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7E7041

Roll No. _____ [Total No. of Pages : 2

# 7E7041

## B.Tech. VII Sem. (Main/Back) Examination, Nov. - 2019
## Electrical Engineering.
## 7EE1A Power System Planning
## Common for EE, EX

**Time : 3 Hours** **Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

### Unit - I

1. a) Explain the power system planning and planning process. **(8)**

   b) Explain the difference between national and regional planning. **(8)**

**OR**

1. Explain electricity forecasting schemes and write the disadvantages of long term forecasting. Discuss various planning tools. **(16)**

### Unit - II

2. a) Explain the integrated resources planning with respect to power generation planning. **(8)**

   b) Explain the term generation planning. Explain the different method of cogeneration. **(8)**

**OR**

2. a) Describe various components of rural electrification planning in India. **(8)**

   b) Explain the concept of financial planning. Explain power trading and power pooling. **(8)**

### Unit - III

3. a) Explain system adequacy and security of power system reliability. **(8)**

   b) Explain the function of power system simulator with block diagram. **(8)**

OR

3. a) Explain various methods of load management. (8)

b) Explain the term state estimation and function of state estimation with the help of neat diagram. (8)

Unit - IV

4. a) Explain the term computer aided planning. (8)

b) Explain the system architecture of CAPP with its advantages over manual experience based process planning. (8)

OR

4. a) Define wheeling in power system and list typical objectives of wheeling. (8)

b) What are the technological impacts of green house effect? (8)

Unit - V

5. a) Explain optimal power system expansion planning. Summarize main step of optimal power system planning. (8)

b) Discuss the formulation of least cost optimization problem with block diagram. (8)

OR

5. a) Write short notes on operating and maintenance cost of any candidate plant. (8)

b) Describe minimum assured reliability constraints by using optimization method by programming. (8)

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7E7042

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# 7E7042

## B.Tech. VII- Semester (Main&Back) Examination, Nov. - 2019
## Electrical Engg.
## 7EE2 A Power System Analysis
## (Common for EE, EX)

**Time : 3 Hours**

**Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

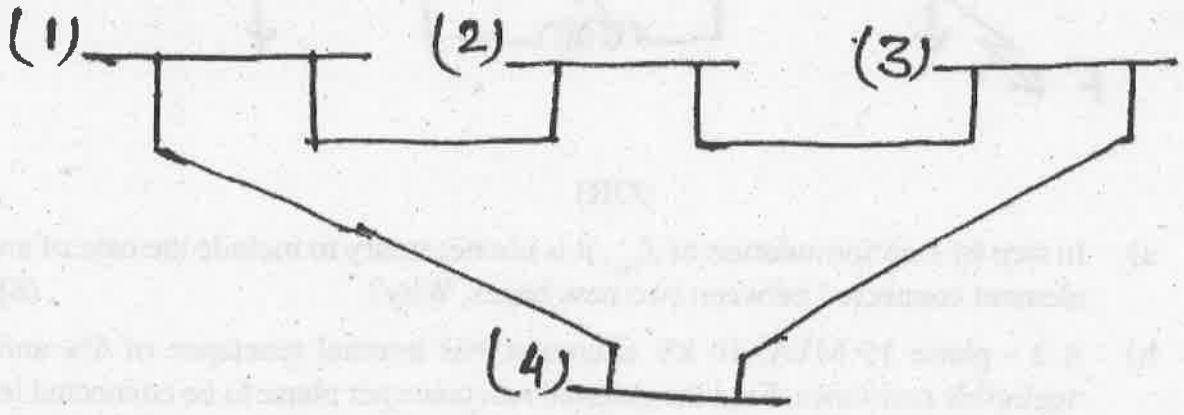
### UNIT - I

1. a) What do you mean by per unit and percentage quantities? What is the need of per unit system? What are the advantages of per unit system? **(8)**

   b) Figure shows a 4 bus system. The shunt admittance at the buses are negligible. the line impedance are as below : Formulate $Y_{BUS}$ matrix

| Line (but to bus) | 1-2 | 2-3 | 3-4 | 1-4 |
|---|---|---|---|---|
| R (P.U) | 0.025 | 0.02 | 0.05 | 0.04 |
| X (P.U) | 0.10 | 0.08 | 0.20 | 0.16 |

