PEL5D001 ELECTRICAL MACHINE DESIGN (3-1-0)

Module-I (12 hours)

University Portion (80%)

Design of Transformers: Classification of transformer, transformer core, yoke, transformer winding, cooling of transformers, method of cooling of transformers, transformer tank, cooling ducts, transformer insulation, conservator and breather, output of transformer, output equation, ratio of iron loss to copper loss, relation between core area and weight of iron and copper, optimum design, variation of output and lossless in transformers with linear dimensions, design of core, selection of core area and type of core, choice of flux density, design of windings, Design of insulation, surge phenomenon, surge protection widow space factor, window dimension, width of window for optimum output, design of yoke, overall dimensions, simplified steps for transformer design, operating characteristics, resistance of winding, leakage reactance of winding, regulation.

Ch- 5.2, 5.7, 5.10, 5.17, 5.18, 5.19, 5.20, 5.21, 5.24, 5.29, 5.30-5.45, 5.46, 5.47, 5.48

College/Institute Portion (20%)

Calculation of mechanical forces, bracing of windings, change of parameters with change of frequency, temperature rise of transformers, design of tanks with tubes, thermal rating.

Ch- 5.50, 5.51, 5.53,5.54, 5.55, 5.58

Module-II (12 hours)

University Portion (80%)

D C Machines; Output equations, choice of average gap density, choice of ampere conductor per meter, selection of number of poles, core length, Armature diameter, pole proportions, number of ventilating ducts, estimation of air gap length, **Armature reaction;** flux distribution at load, effect of armature reaction, brush shift and its effect, reduction of effects of armature reaction **Armature design;** choice of armature winding, numbers of armature conductors, numbers of armature slots, cross section of armature conductors, insulation of armature winding, slot dimension, armature voltage drop, depth of armature core, **Design of field system;** pole design, design of field winding, design of yoke, magnetic circuit, magnetization curve, design of field winding, commutation phenomenon, forms of current in coil undergoing commutation, **Design of commutator and brushes;** number of segments, commutator diameter, length of commutator, dimension of brushes, losses at commutator surface, loss and efficiency.

Ch-9.10, 9.11-9.20, 9.22-9.30, 9.31-9.39

College/Institute Portion (20%)

Design of interpoles; time of commutation, width of commutation zone, width of interpole shoe, calculation of reactance voltage, length of interpole, flux density under interpole shoe, design of interpole winding.

Ch-9.40-9.54

Module-III (8 hours)

University Portion (80%)

Three Phase Induction Motors; output equation, choice of average flux density in air gap, choice of armature conductors, efficiency and power factor, main dimensions, stator winding, Shape of stator slots, number of stator slots, area of stator slots, length

of mean turn, stator teeth, stator core, **Rotor design;** length of air gap, number of rotor slots, effects of harmonics, reduction of harmonic torques, design of rotor bars and slots, design of end rings, full load slip, design of wound rotor, rotor teeth, rotor core, operating characteristics; no load current, short circuit current, leakage reactance.
Ch-10.9, 10.10, 10.11-10.22, 10.22.2, 10.23-10.25, 10, 27, 10.31

College/Institute Portion (20%)

Circle diagram, dispersion coefficient and its effects, effects of change of air gap length, effect of change of number of poles, effect of change of frequency, relation between D and L for best power factor, method of improving starting torque, loss and efficiency.
Ch -10.32,10.34, 10.35-10.38

Module-IV (12 hours)

University Portion (80%)

Design of synchronous Machines; output equation, design of salient pole machines-main dimensions, short circuit ratio, length of air gap, shape of pole face, armature design, armature winding, coils and their insulation, slot dimension, length of mean turn, stator pole, elimination of harmonics, armature parameters, estimation of air gap length, design of rotor, magnetic circuits, Open circuit characteristics, determination of full load field mmf, design of field winding, design of turbo-Alternator- main dimension, length of air gap, stator design, rotor design.
Ch-11.8 - 11.25 and 11. 30 – 11.33

College/Institute Portion (20%)

Determination of direct and quadrature axis synchronous reactances, short circuit characteristics, losses, temperature rise,
Ch- 11.26 -11.29.

Text book

1. A course in Electrical Machine Design by A.K. Sawhney and Dr. A. Chakrabarti – Publisher: Dhanpat Rai & Company Pvt. Ltd., Year of Edition- 2015

References

2. Clayton A E & Hancock N N : The Performance and Design of Direct Current Machines ; CBS Publishers and Distributors Electrical Engineering
3. Say M G : The Performance and Design of Alternating Current Machines; CBS Publishers and Distributors
4. Sen S K : Principles of Electrical Machine Design with Computer Programs ; Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi,
5. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd.