bioreactors for variousoperations.
3. To understand the principle and working of heat transferequipments.
4. To extend the knowledge in principle of heat transfer inside abioreactor
5. To construct the equipments used in mass transferoperations.
6. To learn the equipments used in separationprocess.

**COURSE OUTCOMES:**

Upon completion of this course, the students will be able to

1. Summarize the basic concepts in bioprocessEngineering.
2. Design the bioreactors for variousoperations.
3. Understand the principle and working of heat transferequipments.
4. Develop the heat transfer equipments for BioprocessEngineering.
5. Construct the equipments used in mass transferoperations.
6. Categorize the equipments used in separationprocess.

**UNITI ENGINEERING PROPERTIES ANDSTORAGETANK** **9**

Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

**UNITII REACTORDESIGN** **9**

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

**UNITIII HEATTRANSFEREQUIPMENTS** **9**

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulationevaporator.

**UNITIV MASS TRANSFEREQUIPMENTS** **9**

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

**UNITV SEPERATIONEQUIPMENTS** **9**

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson –walker crystallizer.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | James Edwin Bailey, David F. Ollis | Biochemical Engineering Fundamentals | McGraw- Hill | 2007 |
| 2 | Don W. Green, Robert H. Perry | Chemical Engineer Hand book | The McGraw- Hill Companies, Inc. | 2008 |

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Pauline. M. Doran | Bioprocess Engineering Principles | Academic Press | 2013 |

**15BTBTOE02 FOOD PROCESSING AND PRESERVATION 3 0 0 3100**

**COURSE OBJECTIVES**

1. To learn the scope and importance of foodprocessing.
2. To impart basic knowledge in different food processing methods carried out in the food techcompanies.
3. To extend the brief knowledge in food conservationoperations.
4. To study the methods of food preservation bycooling.
5. To familiarize the students on the concepts of preservation methods forfruits.
6. To create deeper understanding on preservation methods forvegetables.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. Describe the scope and importance of foodprocessing.
2. Outline the various processing methods forfoods.
3. Extend the knowledge in food conservationoperations.
4. Describe the methods of food preservation bycooling.
5. Summarize the preservation methods forfruits.
6. Demonstrate the preservation methods forvegetables.

**UNITI SCOPE AND IMPORTANCE OFFOODPROCESSING 9**

Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

**UNITII PROCESSINGMETHODS 9**

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning- additives fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing- Concepts and equipmentused.

**UNITIII FOODCONVERSIONOPERATIONS 9**

Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments- membrane separation- filtration- equipment andapplication.

**UNITIV FOOD PRESERVATIONBYCOOLING 9**

Refrigeration, Freezing-Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control wateractivity.

**UNITV PRESERVATION METHODS FOR FRUITSANDVEGETABLES 9**

Pre processing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation– Food irradiation- Combined preservation techniques.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | R. Paul Singh, Dennis R. Heldman | Introduction to food engineering. | Academic Press | 2001 |
| 2 | P.Fellows. | Food Processing Technology, Principles and practice. | Wood head Publishing Ltd | 2000 |
| 3 | Mircea EnachescuDauthy | Fruit and Vegetable Processing | FAO agricultural services bulletin no.119 | 1995 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | M.A. Rao, Syed S.H. Rizvi, Ashim K. Datta | Engineering properties of foods | CRC Press | 2005 |
| 2 | B. Sivasankar | Food processing and preservation | PHI Learning Pvt. Ltd | 2002 |

**15BTBTOE03 MOLECULAR MODELING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the theoretical foundation of computational chemistry, with an emphasis on electronic structure calculations using quantum chemistry and classical molecular dynamics simulation techniques
2. To use computational chemistry software to simulate chemical processes, quantify and rationalise reactivity.
3. To study reaction mechanisms, relative free energies and structural dynamics
4. To compute different experimental properties and spectra using computational techniques.
5. To understand how to construct, interpret and utilise potential energy surfaces.
6. To understand the theoretical and practical challenges associated with computational modeling.

**COURSE OUTCOMES**

1. Understand the theoretical foundation of computational chemistry, with an emphasis on electronic structure calculations using quantum chemistry and classical molecular dynamics simulation techniques
2. Can use computational chemistry software to simulate chemical processes, quantify and rationalise reactivity.
3. Study reaction mechanisms, relative free energies and structural dynamics
4. Compute different experimental properties and spectra using computational techniques.
5. Understand how to construct, interpret and utilise potential energy surfaces.
6. Understand the theoretical and practical challenges associated with computational modeling.

**UNITI MOLECULARMODELLING 9**

Introduction to concept of molecular modeling, molecular structure and internal energy, applications of molecular graphics, coordinate systems, potential energy surfaces, discussion of local and global energy minima

**UNITII QUANTUM MECHANICS 9**

Introduction to the computational quantum mechanics; one electron atom, ply electronic atoms and molecules, Hartree Fock equations; calculating molecular properties using ab initio and semi empirical methods.

**UNITIII MOLECULARMECHANICS 9**

Molecular mechanics; general features of molecular mechanics force field, bond stretching, angle bending, torsional terms, non – bonded interactions; force field parameterization and transferability; energy minimization; derivative and non – derivative methods, applications of energy minimization.

**UNITIV MOLECULARDYNAMCS 9**

Molecular dynamics simulation methods; molecular dynamics using simple models, molecular dynamics with continuous potential, setting up and running a molecular dynamic simulation, constraint dynamics; Monte Carlo simulation; Monte Carlo simulation of molecules.

**UNITV MODELLING ANDDRUGDESIGN 9**

Macromolecular modeling, design of ligands for known macro molecular target sites, Drug- receptor interaction, classical SAR /QSAR studies and their implications to the 3 D modeler, 2-D and 3-D database searching, pharmacophore identification and novel drug design, molecular docking, Structure-based drug design for all classes of targets.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Andrew Leach | Molecular Modelling: Principles and Applications | Prentice Hall | 2001 |
| 2 | N. Claude Cohen | Guidebook on Molecular Modeling in Drug Design | Academic Press | 1996 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Yvonne C. Martin, Peter Willett | Designing bioactive molecules :three-dimensional techniques and applications | Washington, DC : American Chemical Society | 1998 |
| 2 | Matthew F. Schlecht | Molecular Modeling on the PC | Wiley- Blackwell; Har | 1998 |

**15BTBTOE04 BIOREMEDIATION 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the basics ofbiology
2. To gain knowledge about differentbiomolecules
3. To get familiarize with humandiseases.
4. To learn about DNA & RNA.
5. To learn about different clinicalinvestigations
6. To know the recent advances inbiology

**COURSE OUTCOMES**

At the end of the course

1. Summarize the cell structures and itsfunctions
2. Explain the Biomoleculesfunctions
3. Classify the communicable and non-communicable humandiseases
4. Illustrate the different organ functiontests
5. Tell the applications of biology in environmentalapplications
6. Describe the concept ofbiomechanics

**UNITI OVERVIEW OFBIOREMEDIATION 9**

Pollution: Types and its consequences, History of bioremediation, Sources of contamination, Bioremediation processes, Environments where bioremediation is used, Microbiology of bioremediation.

**UNIT II BIOFILM PROCESSES 9**

Trickling Filters and Biological Towers, Rotating Biological Contactors, Granular Media Filters,Fluidized-bed Reactors, Hybrid Biofilm Processes

**UNITIII BIOREMEDIATION FORSOILENVIRONMENT 9**

Environment of Soil Microorganisms, Soil Organic Matter and Characteristics, Soil Microorganisms Association with Plants, Pesticides and Microorganisms, Petroleum Hydrocarbons and Microorganisms, Industrial solvents and Microorganism, Biotechnologies for Ex-Situ Remediation & in-Situ Remediation of Soil Phytoremediation Technology for Soil Decontamination

**UNITIV BIOREMEDIATION FOR AIR ANDWATERENVIRONMENT 9**

Atmospheric Environment for Microorganisms, Microbial Degradation of Contaminants in Gas Phase, Biological Filtration Processes for Decontamination of Air Stream-Biofiltration, Biotrickling Filtration, Bioscrubbers, Contaminants in Groundwater, Landfill Leachate Biotreatment Technologies, Industrial Wastewater Biotreatment Technologies, Biotreatment of Surface Waters

**UNITV BIOREMEDIATIONOFMETALS 9**

Microbial Transformation of Metals, Biological Treatment Technologies for Metals Remediation, Bioleaching and Biobenificiation, Bioaccumulation, Oxidation/Reduction Processes, Biological Methylation

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rittmann, B.E., and McCarty, P.L., | Environmental Biotechnology: Principles and Applications. | McGraw Hill, | 2001 |
| 2 | John Cookson | Bioremediation Engineering: Design and Applications | McGraw- Hill Education | 1995 |

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Prescott, L. M., Harley, and Klein, D. A | Microbiology | McGraw- Hill Higher Education | 2008 |

**COURSE OBJECTIVES**

1. To study selected biological phenomena using physical principles.
2. To understand the biological and environmental sciences.
3. To gain the knowledge on technical enormous impact of the biological sciences.
4. To acquire the knowledge about molecular structure of biological systems.
5. To know the uses of proteins and its functions.
6. To understand the biological structure & function: Size and shape of macromolecules.

**COURSE OUTCOMES**

1. Study selected biological phenomena using physical principles.
2. Understand the biological and environmental sciences.
3. Gain the knowledge on technical enormous impact of the biological sciences.
4. Acquire the knowledge about molecular structure of biological systems.
5. Know the uses of proteins and its functions.
6. Understand the biological structure & function: Size and shape of macromolecules.

**UNITI MOLECULAR STRUCTURE OFBIOLOGICALSYSTEMS 9**

Intramolecular bonds – covalent – ionic and hydrogen bonds – biological structures -general features – water structure – hydration – interficial phenomena and membranes – self assembly and molecular structure of membranes.

**UNITII CONFORMATION OFNUCLEICACIDS 9**

Primary structure – the bases – sugars and the phosphodiester bonds- double helical structure – A, B and Z forms – properties of circular DNA – topology – polymorphism and flexibility of DNA – structure of ribonucleic acids – hydration of nucleic acids.

**UNITIII CONFORMATIONOFPROTEINS 9**

Conformationofthepeptidebond–secondarystructures–ramachandranplots–useofpotentialfunctions–
tertiary structure – folding – hydration of proteins – hydropathy index.

**UNITIV ENERGETICS & DYNAMICS OF BIOLOGICALSYSTEMS 9**

Kinetics of ligand interactions; Biochemical kinetics studies, uni-molecular reactions, simple bi molecular multiple intermediates, steady state kinetics, catalytic efficiency, relaxation spectrometry, ribonuclease as an example.

**UNITV APPLIEDTECHNIQUES 9**

Techniques for the study of biological structure & function: Size and shape of macromolecules – methods of direct visualization macromolecules as hydrodynamic particles – macromolecules diffusion – ultra centrifugation – viscometry x-ray crystallography determination of molecular structures, X-ray fibre diffusion electron microscopy neutron scattering – light scattering.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Roland Glaser | Biophysics | Springer Science & Business Media | 2001 |
| 2 | Michel Daune | Molecular Biophysics: Structures in Motion | Oxford University Press | 1999 |

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Charles R. Cantor | Biophysical Chemistry, Part 2: Techniques for the Study of Biological Structure and Function | W.H. Freeman and Company | 1980 |

**COURSE OBJECTIVES**

1. To understand the available tools and databases for performing research inbioinformatics.
2. To expose students to sequence alignment tool inbioinformatics.
3. To construct the phylogenetic trees forevolution.
4. To get familiar with the 3D structure of protein andclassification.
5. To acquire basic knowledge in protein secondary structureprediction.
6. To extend the brief knowledge in Micro array dataanalysis.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. Summarize the basic concepts and importance of Bioinformatics in varioussectors.
2. Demonstrate the sequence alignment tool inbioinformatics.
3. Construct the phylogenetic trees forevolution.
4. Analyze the three dimensional protein structure and classification using varioustools.
5. Illustrate the protein secondary structure prediction by comparativemodeling.
6. Extend the knowledge in micro array technology and applications of bioinformatics in varioussectors.

**UNITI OVERVIEW OFBIOINFORMATICS 9**

The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

**UNITII RETRIEVAL OFBIOLOGICALDATA 9**

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

**UNITIII PHYLOGENETICS 9**

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

**UNITIV STRUCTURALBIOINFORMATICS 9**

Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

**UNITV MICROARRAYDATAANALYSIS 9**

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dan E. Krane, Michael L. Rayme | Fundamental Concepts of Bioinformatics | Pearson education | 2004 |
| 2 | Andreas D., F. Francis Ouellette | Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins | Wiley-Interscience | 2004 |
| 3 | David W. Mount | Sequence and Genome Analysis | Cold Spring Harbor Laboratory | 2004 |
| 4 | Jonathan Pevsner | Bioinformatics and Functional Genomics | Wiley-Liss | 2003 |

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Michael J. Korenberg | Microarray Data Analysis: Methods and Applications | Springer Science & Business Media | 2007 |

## 15BTBTOE07 FUNDAMENTALS OF NANO BIOTECHNOLOGY 3 0 0 3100

**COURSE OBJECTIVES**

1. To impart the skills in the field of nano biotechnology and itsapplications.
2. To acquire knowledge in the nano particles and its significance in variousfields.
3. To extend the knowledge in types and application of nano particles insensors.
4. To define the concepts of biomaterials through molecular selfassembly.
5. To equip students with clinical applications of nanodevices.
6. To describe deeper understanding of the socio-economic issues innanobiotechnology.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

1. Develop skills in the field of nano biotechnology and itsapplications.
2. Summarize the nanoparticles and its significance in variousfields.
3. Extend the knowledge in types and application of nano particles insensors.
4. Define the concepts of biomaterials through molecular selfassembly.
5. Outline the clinical applications of nanodevices.
6. Describe the socio-economic issues innanobiotechnology.

