2K6 EE 501 ENGINEERING MATHEMATICS IV

3 hours lecture and 1 hour tutorial per week

Module I Probability distributions (13 hours)

Random variables-Probability distributions - binomial distribution –Poisson distribution-normal distribution –Mean, variance and Moment generating function -Poisson process - Chebyshev's theorem- Geometric Distribution-Uniform Distribution, Gamma distribution, Beta Distribution, Exponential Distribution and Hyper-Geometric Distributions.

Module II Statistical inference (13hours)

Population and Sample-Sampling Distributions of Mean and Variance-Point Estimation-Interval Estimation -Null Hypotheses and Significance tests-Hypotheses concerning one mean- Confidence Intervals of mean and variance - Estimation of Variances-Hypotheses concerning one variance-Hypotheses concerning two variance- Chi square test as test of goodness of fit.

Module III (Series solutions of differential equations (13hours)

Power series method of solving ordinary differential equations - series solution of Bessel's equation – Recurrence formula for Jn(x)-expansions for J_0 and J_1 – value of $J_{1/2}$- generating function for Jn(x)- Orthogonality of Bessel functions - Legendre's equation – series solution of Legendre's differential equation -Rodrigues formula-Legendre Polynomials – Generating function for Pn(x)- Recurrence formulae for Pn(x) -Orthogonality of Legendre polynomials

Module IV Quadratic forms and Fourier Transforms (13 hours)

Quadratic forms - Matrix associated with a quadratic form - Technique of Diagonalization using row and column transformations on the matrix - Definite, Semidefinite and Indefinite forms - their identification using the Eigen values of the matrix of the quadratic form.

Fourier Transform-Properties of Fourier Transforms-Linearity property-Change of scale property-shifting properties –Modulation property-Transform of the Derivative-simple problems- Fourier Cosine transform-Fourier Sine Transform.

Text book

Johnson RA, Miller & Freund's Probability and Statistics for Engineers, Prentice Hall of India
(For Module I and II only)

Reference Books

1. Wylie C R & Barrett L. C., Advanced Engineering Mathematics, Mc Graw Hill
2. Kreyszig E., Advanced Engineering Mathematics, John Wiley.
3. Bali N. P. & Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications
4. Grewal B. S, Higher Engineering Mathematics, Khanna Publishers

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total marks	= 50

University Examination Pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions of 15 marks each from module I with choice to answer any one.
Q III - 2 questions of 15 marks each from module II with choice to answer any one.
Q IV - 2 questions of 15 marks each from module III with choice to answer any one.
Q V - 2 questions of 15 marks each from module IV with choice to answer any one.

2K6 EE 502 ENVIRONMENTAL ENGG: & DISASTER MANAGEMENT

3 hours lecture and 1 hour tutorial per week

MODULE I (12 HOURS)

Multidisciplinary nature of Environmental studies – Definition – scope and importance – need for public awareness Natural resources – renewable and non-renewable resources – natural resources – forest resources - water resources Mineral resources – food resources – energy resources – Land resources – use, overuse and misuse of these resources with appropriate case studies to substantiate – effect on the environment – role of individual in conservation of natural resources – equitable use of resources for sustainable lifestyle.

MODULE II (12 HOURS)

Ecosystem – concept – structure and function – producers, consumers & decomposers – energy flow in the ecosystem- Ecological successive food chains - food webs (all in brief)

Ecological pyramids – introduction, types and characteristic features, structure and function of forest, grassland, desert and acquatic ecosystems (ponds, lakes, streams, rivers, oceans and estuaries) Biodiversity and its conservation – Introduction – definition : genetic species and ecosystem diversity – Biogeographical classification of India – value of biodiversity – consumptive and productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels –India as a mega-diversity nation – hot spots of biodiversity – threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

MODULE III (13 HOURS)

Environmental Pollution – Definition – causes - effects and control measures of : Air Pollution – water Pollution – soil Pollution – marine Pollution – noise Pollution – thermal Pollution – Nuclear hazards .