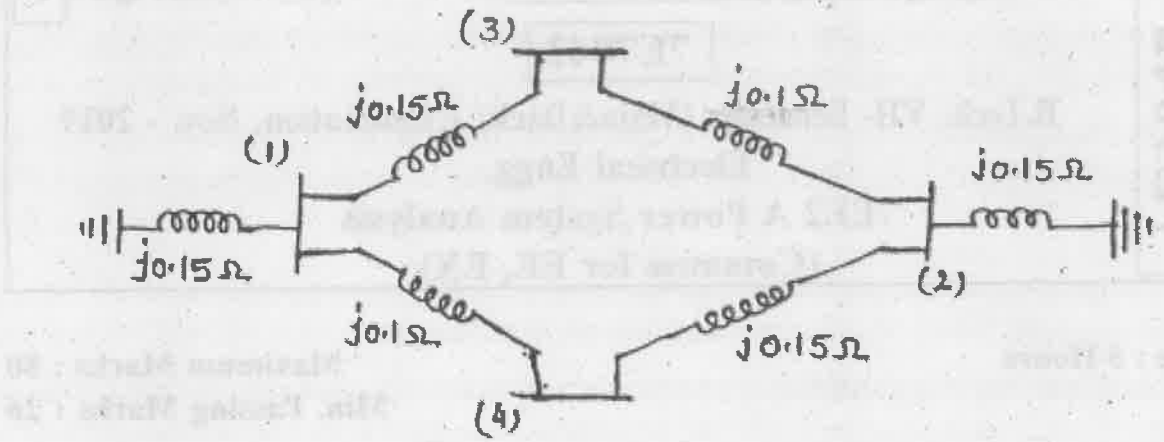
**(8)**




**(OR)**

1. a) Explain the procedure for formulations of admittance matrix also explain the modification fo admittance matrix. **(8)**

b) Constitute the bus admittance matrix for the following network. **(8)**



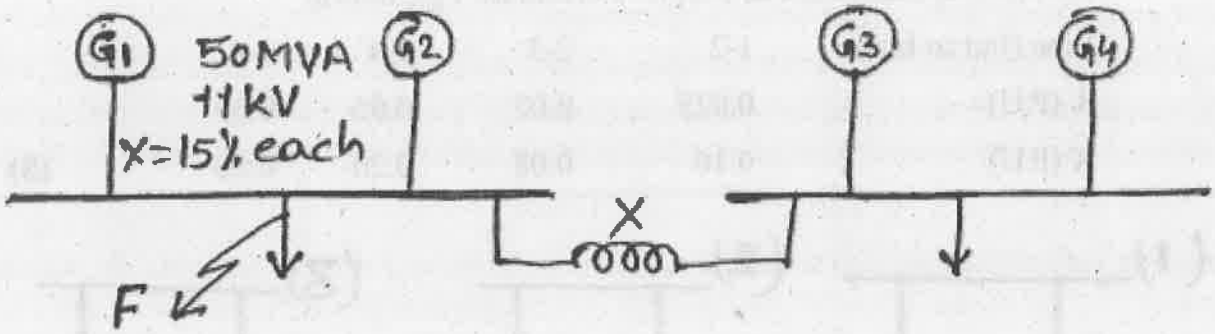

## UNIT - II

2. a) Discuss the analysis of short circuit on a loaded synchronous machine and draw models for computing subtransient and subtransient current. **(8)**

b) Fig shows a system having 4 alternator each rated at 11 kV, 50 MVA and each having a subtransient reactance of 15%. Find.

i) Fault level for a fault on one of the feeders (near the bus) with zero value of reactance X.

ii) The reactance of the current limiting reactor X to limit the fault level to 800 MVA for a fault on. **(8)**




**(OR)**

2. a) In step by step formulation of $Z_{bus}$, it is not necessary to include the case of an element connected between two new buses, Why? **(8)**

b) A 3 - phase 15 MVA, 10 kV alternator has internal reactance of 6% and negligible resistance. Find the external reactance per phase to be connected in series with the alternator so that steady current on short circuit does not exceed 6 times the full load current. **(8)**