**UNITIINTRODUCTION** **9**

Introduction, Scope and Overview, Length scales , Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

**UNIT IINANOPARTICLES** **9**

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications-MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes.

**UNITIII APPLICATIONS** **9**

Nanomedicine, Nanobiocensor and Nanofludics.Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems.Nano-Biodevices and Systems.Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine.

**UNITIV NANOBIOTECHNOLOGY** **9**

Clinical applications of nanodevices.Artificialneurons.Real-time nanosensors- Applications in cancer biology.Nanomedicine.Synthetic retinyl chips based on bacteriorhodopsins.High throughput DNA sequencing with nanocarbon tubules.Nanosurgical devices.

**UNITV ETHICAL ISSUESINNANOTECHNOLOGY** **9**

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Niemeyer. C.M. and Mirkin. C.A | Nanobiotechnology: Concepts, Applications and Perspectives | Wiley- VCH | 2004 |
| 2 | Goodsell. D.S. | Bionanotechnology | John Wiley and Sons, Inc | 2004 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Shoseyov. O., Levy. I | Nanobiotechnology: Bioinspired Devices and Materials of the Future | Humana Press | 2007 |
| 2 | Bhushan. B. | Springer Handbook of Nanotechnology | Springer- Verlag Berlin Heidelberg | 2004 |
| 3 | FreitasJrR.A | Nanomedicine | Landes Biosciences | 2004 |
| 4 | Kohler. M. and Fritzsche. W. | Nanotechnology – An Introduction to Nanostructuring Techniques | Wiley- VCH | 2004 |

**15BEAEOE01 AUTOMOBILEENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To impart the knowledge on constructional details and principle of operation of various automobile components.
2. To learn the function and working of various components in transmission and drivelines.
3. To study the concept and working of steering and suspension systems in anautomobile.
4. To give the knowledge on wheels, tyres and brakes ofautomobiles.
5. To provide the information on current trends
6. To provide the information on future trends inautomobiles.

**COURSE OUTCOMES:**

Upon successful completion of the course, the students should be able to:

1. Demonstrate the operating principles and constructional details of various automobilecomponents.
2. Explain the function and working of components in transmission and drivelines.
3. Identify and explain the types of steering system
4. Identify and explain the types of suspensionsystem.
5. Classify and describe the types of wheels, tyres and brakes ofautomobiles.
6. Discuss the current and future trends in theautomobiles.

**UNITI ENGINE AND FUELFEEDSYSTEMS 9**

Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburettor working principle, requirements of an automotive carburettor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

**UNITII TRANSMISSIONSYSTEMS 9**

Requirements of transmission system.Flywheel. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles. Performance characteristics at different speeds. Different types of gearboxes - operation. Function of Propellar Shaft Construction details of multi drive axle vehicles. Different types of final drive. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock

**UNITIII SUSPENSIONSYSTEM 9**

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension – Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

**UNITIV BRAKES 9**

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theoryBrake actuating systems - Mechanical, Hydraulic and Pneumatic. Parking and engine exhaust brakes. Power and power assisted brakes. Antilock Braking System (ABS).

**UNITV ELECTRICALSYSTEM 9**

Principle and construction of lead acid battery.Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.Starting System and charging system.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Young U.P and Griffiths L | Automotive Electrical Equipment | ELBS & New Press | 1999 |
| 2 | Ganesan.V | Internal Combustion Engines | Tata McGraw-Hill Publishing Co., New Delhi | 2003 |
| 3 | Dr.Kirpal Singh | Automobile Engineering | Standard Publishes | 2011 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Heldt .P.M | The Automotive Chassis | Literary Licensing,LLC | 2012 |
| 2 | Crouse.W.H | Automobile Electrical Equipment | McGraw-Hill Book Co., Inc., New York. | 1986 |
| 3 | N.Newton, W. Steeds and T.K.Garrett | The Motor vehicle, 13th edition | SAE Inc | 2001 |

**15BEAEOE02 BASICS OF TWO AND THREE WHEELERS 3 0 0 3100**

**COURSE OBJECTIVES**

1. The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.
2. Construct the frames of two and three wheelers of different layouts.
3. Demonstrate the constructional details and principle of operation of various engine components.
4. Identify and explain the types of transmission systems.
5. Identify and explain the types of steering and suspension systems.
6. Classify and describe the types of wheels, tyres and brakes for two and three wheelers

## COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

1. Construct the frames of two and three wheelers of different layouts.
2. Demonstrate the constructional details and principle of operation of various engine components.
3. Identify and explain the types of transmission systems.
4. Identify and explain the types of steering and suspension systems.
5. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
6. Explain the servicing of two and three wheelers

**UNITI INTRODUCTION 9**

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

**UNITII POWER UNITS, IGNITION SYSTEMS AND OTHERELECTRICALSYSTEMS 9**

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

**UNITIII CLUTCHES ANDTRANSMISSION 9**

Types of clutches for 2 and 3 wheelers. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

**UNITIV FRAMES, SUSPENSION, WHEELS ANDTYRES 9**

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

**UNITV THREEWHEELERS 9**

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Irving P.E. | Motor Cycle Engineering. | Temple Press Book, London. | 1992 |
| 2 | Srinivasan.S. | Motor cycle, Scooter, Mobeds. | New century book house. | 1988 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | M.M.Griffin. | Motor cycles from inside and outside. | Prentice Hall Inc, New Jersey. | 1978 |
| 2 | Bruce A. Johns and Robert Scharff | Motorcycles: Fundamentals, Service, Repair | Goodheart-Willcox | 1999 |

**15BEAEOE03 AUTOMOBILE MAINTENANCE 3 0 0 3100**

**COURSE OBJECTIVES**

1. The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems inAutomobile.
2. Describe and differentiate the types of maintenance.
3. List the procedure for dismantling, servicing and assembling of engine components.
4. Demonstrate the servicing of transmission and driveline components.
5. Discuss the procedure for steering and suspension
6. Discuss the procedure for wheel and brake maintenance.

**COURSE OUTCOMES**

Upon successful completion of the course, the students should be able to:

1. Describe and differentiate the types of maintenance.
2. List the procedure for dismantling, servicing and assembling of engine components.
3. Demonstrate the servicing of transmission and driveline components.
4. Discuss the procedure for steering and suspension
5. Discuss the procedure for wheel and brake maintenance.
6. Explain the fault diagnosis in the electrical and air conditioner systems

**UNITI MAINTENANCE OF RECORDSANDSCHEDULES 9**

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

**UNITII ENGINEMAINTENANCE 9**

Dismantling of engine components and cleaning, cleaning methods, visual anddimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

**UNITIII CHASSIS MAINTENANCE 9**

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems. Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheelbalancing.