Solid waste management – causes, effects and control measures of urban and industrial wastes – Role of an individual in preventing Pollution – Environmental Protection Act – Prevention and control of air and water Pollution – Wildlife Protection Act – Forest Conservation Act – Issues involved in Enforcement of Environmental Legislation – Public awareness.

Disaster Management – Principles of disaster management – nature and extent of disasters – natural disasters , hazards, risks and vulnerabilities – man-made disasters – chemical, industrial, nuclear and fire. – preparedness and mitigation measures for various hazards – financing relief expenditure – legal aspects - post disaster relief – voluntary agencies and community participation at various stages of disaster management – rehabilitation programmes.

MODULE IV (10 HOURS)

Social Issues and the Environment – From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting , watershed management – resettlement and rehabilitation of people ; its problems and concerns, case studies – environmental ethics : Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies – waste land reclamation – consumerism and waste products.

Human population and the environment – Population growth, variations among nations – population explosion – Family welfare programmes – Environment and human health – Pollution hazards, sanitation and health – Human rights for a clean environment – value education – HIV/AIDS – social concern – Women and Child welfare – role of Information Technology in environment and human health – Case studies.

FIELD WORK (5 HOURS)

- Visit to a local area to document environmental assets – river / forest / grassland / hill / mountain
- Visit to local polluted site – urban / rural / industrial / agricultural
- Study of common plants, insects , birds
- Study of simple ecosystems – pond, river, hill slopes, etc.

Text book

1. Clarke. R.S. Marine Pollution. Clanderson Oress Oxford.`
2. Mhaskar A.K. Matter Hazardous. Techno-Science Publications.
3. Townsend. C., Harper. J. and Michael Begon, Essential of Ecology. Blackwell Science.
4. S. Deswal & A . Deswal, A Basic Course in Environmental Studies, Dhanpat Rai & Co
5. Environmental Studies – Dr. B . S. Chauhan, University Science Press.
6. Kurien Joseph & R. Nagendran, Essentials of Environmental Studies, Pearson Education.
7. Trivedi. R.K. and Goel. P.K. Introduction to air pollution. Techno-Science Publications.

Reference Books

1. Agarwal.K.C. Environmental biology. Nidi Publ.Ltd. Bikaner.
2. Bharucha erach, Biodiversity of India, Mapin Publishing Pvt.Ltd.,.
3. Brunner,R.C.. Hazardous Waste Incineration. McGraw Hill Inc..
4. Cunningham W.P. , Cooper T.H., Gorhani E. & Hepworth M.T. Environmental Encyclopedia ,Jaico Publ.House ,.
5. De A.K. Environmental Chemistry.Wiley Eastern Ltd.
6. Hawkins R.E. Encyclopediaof Indian Natural History, Bombay Natural History Society ,.
7. Heywood V.H. & Watson R.T.. Global Biodiversity Assessment. Cambridge Univ. Press.
8. Jadhav H. & Bhosale V.M.. Environmental Protection and Laws. Himalaya Pub. House,
9. Odum E.P. Fundamentals of Ecology W.B. Saunders Co..
10. Rao M.N. & Datta A.K. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd..
11. Sharma B.K.. Environmental Chemistry Goel Publ. House, Meerut
12. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.I & II.Enviro Media.
13. Wagner K.D. Environmental Management. W.B. Saunders Co.

Sessional work assessment

Two Tests	2 × 15	= 30 marks
Two Assignment	2 × 10	= 20 marks
Total		= 50 marks

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.
Q II- 2 questions of 15 marks each from module I with choice to answer any one.
Q III- 2 questions of 15 marks each from module II with choice to answer any one.
Q IV- 2 questions of 15 marks each from module III with choice to answer any one.
Q V- 2 questions of 15 marks each from module IV with choice to answer any one.

2K6 EE 503: FIELD THEORY

3 hours lecture and 1 hour tutorial per week

Module I: (16 hours)

Electric field : Co-ordinate System and transformations – Cartesian co-ordinates – circular cylindrical co-ordinates – spherical co-ordinates – relation between Cartesian, cylindrical and spherical co-ordinates

Vector calculus – Del operator – Gradient of a scalar – Divergence of a vector – Curl of a vector – Laplacian of a vector – Divergence theorem – Stoke's theorem.

Electrostatics – Electric field concept – Electric field intensity – Electric field due to continuous charge distributions – Electric flux – Gauss's law – Applications – Electric scalar potential – Electric dipole moment – Electric field polarization – Condition at boundary between dielectrics – Capacitance of an isolated sphere –Spherical capacitor – Capacitance between co-axial cylinder- Capacitance between parallel wires.

Module II: (16 hours)

Magnetic field: Magnetic circuit and electric circuit – Magnetic field intensity – Magnetic flux density – mmf – Flux – reluctance – Comparative study with electric and magnetic circuit – Lorentz force – Biot –Savart's law and Ampere's circuital law – H due to a long wire – H due to a long solenoid – H due to an infinite current sheet – H due to a circular wire loop – Skin effect – Faraday's laws of Electromagnetic induction – inductance and mutual inductance – Self inductance of toroid and toroidal solenoid – Lifting power of an electromagnet – Force and torque in terms of stored energy – Torque on a closed circuit

Magnetic vector potential and magnetic scalar potential – Helmholt's theorem – Magnetic dipole – Magnetic force on a charged particle – Force on a current element – Magnetic boundary conditions.

Module III: (10 hours)

Maxwell's equations: Faraday's law – Displacement current – Maxwell's equations in point form – Maxwell's equations in integral form and differential form – Boundary conditions.

The uniform plane wave – Propagation in free space – Plane wave propagation in loss less dielectrics – Plane wave in good conductor – Poynting theorem and wave power – Complex pointing theorem – Poynting vector.

Module IV: (10 hours)

Waves and transmission lines: Polarization of electromagnetic waves - Wave polarization - Elliptically and circularly polarized waves – Reflection and refraction of plane electromagnetic wave oblique – Law of refraction (Snell's law) - Brewster's law .

Transmission line parameters – Standing wave ratio – Impedance matching - Stub matching – Phase velocity and group velocity – Characteristic impedance – Reflection co-efficient – Reflection and transmission of plane wave at boundaries.

Text books

1. Hayt W.H., Engineering Electromagnetics, McGraw Hill
2. Premlet B., Electromagnetic Theory with Applications, Phasor Books
3. K A Gangadhar, Field Theory, Khanna Publishers
4. V V Sawate, Electromagnetic Fields and Waves, New Age international

Reference books

1. Guru & Hiziroglu, Electromagnetic Field Theory, *Fundamentals*
2. John D. Kraus, Electromagnetics, McGraw Hill
3. S P Seth, Elements of Electromagnetic Fields, Danapath Rai & Co
4. R Meenakumari & Subasri, Electromagnetic fields, New Age International
5. David K. Cheng, Field and Wave Electromagnetics, Addison Wesley

Sessional work assessment

Two tests	2 x 15	= 30
Two assignments	2 x 10	= 20
Total marks		= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module
Q II - 2 questions of 15marks from module I with choice to answer any one
Q III - 2 questions of 15marks from module II with choice to answer any one
Q IV - 2 questions of 15marks from module III with choice to answer any one
Q V - 2 questions of 15marks from module IV with choice to answer any one

2K6 EE 504 : ELECTRICAL MACHINES II

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Synchronous generators: Construction - principle of operation - type and selection- EMF developed in a winding - Distribution factor- Chording factor - armature reaction - voltage regulation - automatic voltage regulator - predetermination of voltage regulation - EMF method - MMF method - Potier method – ASA method - phasor diagrams - short circuit ratio- two reaction theory - modified phasor diagram - analysis by two reaction theory - slip test - sudden short circuit - current waveforms - transient and subtransient reactances - DC excitation - static excitation - brush less excitation .