## UNIT - III

3. a) Write short note on sequence impedance of transformer and draw the transformer connection and their equivalent sequence network. (8)

   b) Determine the symmetrical components of current in a three phase system, the original phasors of which are $I_a = 12+J6$, $I_b = 12-j12$, $I_c = -15+j10$. (8)

**(OR)**

3. a) What do you understand by symmetrical components? Explain positive, Negative and zero sequence components. (8)

   b) Derive expression for fault current by symmetrical component method for single line to ground fault. (8)

## UNIT - IV

4. a) Derive the expression for fault current by symmetrical component method for line to line fault. (8)

   b) For a fault at alternator terminals, a single line to ground fault is more severe than a 3 - phase fault. Why? (8)

**(OR)**

4. a) Distinguish between

      i) Symmetrical and Unsymmetrical faults.

      ii) Short circuit and open circuit fault. (8)

   b) A 50 MVA, 11 kV, $3-\phi$ alternator was subjected to different types of faults, The fault current were : $3-\phi$ fault 1870 Amp., line to line fault 2590 Amp, single line to ground fault 4130 Amp. The alternator neutral is solidly grounded. Find per unit values of three sequence reactances of the alternator. (8)

## UNIT - V

5. a) Explain different type of buses and variables in power system. Derive steady state load flow equation. (8)

   b) What do you mean by load flow problems? (8)

**(OR)**

5. a) Give the comparison of Gauss - Seidal, Newton Raphson and fast decoupled load flow studies. (8)

   b) Give reason

      i) Majority of buses in power system are load buses

      ii) Bus admittance matrix is preferred for load flow study. (8)

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7E7043

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# 7E7043

## B.Tech. VII Semester (Main/Back) Examination, Nov. - 2019
## Electrical Engg.
## 7EE3A Artificial Intelligence Techniques
## (Common for EE,EX)

**Time : 3 Hours** **Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

### Unit - I

1. a) Discuss the different application areas of Artificial Intelligence. **(8)**

   b) Differentiate between Machine learning and expert systems. **(8)**

**OR**

1. a) What are the characteristics of a good production system? **(8)**

   b) Discuss about the state space search technique. **(8)**

### Unit - II

2. a) Discuss the characteristics of knowledge representation. Define properties of knowledge. **(8)**

   b) Write down the step by step procedure of hill climbing algorithm. **(8)**

**OR**

2. a) Discuss about the following terms in knowledge representation.

   i) Validity

   ii) Satisfiability

   iii) Contradiction **(2+3+3)**

   b) With respect to support vector machine, define

   i) Positive margin

   ii) Negative margin **(4+4)**

## Unit - III

3. a) Explain the concept of neural network. **(8)**

   b) Explain the learning algorithm in neural networks. **(8)**

**OR**

3. Explain the different characteristics of perception. Also discuss the application area of perception. **(16)**

## Unit - IV

4. a) What is machine learning systems? Explain. **(8)**

   b) Discuss any supervised algorithm with neat diagram. **(8)**

**OR**

4. a) Discuss about support vector machine. **(8)**

   b) Differentiate between supervised and unsupervised learning. **(8)**

## Unit - V

5. What is fuzzy logic? Differentiate between predicate logic and fuzzy logic. **(16)**

**OR**

5. a) List different genetic algorithm approaches. **(8)**

   b) Write down fuzzy set operations and fuzzy quantifiers with types. **(8)**

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7E7044

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**7E7044**

**B.Tech. VII- Semester (Main/Back) Examination, Nov. - 2019**
**Electrical Engg.**
**7EE4A Non Conventional Energy Sources**
**(Common for EE,EX)**

**Time : 3 Hours** **Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

**UNIT - I**

1. a) What are the reasons of tide and how it can be used for power production? Draw the layout of a tidal power plant and name its various components. **(12)**

   b) Explain the environmental impact of tidal power plant. **(4)**

**(OR)**

1. Differentiate conventional and non - conventional energy sources. **(16)**

**UNIT - II**

2. a) How solar radiation on titled surface can be calculated? Discuss mathematical used for the same. **(8)**

   b) What are the solar energy collectors and how do they function? Explain the different types of flat and concentrating collectors. **(8)**