**UNITIV ELECTRICALSYSTEM MAINTENANCE 9**

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

**UNITV MAINTENANCE OFFUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLEBODY 9**

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts, Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating systemmaintenance.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | John Doke | Fleet Management | McGraw Hill Co | 1984 |
| 2 | James D Halderman | Advanced Engine Performance Diagnosis | Prentice Hall Publications | 2011 |

**REFERENCE**

1. Service Manuals from Different VehicleManufacturers

**15BEAEOE04 INTRODUCTION TO MODERN VEHICLE TECHNOLOGY 3 0 0 3100**

## COURSE OBJECTIVES:

1. To impart knowledge on trends in the vehicle power plants.
2. To learn the various advanced driver assistance systems.
3. To study the working of advanced suspension and braking systems in an automobile.
4. To give information about motor vehicle emission and noise pollution control.
5. To provide knowledge of the vehicle telematics.
6. To give information about the noise control techniques

## COURSE OUTCOMES:

**Upon successful completion of the course, the students should be able to:**

1. Distinguish and describe the various modern vehicle power plant systems.
2. List and explain the various driver assistant mechanisms.
3. Identify and describe the working of advanced suspension and braking systems.
4. Apply the knowledge of motor vehicle emission and noise pollution control.
5. Describe the noise control techniques
6. Describe the vehicle telematics and its applications

**UNITI TRENDS INPOWERPLANTS 9**

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

**UNITII DRIVERASSISTANCESYSTEMS 9**

Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut- off technology, ABS, Driver Drowsiness Detection system

**UNITIII SUSPENSION BRAKESANDSAFETY 9**

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passengercomfort.

**UNITIV NOISE&POLLUTION 9**

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

**UNITV TELEMATICS 9**

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | LjuboVlacic and Fumio Harashima | Intelligent Vehicle Technologies | Butterworth-Heinemann publications, Oxford | 2001 |
| 2 | Ronald K.Jurgen | Navigation and Intelligent Transportation Systems –Progress in Technology | Automotive Electronics Series, SAE, USA. | 1998 |

**15BEAEOE04 INTRODUCTION TO MODERN VEHICLE 3 0 0 3100**

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | William B Riddens | "Understanding Automotive Electronics" | Butterworth Heinemann Woburn. | 1998 |
| 2 | Bechhold, | "Understanding Automotive Electronics" | SAE | 1998 |
| 3 | Robert Bosch, | "Automotive HandBook" | SAE | 2000 |

## CIVIL ENGINEERING

**15BECEOE01 HOUSING, PLANANDMANAGEMENT 3 0 0 3100**

## COURSE OBJECTIVES

1. To examine the role and tasks of basic housing policies and building bye laws
2. Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
3. Analyze the Innovative construction methods and Materials
4. Analyze city management strategies and strengthen the urban governance through a problem solving approach
5. To know the Importance of basic housing policies and building bye laws
6. To use Housing Programmes and Schemes

## COURSE OUTCOMES

The students will be able to

1. Know the Importance of basic housing policies and building bye laws.
2. Use Housing Programmes and Schemes.
3. Plan and Design of Housing projects.
4. Examine Innovative construction methods and Materials.
5. Know Housing finance and loan approval procedures.
6. Understand Construction as well as managing techniques.

**UNITI INTRODUCTIONTOHOUSING 9**

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

**UNITII HOUSINGPROGRAMMES 9**

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

**UNITIII PLANNING AND DESIGN OFHOUSINGPROJECTS 9**

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

**UNITIV CONSTRUCTION TECHNIQUES ANDCOST-EFFECTIVEMATERIALS 9**

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

**UNITV HOUSING FINANCE ANDPROJECTAPPRAISAL 9**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Meera Mehta and Dinesh Mehta | Metropolitan Housing Markets | Sage Publications Pvt. Ltd., New Delhi | 2002 |
| 2 | Francis Cherunilam and Odeyar D Heggade | Housing in India | Himalaya Publishing House, Bombay | 2001 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | CMA | Development Control Rules for Chennai Metropolitan Area | CMA, Chennai | 2002 |
| 2 | UNCHS | National Experiences with Shelter Delivery for the Poorest Groups | UNCHS (Habitat), Nairobi | 2000 |

**15BECEOE02 BUILDING SERVICES 3 0 0 3100**

## COURSE OBJECTIVES

1. Defining and identifying of engineering services systems in buildings.
2. The role of engineering services systems in providing comfort and facilitating life of users of the building.
3. The basic principles of asset management in a building & facilities maintenance environment
4. Importance of Fire safety and its installation techniques
5. To Know the principle of Refrigeration and application
6. To Understand Electrical system and its selection criteria

## COURSE OUTCOMES

The students will be able to

1. Machineries involved in building construction
2. Understand Electrical system and its selection criteria
3. Use the Principles of illumination & design
4. Know the principle of Refrigeration and application
5. Importance of Fire safety and its installation techniques
6. Know the principle behind the installation of building services and to ensure safety in buildings

**UNITI MACHINERIES 9**

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

**UNITII ELECTRICAL SYSTEMSINBUILDINGS 9**

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

**UNITIII PRINCIPLES OF ILLUMINATION&DESIGN 9**

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in buildingtypes.

**UNITIV REFRIGERATION PRINCIPLES&APPLICATIONS 9**

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

**UNITV FIRESAFETYINSTALLATION 9**

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | E.R.Ambrose | Heat Pumps and Electric Heating | John and Wiley and Sons, Inc., New York | 2002 |
| 2 | NBC | Handbook for Building Engineers in Metric systems | NBC, New Delhi | 2005 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | - | Philips Lighting in Architectural Design | McGraw-Hill, New York | 2000 |
| 2 | A.F.C. Sherratt | Air-conditioning and Energy Conservation | The Architectural Press, London | 2005 |
| 3 | National Building Code | | | |

**15BECEOE03 COASTAL ZONE MANAGEMENT 3 0 0 3100**

**COURSE OBJECTIVES**

1. To understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.
2. To describe the Coastal zone regulations, coastal processes and wave dynamics.
3. To forecast waves and tides and plan coastal structures including harbours.
4. To explain which scientific background values that are necessary for a successful planning,
5. To apply knowledge about ecosystem values and management in the planning process,
6. To plan and carry out a simplified consultation process for activities in the coastal zone

## COURSE OUTCOMES

1. Understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.
2. The Coastal zone regulations, coastal processes and wave dynamics.
3. Forecast waves and tides and plan coastal structures including harbours.
4. To explain which scientific background values that are necessary for a successful planning,
5. To apply knowledge about ecosystem values and management in the planning process,
6. To plan and carry out a simplified consultation process for activities in the coastal zone.

**UNITI COASTALZONE 9**

Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries– Wet lands and Lagoons – Living resources – Non living resources.

**UNITII WAVEDYNAMICS 9**

Wave classification – Airy's Linear Wave theory – Deep water waves – Shallow water waves – Wavepressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles.