Module II (14 hours)

Analysis of synchronous machines - Power angle characteristics of cylindrical rotor and salient pole machines - active and reactive power control - alternator connected to infinite bus -synchronizing power and torque- effect of armature reactance- load sharing upon parallel operation - power frequency characteristics - locus of generated voltage for constant real power and variable excitation - V curves - inverted V curves

Synchronous motor - Principle of operation - different starting methods -equivalent circuit - phasor diagram- effect of load changes on synchronous motor - mechanical load diagram - torque and power relations- synchronous condenser- hunting - periodicity of hunting – suppression- applications.

Module III (14 hours)

Theory of induction machines: 3 phase induction motors - construction - principle of operation - rotor MMF and production of torque - slip and frequency of rotor current - phasor diagram - equivalent circuit - mechanical power developed - maximum torque - torque slip characteristics - losses and power flow - single phasing - no-load and blocked rotor tests - the circle diagram - double cage rotors - effects of air gap flux harmonics - cogging and crawling - line excited and self excited induction generators - applications of induction motors.

Module IV (12 hours)

Starting and speed control of induction motors: starting methods for three phase induction motors - direct on line starting - auto transformer starting - star delta starting - rotor resistance starting - speed control - basic methods - voltage control - frequency control - rotor resistance control - pole changing - slip power recovery scheme

Single phase induction motor - double field revolving theory - equivalent circuit- starting methods-capacitor based starting and running.

Text book and References

1. Langsdorf A.S., Theory of A.C Machinery, McGraw Hill.
2. Dr PS Bimbhra, Electrical Machinery, Khanna Publishers
3. Nagrath I.J. & Kothari D.P., Electric Machines, Tata McGraw Hill
4. Fitzgerald A.E. & Kingsley, Electrical Machinery, McGraw Hill
5. Say M.G., Performance and Design of AC Machines, Pitman, ELBS.
6. Stephen J Chapman, Electric Machinery Fundamentals, McGraw Hill.
7. Vincent Del Toro, Electrical Machines and Power Systems, Prentice Hall
8. Ashfaq Hussain, Electric machines, Dhanpat Rai & co.
9. Theodore Wildi, Electrical Machines, Drives and Power systems, Pearson
10. Smarajit Ghosh, Electrical Machines, Pearson
11 JB Gupta, Theory and Performance of Electrical Machines, SK Kataria & Sons

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total marks	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

2K6 EE 505 : MODERN COMMUNICATION SYSTEMS

3 hours lecture and 1 hour tutorial per week

Module I (16 hours)

Analog modulation schemes: Super heterodyne receivers-receiver parameters-AM receivers-IF and its selection-AGC, AM demodulator circuits-SSB receivers-demodulation of SSB, receiver types-FM receiver-FM demodulators, FM noise suppression- Pulse modulation, principle of PAM, PWM,PPM modulation and demodulation-circuits.

Digital modulation schemes: Coherent binary schemes: ASK,FSK,PSK,MSK, coherent M-ray schemes, calculation of average probability of error for different modulation schemes, Power spectra of digital modulated signals, performance comparison of different modulation schemes-PCM, DPCM, Delta modulation, generation and demodulation- Multiplexing- TDM, FDM, WDM.

Module II (12 hours)

Principle of TV communication: Theory of interlaced scanning- composite video waveforms-synchronising signal standards as per PAL625 line system-bandwidth-Block diagram of monochrome transmitter and receiver.

Colour TV signal standards-principle of NTSC, PAL and SECAM encoders/ decoders-Block diagram of transmitters and receivers.

Principles of Radar: Radar frequencies-Radar equation-Transmitter and receiver(Block diagram approach), Pulsed, CW, FMCW, MTI, and tracking radars.

Module III (12 hours)

Principles of optical communication system: LED and LASER diode- Principle of operation- optical detectors-pin detector-APD- optical fibres- step index- graded index- single mode and multimode

Principles of mobile communication systems: operation of cellular system- improving capacity in cellular systems-frequency re usage- hand off strategies- cell splitting- sectoring channel assignment strategies- call blocking in cellular networks.

Module IV (12 hours)

Satellite communication: Orbit of communication satellite-satellite constellation- orbital parameters- orbital perturbations- geostationary orbits-low earth and medium orbits- frequency selection- RF links- propagation characteristics- modulation methods- coding- multiple access spacecraft- antennas-transponders-inter satellite link-link power budget- earth station interference- special spectrum communication general concepts- frequency hopping- frequency hopping transmitter- frequency hopping receiver- time hopping- antijam consideration-CDMA.

Text books & References

1. Principles of Communication systems, George Kennedy, TMH.
2 Dennis Roody and john Coolen, Electronic communication, Prentice Hall..
3. Bernard sklar, Digital communications Fundamentals and applications, Pearson
4. Dennis Roddy, Satellite Communication, PHI.
5. TS Rappaport, Wireless digital communications, Principles and Practice, Pearson
6. R. R. Gulati, Monochrome and colour Television, John Wiley.
7. Skolnik, Introduction to Radar Systems
8. John Senior, Optical Fiber Communications, PHI
9. RE Ziemer , WH Tranter, Principles of Communication, 5th edition, John Wiley.
10. BP Lathi, Modern Digital and Analog Communication system, 3rd edition, Oxford.
11. Wayne Tomasi, Modern Electronic Communication system, Pearson
12. Simon, Hindey, Lindsey, Digital Communication Techniques, PHI
13. John G Proakis, Digital Communication, MGH
14. WL Prichard, Satellite Communication system engineering, Pearson

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

2K6 EE 506 : POWER SYSTEMS- I

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Economic considerations in power generation: Classification of generation costs-interest and depreciation-methods of providing depreciation-load curves-terms associated with generation-significance of load and diversity factors-base load and peak load plants. Tariff-types, Power factor-causes of low power factor-disadvantages-methods of power factor improvement-most economical power factor-economical comparison of the two methods of increasing power supplied.

Module II (15 hours)

Design of transmission lines: Main components of overhead lines- Conductors-materials-configuration-spacing and clearances-supports-span length-calculation of sag and tension- effect of wind and ice-supports at unequal heights - sag template-equivalent span -vibration and dampers-Insulators-materials-types-causes of failure of insulators-distribution of potential over a string of insulators-string efficiency-methods of improving string efficiency-formation of corona-disruptive and visual critical voltages-factors affecting corona-advantages and disadvantages-corona power loss-methods of reducing corona effects-underground cables-general construction-classification-insulation resistance-capacitance of 1-core cable-dielectric stress-grading methods-capacitance of 3-core cables-laying of cables-heating of cables.

Module III (13 hours)

Characteristics and performance of transmission lines: Constants of transmission lines-resistance-inductance and capacitance of 1-Φ,2 wire lines-composite conductors-GMD and GMR-inductance and capacitance of 3-Φ lines-transposition-double circuit lines-bundled conductors-classification of lines-short lines-voltage regulation and efficiency-medium lines-nominal T and Π configurations-ABCD constants- long lines- rigorous solution-interpretation of long line equation-Ferranti effect- tuned power lines-power flow through lines-methods of voltage control.

Module IV (12 hours)

Power distribution: -Feeders, distributors and service mains- types of distribution systems -design of feeders-Kelvin's law-current distribution and voltage drop calculations in DC distributors with concentrated loading and uniform loading-AC distributors with concentrated loading-radial and ring systems-AC interconnected systems, Improvement of existing distribution system-LT capacitor installation-size, connection and specifications.

Text books

1. Nagarth J & Kothari D P, Power system Engineering, TMH
2 J B Gupta, A course in electrical power, S K Kataria & Sons

Reference books

1. Stevenson Jr, Elements of power system analysis, TMH
2. Pabla A S, Electric power distribution systems, TMH
3. Wadhwa C L, Electric power systems, Wiley eastern LTD
4. Gupta B R power system analysis and design, Wheeler publishing & co.