**UNITIII WAVE FORECASTINGANDTIDES 9**

Need for forecasting - SMB and PNJ methods of wave forecasting – Classification of tides –Darwin's equilibrium theory of tides – Effects on structures – seiches, Surges and Tsunamis.

**UNITIV COASTALPROCESSES 9**

Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers – Sea water intrusion – Impact of sewage disposal in seas.

**UNITV HARBOURS 9**

Types of classification of harbours – Requirements of a modern port – Selection of site – Types and selection of break waters – Need and mode of dredging – Selection ofdredgers.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Richard Sylvester | Coastal Engineering, Volume I and II | Elseiner Scientific Publishing Co | 2006 |
| 2 | Quinn, A.D | Design & Construction of Ports and Marine Structures | McGraw-Hill Book Co | 2007 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Ed. A.T. Ippen | Coastline Hydrodynamics | McGraw-Hill Inc., New York | 2002 |
| 2 | Dwivedi, S.N., and Ramachandran, S | Coastal Zone Management in Tamilnadu | McGraw-Hill Inc., New York | 2000 |

## 15BECEOE04 EXPERIMENTAL METHOD AND MODEL ANALYSIS 3 0 0 3100

**COURSE OBJECTIVES**

1. To Describe some of the factors affecting reproducibility and external validity.
2. To List the different types of formal experimental designs (e.g. completely randomised, randomised block, repeated measures, Latin square and factorial experimental designs).
3. To explain the concept of variability, its causes and methods of reducing it
4. To describe possible causes of bias and ways of alleviating it
5. To identify the experimental unit and recognise issues of non-independence (pseudo-replication).
6. To describe the six factors affecting significance, including the meaning of statistical power and "p-values".

**COURSE OUTCOMES**

1. Describe some of the factors affecting reproducibility and external validity.
2. List the different types of formal experimental designs (e.g. completely randomised, randomised block, repeated measures, Latin square and factorial experimental designs).
3. Explain the concept of variability, its causes and methods of reducing it
4. Describe possible causes of bias and ways of alleviating it
5. Identify the experimental unit and recognise issues of non-independence (pseudo-replication).
6. Describe the six factors affecting significance, including the meaning of statistical power and "p-values".

**UNITI MEASUREMENTS 9**

Basic Concept in Measurements, Measurement of displacement, strain pressure, force, torque etc, Type of strain gauges (Mechanical, Electrical resistance, Acoustical etc)

**UNITII GAUGING 9**

Strain gauge circuits – The potentiometer and Wheatstone bridge – use of lead wires switches etc. Use of electrical resistance strain gauges in transducer applications.

**UNITIII RECORDINGDEVICES 9**

Indicating and recording devices - Static and dynamic data recording –Data (Digital and Analogue) acquisition and processing systems. Strain analysis methods – Rosette analysis. Static and dynamic testing techniques. Equipment for loading - Moire's techniques.

**UNITIV NON DESTRUCTIVETESTINGTECHNIQUES 9**

Non destructive testing techniques. Photoelasticity – optics of photoelasticity – Polariscope – Isoclinics and Isochromatics - methods of stress separation.

**UNITV LAWS OFSIMILITUDE 9**

Laws of similitude - model materials – model testing – testing large scale structures – holographic techniques

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dally J W and Riley W.F | Experimental stress Analysis | McGraw-Hill, Inc. New York | 2005 |
| 2 | Srinath L S | Experimental Stress Analysis | Tata McGraw-Hill Publishing co., Ltd., New Delhi | 2006 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rangan C S | Instrumentation – Devices and Systems | Tata McGraw-Hill Publishing Co., Ltd., New Delhi | 2002 |
| 2 | Sadhu Singh | Experimental Stress Analysis | Khanna Publishers, New Delhi | 2006 |

## 15BECEOE05 MANAGEMENT OF IRRIGATION SYSTEMS 3 0 0 3100

### COURSE OBJECTIVES

1. To enable the students for a successful career as water management professionals.
2. To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
3. To expose the students the need for an interdisciplinary approach in irrigation water management
4. To providing a platform to work in an interdisciplinary team.
5. To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.
6. To promote student awareness for a life-long learning process and inculcate professional ethics and codes of professional practice in water management.

### COURSE OUTCOMES

At the end of this the students will be in a capacity to

1. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
2. Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.
4. Gain insight on local and global perceptions and approaches to participatory water resource management
5. Learn from successes and failures in the context of both rural and urban communities of water management.
6. Exposure on the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.

**UNITI IRRIGATIONSYSTEMREQUIREMENTS 9**

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

**UNITII IRRIGATIONSCHEDULING 9**

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

**UNITIII MANAGEMENT 9**

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

**UNITIV OPERATION 9**

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

**UNITV INVOLVEMENT OFSTAKEHOLDERS 9**

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Dilip Kumar Majumdar | Irrigation Water Management – Principles and Practice | Prentice Hall of India Pvt. Ltd., New Delhi | 2000 |
| 2 | R.T. Gandhi | Hand book on Irrigation Water Requirement | Water Management Division, Department of Agriculture | 1990 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Technical report No. 33, | Hand Book on Irrigation System Operation Practices | CWC, New Delhi | 2000 |
| 2 | Maloney, C. and Raju, K.V | Managing Irrigation Together - Practice and Policy in India | , Stage Publication, New Delhi, India | 2000 |

**15BECEOE06 COMPUTER AIDED DESIGN OF STRUCTURES 3 0 0 3100**

**COURSE OBJECTIVES**

1. To learn how to Develop Parametric design and the conventions of formalengineering drawing
2. To learn how to Produce and interpret 2D &3Ddrawings
3. To learn about how to Communicate a design idea/conceptgraphically/visually
4. To know how to Examine a design critically and with understanding of CAD - The student learns to interpret drawings, and to produce designs using a combination of 2D and 3Dsoftware.
5. To discuss how to Get a Detailed study of anengineering artifact
6. To know how to Plan and designstructures

**COURSE OUTCOMES**

The students will be able to

1. Develop Parametric design and the conventions of formalengineering drawing
2. Produce and interpret 2D &3Ddrawings
3. Communicate a design idea/conceptgraphically/visually
4. Examine a design critically and with understanding of CAD - The student learns to interpret drawings, and to produce designs using a combination of 2D and 3Dsoftware.
5. Get a Detailed study of anengineering artifact
6. Plan and designstructures

**UNITI INTRODUCTION 9**

Fundamentals of CAD - Hardware and software requirements -Design process - Applications and benefits.

**UNITII COMPUTERGRAPHICS 9**

Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards –Drafting packages

**UNITIII STRUCTURALANALYSIS 9**

Fundamentals of finite element analysis - Principles of structural analysis -Analysis packages and applications.

**UNITIV DESIGNANDOPTIMISATION 9**

Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming – Simplex method

**UNITV EXPERTSYSTEMS 9**

Introduction to artificial intelligence - Knowledge based expert systems -Rules and decision tables –Inference mechanisms - Simple applications.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Groover M.P. and Zimmers E.W. Jr | CAD/CAM, Computer Aided Design and Manufacturing | Prentice Hall of India Ltd, New Delhi | 2005 |
| 2 | Krishnamoorthy C.S.Rajeev S | Computer Aided Design | Narosa Publishing House, New Delhi | 2000 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Harrison H.B | Structural Analysis and Design | Part I and II Pergamon Press, Oxford | 2002 |
| 2 | Rao S.S | Optimisation Theory and Applications | Wiley Eastern Limited, New Delhi | 2002 |
| 3 | Richard Forsyth (Ed) | Expert System Principles and Case Studies | Chapman and Hall, London | 2000 |

**15BECEOE07 PAVEMENT ENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To discuss about the various pavement types
2. To study about the stress distribution in layered systems
3. To design the flexible pavements
4. To learn about the concepts of rigid pavements
5. To learn about the performance evaluation and maintenance of pavements
6. To know how to stabilization of pavements

**COURSE OUTCOMES**

Students will be able to

1. Recognize the various pavement types
2. Understand the stress distribution in layered pavements
3. Design a flexible pavement
4. Explain about the rigid pavements
5. Perform pavement performance evaluation and maintenance
6. Know how to stabilize the pavements

**UNITI TYPE OF PAVEMENT AND STRESS DISTRIBUTION ONLAYEREDSYSTEM 9**

Introduction - Pavement as layered structure - Pavement types - rigid and flexible -Stress and deflections in pavements under repeated loading

**UNITII DESIGN OFFLEXIBLEPAVEMENTS 9**

Flexible pavement design - Empirical - Semi empirical and theoretical Methods - Design procedure as per latest IRC guidelines – Design and specification of ruralroads

**UNITIII DESIGN OFRIGIDPAVEMENTS 9**

Cement concrete pavements - Modified Westergard approach - Design procedure as per latest IRC guidelines - Concrete roads and their scope in India.

**UNITIV PERFORMANCE EVALUATIONANDMAINTENANCE 9**

Pavement Evaluation [Condition and evaluation surveys (Surface Appearance, Cracks, Patches And Pot Holes, Undulations, Ravelling, Roughness, Skid Resistance), Structural Evaluation By Deflection Measurements, Present Serviceability Index] Pavement maintenance. [IRC Recommendations Only]

**UNITV STABILISATIONOFPAVEMENTS 9**

Stabilisationwithspecialreferencetohighwaypavements-Choiceofstabilisers-Testingandfieldcontrol– Stabilisation for rural roads in India -use of Geosynthetics (geotextiles & geogrids) in roads.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Kadiyali, L.R | Principles and Practice of Highway Engineering | Khanna tech. Publications, New Delhi | 2007 |
| 2 | Croney, D | Design and Performance of Road Pavements | HMO Stationary Office | 2005 |
| 3 | Wright, P.H | Highway Engineers | John Wiley & Sons, Inc., New York | 2001 |
| 4 | Ministry of rural roads | Design and Specification of Rural Roads (Manual) | Government of India, New Delhi | 2001 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Yoder R.J and WitczakM.W | Principles of Pavement Design | John Wiley | 2003 |
| 2 | IRC:37 | Guidelines for the Design of Flexible Pavements | The Indian roads Congress, New Delhi | 2001 |
| 3 | IRC:58 | Guideline for the Design of Rigid Pavements for Highways | The Indian Roads Congress, New Delhi | 2001 |

**15BECEOE08 ROCK ENGINEERING 3 0 0 3100**

**COURSE OBJECTIVES**

1. To provide the knowledge on classification of rocks
2. To learn about the properties of rocks
3. To learn about the rock failure modes
4. To learn about the initial stresses and measurements
5. To know the applications of rock mechanics
6. To understand the concepts of rock bolting

**COURSE OUTCOMES**

**Students will be able**

1. Recognize the various forms of rocks
2. Say the various properties of rocks
3. Explain the failure modes of the rocks
4. Understand the initial stresses and how to measure the same
5. Say the various applications of rock mechanics
6. Explain the concepts of rock bolting

**UNITI CLASSIFICATION AND INDEX PROPERTIESOFROCKS 9**

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.

**UNITII ROCK STRENGTH ANDFAILURECRITERIA 9**

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength – Stress strain behaviour in compression – Mohr-coulomb failure criteria and empirical criteria for failure – Deformability of rock.

**UNITIII INITIAL STRESSES ANDTHEIRMEASUREMENTS 9**

Estimationofinitialstressesinrocks–influenceofjointsandtheirorientationindistributionofstresses– technique for measurements of insitu stresses.

**UNITIV APPLICATION OF ROCK MECHANICSINENGINEERING 9**

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

**UNITV ROCKBOLTING 9**

Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Goodman P.E | Introduction to Rock Mechanics | John Wiley and Sons | 2005 |
| 2 | Stillborg B | Professional User Handbook for rock Bolting | Tran Tech Publications | 2006 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Brow E.T | Rock Characterisation Testing and Monitoring | Pergaman Press | 2002 |
| 2 | Arogyaswamy R.N.P | Geotechnical Application in Civil Engineering | Oxford and IBH | 2000 |
| 3 | Hock E. and Bray J | Rock Slope Engineering | Institute of Mining and Metallurgy | 1991 |

**15BECEOE09 STORAGE STRUCTURES 3 0 0 3100**

**COURSE OBJECTIVES:**

1. To build on the student's background in hydrology and hydraulics and understanding of waterresources systems
2. To develop the skills in modeling of flood flows and flood routing
3. To develop skills in the ground water flow, type of aquifer and yield from the well
4. To provide the knowledge of design of reservoir, operation and sedimentation
5. To study the effect, causes and remedial measures of water logging
6. To know about various concrete bunkers and silos

**COURSE OUTCOMES:**

Students will be able to

1. Understand about the steel water tanks
2. Understand about the concrete water tanks
3. Explain about the steel bunkers
4. Say the working of silos
5. Give basics of concrete bunkers
6. Understand the basics of prestresses concrete water tanks

**UNITI STEELWATERTANKS 9**

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays –Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder – Design of staging andfoundation.

**UNITII CONCRETEWATERTANKS 9**

Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of under ground tanks – Design of base slab and side wall – Check for uplift.

**UNITIII STEEL BUNKERSANDSILOS 9**

Designofsquarebunker–Jansen'sandAiry'stheories–ISCodalprovisions–Designofsideplates–
Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.

**UNITIV CONCRETE BUNKERSANDSILOS 9**

Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction.