Sessional work assessment

Two tests	2 x 15 = 30
Two assignments	2 x 10 = 20
Total	= 50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

2K6 EE 507(P) LINEAR INTEGRATED CIRCUITS LAB

3 hours practical per week

1) Study of OP AMPs: Measurement of OP AMP parameters-CMRR, slew rate ,open loop gain ,input and output impedances.
2) Design and set up of inverting and non inverting amplifier, summer, subtractor, scale changer, integrator and differentiator circuits.
3) Inverting and non inverting comparator, Level detector and zero crossing detector circuits using OP AMP.
4) Phase shift and Wein bridge oscillator with amplitude stabilization using OP AMPs.
5) OPAMP comparator –design and set up Schmitt trigger-window comparator.
6) Square, Triangular and Ramp generation using OP AMPS
7) Astable and Monostable Multivibrators using OP AMP s.
8) Precision rectification –absolute value and averaging circuit using OP AMPS.
9) Second order Low pass, High pass and Band pass filters using single OP AMPS.
10) Active notch filter realization using OP AMPs.
11) Experiments on precision OP AMPS.
12) Voltage regulation using IC723or 78xxor 79xx.
13) Design of PLL for given Lock and capture ranges and Frequency Multiplication.
14) Resistance-Temperature characteristics of Thermistors.
15) Characteristics of Optocoupler.
16) Audio Amplifiers- Input impedance. Output impedance, frequency response etc.

A minimum of 12 experiments to be conducted from the above list.

Sessional work assessment	
Laboratory Practicals and Record	= 35
Test	= 15
Total marks	= 50

2K6 EE 508(P) : ELECTRICAL MACHINES LAB I

3 hours practical per week

DC Machines

1. Open circuit characteristics of DC shunt generator at rated speed
   (a) Predetermine the OCC at different speeds and determine resistance required in the field circuit for generating different voltages on no load.
   (b) Find the critical resistance and the critical speed for a given field circuit resistance
2. Load test on DC shunt generator
   (a) Plot the external and internal characteristics by conducting load test
   (b) Deduce the armature reaction curve
3. Brake test on DC shunt and series motor
   Plot the following characteristics
   i) Output Vs Efficiency ii) Output Vs Line current iii) Output Vs Speed
   iv) Speed Vs Torque v) Line current Vs Torque
4. Swinburne's test on a DC shunt motor

   Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator delivering 1/4, 1/2, 3/4 and full rated output and plot the characteristics
5. Hopkinson's Test on a pair of DC machines

   Predetermination of the efficiency of the machine working as a motor and as a generator under various load conditions on the generator
6. Retardation test on a DC machine

   i). Separate the losses ii) Find the moment of inertia of the rotating system
7. Separation of losses in a DC machine at rated speed

   By conducting no load test at different excitations, separate the losses in the DC shunt motor

Transformers

8. O.C and S.C test on the single-phase transformer - pre-determination of the following
   i). Equivalent circuit referred to HV and LV sides
   ii). Efficiency at 1/4, 1/2, 3/4 and full loads at 0.5, 0.86 and u p f.
   iii). Plot the regulation curve for full load and half load conditions
   iv). Upf load at which efficiency is maximum
   v). Performance of the transformer when a load of 30+j40 Ω is connected to the secondary.
9. Separation of losses in a transformer

   At normal voltage and frequency separate the hysterisis and eddy current losses of a single phase transformer
10. Sumpner's test
    Predetermination of efficiency and regulation at various loads and p.f.
11. Scott connection of the single phase transformers

    To determine the performance under various load conditions at upf and plotting the efficiency curves with
    (a) Main transformer secondary alone loaded, (b)Teaser transformer secondary alone loaded
    (c) Balanced loading

Sessional work assessment	
Laboratory Practicals and Rrecord	= 35
Test	= 15
Total marks	= 50