**UNITV PRESTRESSED CONCRETEWATERTANKS 9**

Principles of circular prestressing – Design of prestressed concrete circular water tanks.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Rajagopalan K | Storage Structures | Tata McGraw-Hill, New Delhi | 2002 |
| 2 | Krishna Raju N | Advanced Reinforced Concrete Design | CBS Publishers and Distributors, New Delhi | 2000 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | R.G.Hopkinson and J.D.Kay | The Lighting of buildings | Faber and Faber, London | 2000 |
| 2 | William H.Severns and Julian R.Fellows | Air-conditioning and Refrigeration | John Wiley and Sons, London | 2000 |

**COURSE OBJECTIVE**

1. To provide knowledge on wind data
2. To explain about the various factors involved in wind engineering
3. To study about the effect on wind on various structures
4. To learn about the effect of typical buildings
5. To learn about the design of multistory buildings
6. To know about the basics of wind tunnel

**COURSE OUTCOMES**

Students will be

1. Able to know about the wind data
2. Able to explain the factirs involved in wind engineering
3. Able to recognize the effects of wind of varuosu structures
4. Able to provide the details on typical buildings
5. Able to give the basics of desing of multistorey buildings
6. Able to explain the basics of wind tunnel

**UNITI INTRODUCTION** **9**

Terminology – Wind Data – Gust factor and its determination - Wind speed variation with height – Shape factor – Aspect ratio – Drag and lift.

**UNITII EFFECT OF WINDONSTRUCTURES** **9**

Static effect – Dynamic effect – Interference effects (concept only) – Rigid structure – Aeroelastic structure (concept only).

**UNITIII EFFECT ONTYPICALSTRUCTURES** **9**

Tail buildings – Low rise buildings – Roof and cladding – Chimneys, towers and bridges.

**UNITIV APPLICATIONTODESIGN** **9**

Design forces on multistorey building, towers and roof trusses.

**UNITV INTRODUCTION TOWINDTUNNEL** **9**

Types of models (Principles only) – Basic considerations – Examples of tests and their use.

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Peter Sachs | Wind Forces in Engineering | Pergamon Press, New York | 2002 |
| 2 | Lawson T.V | Wind Effects on Buildings, Vol. I & II | Applied Science and Publishers, London | 2005 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | DevenportA.G | Wind Loads on Structures | Division of Building Research, Ottowa | 2003 |
| 2 | Course Notes | Wind Force on Structures | Building Technology Centre, Anna University | 2002 |

## 15BECEOE11 ADVANCED CONSTRUCTION TECHNOLOGY 3 0 0 3100

**COURSE OBJECTIVES**

1. To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
2. To study different methods of construction to successfully achieve the structural design with recommended specifications.
3. To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. To study of construction equipment's, and temporary works required to facilitate the construction process
5. To provide a coherent development to the students for the courses in sector of Advanced construction technology.
6. To present the new technology of civil Engineering and concepts related Advanced construction technology.

**COURSE OUTCOMES:**

1. The students will gain an experience in the implementation of new construction technology on engineering concepts
2. the students will learn about how to apply in field of Advanced construction technology.
3. The students will get a diverse knowledge of Advanced technology practices applied to real life problems.
4. The students will learn to understand the theoretical and practical aspects of new technology in civil engineering
5. The students will learn to design and
6. The students will learn about management applications

**UNITI MODERNCONSTRUCTIONMETHODS 9**

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

**UNITII CONSTRUCTION METHODS FORSPECIALSTRUCTURES 9**

Construction Methods For Bridges, Construction Methods for Roads, Construction Methods For Special Structures for Railways, Construction Methods for Dams, Construction Methods for Harbour, Construction Methods for River Works Pipelines

**UNITIII MODERN CONSTRUCTION EQUIPEMENTS-I 9**

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting,Tunneling and hoisting

**UNITIV MODERN CONSTRUCTION EQUIPEMENTS-II 9**

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

**UNITV PRINCIPLES AND PRACTICES OFTEMPORARYSTRUCTURES 9**

Principles and Practices of Temporary structures, Shoring, and Strutting,Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Peurifoyu , R. L, Ledbette, W.B | Construction Planning , Equipment and Methods | Mc Graw Hill Co | 2000 |
| 2 | Antill J.M., PWD | Civil Engineering Construction | Mc Graw Hill Book Co | 2005 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Varma, M | Construction Equipment and its Planning & Applications | Metropoltian Book Co | 2000 |
| 2 | Nunnaly, S.W | Construction Methods and Management | Prentice – Hall | 2000 |
| 3 | Ataev, S.S | Construction Technology | MIR , Pub | 2000 |

## OPEN ELECTIVES
## (COURSES OFFERED TO OTHER DEPARTMENTS)

**15BEMEOE01 INTRODUCTIONTOMEMS 3 0 0 3100**

**COURSE OBJECTIVES**

1. To know the characteristics of micro elecromechanical system.
2. To understand the working of electrostatic sensors.
3. To understand the working of actuators.
4. To learn the principle of micromachining.
5. To understand the concept of polymer MEMS.
6. To understand the concept of optical MEMS.

**COURSE OUTCOMES**

1. Understand the characteristics of micro elecromechanical system.
2. Understand the working of electrostatic sensors.
3. Understand the working of actuators.
4. Learn the principle of micromachining.
5. Understand the concept of polymer MEMS.
6. Understand the concept of optical MEMS.

**UNITIINTRODUCTION 9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

**UNIT II SENSORSANDACTUATORS-I 9**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

**UNIT III SENSORSANDACTUATORS-II 9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

**UNITIVMICROMACHINING 9**

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

**UNIT V POLYMER ANDOPTICALMEMS 9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Chang Liu | Foundations of MEMS | Pearson Education Inc | 2006 |
| 2 | Stephen D Senturia | Microsystem Design | Springer Publication | 2000 |
| 3 | Tai Ran Hsu | MEMS & Micro systems Design and Manufacture | Tata McGraw Hill, New Delhi | 2002 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nadim Maluf | An Introduction to Micro Electro Mechanical System Design | Artech House | 2000 |
| 2 | Mohamed Gad-el-Hak | The MEMS Handbook | CRC press Baco Raton | 2000 |
| 3 | Julian w. Gardner, Vijay K. Varadan | Micro Sensors MEMS andSmart Devices | John Wiley & Son LTD | 2002 |
| 4 | James J.Allen | Micro Electro Mechanical System Design | CRC Press Publisher | 2010 |
| 5 | Thomas M.Adams and Richard A.Layton | Introduction MEMS, Fabrication and Application | Springer | 2012 |

**15BEMEOE02 ROBOTICS 3 0 0 3100**

## COURSE OBJECTIVES

1. To develop the student's knowledge in various robot structures and their workspace.
2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To develop student's skills in perform kinematics analysis of robot systems.
4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
6. To provide the student with some knowledge and skills associated with robot control.

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

1. Understand the fundamentals of therobots
2. Describe the robot celldesign
3. Know the safety considerations in roboticapplications.
4. The student with knowledge of the singularity issues associated with the operation of robotic systems.
5. The student with some knowledge and analysis skills associated with trajectory planning.
6. The student with some knowledge and skills associated with robot control.

**UNITI FUNDAMENTALS OFROBOT 9**

Robot – Definition, Need for Robots, Robot Anatomy, Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions, grippers types. Forward kinematics, inverse kinematics- Manipulators with two, three degrees of freedom in 2D - Derivations andproblems.

**UNITII DRIVES ANDSENSORS 9**

Drives- hydraulic, pneumatic and electrical. Force sensing, touch and tactile sensors, proximity sensors, non contact sensors and Machine vision sensors. Safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism.

**UNITIII PROGRAMMINGANDAPPLICATIONS 9**

Robot programming languages – VAL programming – Motion Commands, Sensorscommands. Role of robots in inspection, assembly, material handling, underwater, space, nuclear, defence and medical fields.

**UNITIV MACHINEVISION 9**

Machine Vision - Sensing - Low and higher level vision - Image acquisition and digitization - Cameras, CCD,CID, CPD, etc., - Illumination and types - Image processing and analysis - Feature extraction - Applications.

**UNITV IMPLEMENTATION ANDROBOTECONOMICS 9**

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

**TOTAL 45PERIODS**

**TEXT BOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Klafter R.D., and Negin M | Robotic Engineering - An Integrated Approach | Prentice Hall | 2003 |
| 2 | Groover M.P | Industrial Robotics -Technology Programming and Applications | McGraw Hill | 2001 |

**REFERENCES**


| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Craig J.J | Introduction to Robotics Mechanics and Control | Pearson Education | 2008 |
| 2 | Deb S.R | Robotics Technology and Flexible Automation | Tata McGraw Hill Book Co | 1994 |
| 3 | Koren Y | Robotics for Engineers | Mc Graw Hill Book Co | 1992 |
| 4 | Fu.K.S.,Gonzalz R.C. and Lee C.S.G | Robotics Control, Sensing, Vision and Intelligence | McGraw Hill Book Co | 1987 |
| 5 | JanakiramanP.A | Robotics and Image Processing | Tata McGraw Hill | 1995 |
| 6 | Rajput R.K | Robotics and Industrial Automation | S.Chand and Company | 2008 |
| 7 | Surender Kumar | Industrial Robots and Computer Integrated Manufacturing | Oxford and IBH Publishing Co. Pvt. Ltd | 1991 |

**15BEMEOE03 INDUSTRIAL SAFETY AND ENVIRONMENT 3 0 0 3100**

## COURSE OBJECTIVES

1. To recognize and evaluate occupational safety and health hazards in the workplace.
2. To determine appropriate hazard controls following the hierarchy of controls.
3. To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. To prevent or mitigate harm or damage to people, property, or the environment.

## COURSE OUTCOMES

At the end of the course, student will be able to

1. Recognize and evaluate occupational safety and health hazards in the workplace.
2. Determine appropriate hazard controls following the hierarchy of controls.
3. Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. Prevent or mitigate harm or damage to people, property, or the environment.

**UNITI INTRODUCTIONTOLOGISTICS 9**

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

**UNITII PHASES OFSUPPLYCHAIN 9**

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

**UNITIII EVOLUTION OF SUPPLYCHAINMODELS 9**

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

**UNITIV SUPPLYCHAINACTIVITIES 9**

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

**UNITV SCM ORGANISATION ANDINFORMATIONSYSTEM 9**

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERPSoftware's

**TOTAL 45PERIODS**

**TEXTBOOKS**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Shari.P.B and Lassen.T.S | Managing the global supply chain | Viva books, New Delhi | 2000 |
| 2 | Ayers.J.B | Hand book of supply chain management | The St. Lencie press | 2000 |

**REFERENCES**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Nicolas.J.N | Competitive manufacturing management - continuous improvement, Lean production, customer focused quality | McGrawHill, New York | 1998 |
| 2 | Steudel.H.J and Desruelle.P | Manufacturing in the nineteen - How to become a mean, lean and world class competitor | Van No strand Reinhold, New York | 1992 |

**15BEMEOE04 TRANSPORT PHENOMENA 3 0 0 3100**

**COURSE OBJECTIVES**

1. To generalized equations for mass, momentum and heat.
2. To understand the concepts of Reynolds and Gauss theorems.
3. To learn combined diffusive and convective transport.
4. To apply Film- and penetration models for mass and heat transfer.
5. To apply Stefan-Maxwells equations for multi-component diffusion.
6. To Solve the given set of equations either analytically or numerically.

**COURSE OUTCOMES**

1. Generalized equations for mass, momentum and heat.
2. Understand the concepts of Reynolds and Gauss theorems.
3. Learn combined diffusive and convective transport.
4. Apply Film- and penetration models for mass and heat transfer.
5. Apply Stefan-Maxwells equations for multi-component diffusion.
6. Solve the given set of equations either analytically or numerically.

**UNITI INTRODUCTION ANDBASICCONCEPTS 9**

General overview of transport phenomena including various applications, Transport of momentum, heat and mass , Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

**UNITII PROPERTIES, UNITS AND OTHERPHYSICALPARAMETERS 9**

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

**UNITIII MOMENTUM TRANSPORT 9**

Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non- Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

**UNITIV ENERGYTRANSPORT 9**

Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heattransfer

**UNITV MASS TRANSPORT 9**

Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion-Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

**TOTAL 45PERIODS**

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Geankoplis, C. J | Transport Processes and Separation Processes Principles | Prentice Hall | 2003 |

**WEB REFERENCE**

1. https://laulima.hawaii.edu/portal

## 15BEMEOE05 INTRODUCTION TO BIOMECHANICS 3 0 0 3100

**COURSE OBJECTIVES**

1. To describe the principles of the study of human movement.
2. To describe the range of factors that influence the initiation, production and control of human movement.
3. To identify the body's lever systems and their relationship to basic joint movement and classification.
4. To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. To relate the different body systems necessary for human movement to occur.

**COURSE OUTCOMES**

1. Describe the principles of the study of human movement.
2. Describe the range of factors that influence the initiation, production and control of human movement.
3. Identify the body's lever systems and their relationship to basic joint movement and classification.
4. Distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. Explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. Relate the different body systems necessary for human movement to occur.

**UNITI INTRODUCTION 9**

Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

**UNITII KEYMECHANICALCONCEPTS 9**

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application ofBiomechanics

**UNITIII HUMAN ANATOMY AND SOMEBASICTERMINOLOGY 9**

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements - Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

**UNITIV ANATOMICALDESCRIPTION 9**

Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

**UNITV MECHANICS OF THEMUSCULOSKELETALSYSTEM 9**

Tissue Loads - Response of Tissues To Forces - Biomechanics of The Passive Muscle–Tendon Unit - Biomechanics of Bone - Biomechanics of Ligaments - Three Mechanical Characteristics of Muscle - Stretch-Shortening Cycle (SSC) - Force–Time Principle - Neuromuscular Control

**TOTAL 45PERIODS**

**REFERENCE**

| S. No. | Author(s) Name | Title of the book | Publisher | Year of Publication |
|---|---|---|---|---|
| 1 | Duane Knudson | Fundamentals of Biomechanics | Springer Science+ Business Media, LLC | 2007 |
| 2 | C. Ross Ethier Craig A. Simmons | Introductory Biomechanics | Cambridge University Press | 2007 |