**(OR)**

2. a) Describe with the neat sketch the working of solar water heating system with back up support used in a hostel. **(8)**

   b) Explain the following terms related to solar radiation geometry. Declination, hour angle, inclination angle, zenith angle, latitude angle, solar azimuth angle, surface azimuth angle and angle of incidence. **(8)**

## UNIT - III

3. a) What are the conditions and criterian for selection of site for wind farm and the type of wind machine. (8)

   b) Explain geothermal energy and geothermal preheat hybrid power plant. (8)

**(OR)**

3. Differentiate horizontal axis and vertical axis wind turbine with neat and clear diagram. (16)

## UNIT - IV

4. a) Describe with neat sketch the working of laser fusion reactor. (8)

   b) Briefly explain the different methods of plasma confinement. (8)

**(OR)**

4. a) What are the requirements of nuclear fission and fusion. (8)

   b) Explain the following terms in detail magnetic heating pellet fusion reactor, plasma heating fusion reactor, hybrid and beam fusion reactor. (8)

## UNIT - V

5. a) Explain the process of ethanol production from cassava. What are the uses of ethanol in power sector? (8)

   b) How biogas can be produced. Discuss its application and mechanism involved for generation. (8)

**(OR)**

5. a) What are the different factors considered for selection of biogas plant site. (8)

   b) What do you mean by pyrolysis? Discuss working of one of the most efficient pyrolysis unit. (8)

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7E7045

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# 7E7045

## B.Tech. VII Semester (Main and Back) Examination, Nov. - 2019
## Electrical Engineering.
## 7EE5A Power System Engineering
## (Common for EE,EX)

**Time : 3 Hours** **Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

*1. Calculator - 100 Ms.*

### Unit - I

**1.** a) Derive the condition of economic distribution of load between large number of generating units without considering losses in transmission line. **(8)**

b) A simple power system consists of two plants connected by a transmission line. The load in the system is directly connected at the bus of plant 2. When 100 MW power flows from plant 1 to plant 2, then 15 MW is lost in transmission. The incremental costs of two plants are : -

$$\frac{dC_1}{dP_1} = 0.20P_1 + 20 \text{ Rs/Mwh}$$

$$\frac{dC_2}{dP_2} = 0.15P_2 + 30 \text{ Rs/Mwh}$$

Calculate the economic loading of plants 1 and 2 for system $\lambda = 60$. Also calculate the transmission loss and total demand. **(8)**

**(OR)**

1. a) Derive the function of transmission losses for a system having two generators. **(8)**

b) The incremental costs in Rs/mw-hr of two 250 mw units are as under :-

$$\frac{dC_1}{dP_1} = 0.20P_1 + 30$$

$$\frac{dC_2}{dP_2} = 0.15P_2 + 40$$

Find the economic loading for the total load of 225 mw. Also calculate the saving per year for economic loading compared to equal load division between the units throughout the year. **(8)**

## Unit - II

2. a) Define the steady state limit of a transmission line. Derive an expression for steady state stability limit of a transmission line connected two machines. **(8)**

b) A 4 - pole, 50 Hz, 11 kv turbo alternator has a rating of 100 Mw at power factor of 0.85 lagging. The rotor has a moment of inertia of a 10,000 kg-$m^2$. Calculate the H and M of the machine. Also calculate the stored energy in the rotor at sychronous speed. **(8)**

**(OR)**

2. a) Derive the swing equation of synchronous machine. **(8)**

b) Find the expression for angular momentum (M) in terms of machine MVA rating (G), machine inertia Constant (H) and system frequency (f), Also find out the expression for per unit angular momentum M (pu). **(8)**

## Unit - III

3. Explain the application of equal area criterion to study transient stability for a fault away from line ends. Also derive the expression for critical clearing angle and critical clearing time. **(16)**

**(OR)**

3. Given the system of fig. 1 where a three - phase fault is applied at the point P as shown. **(16)**

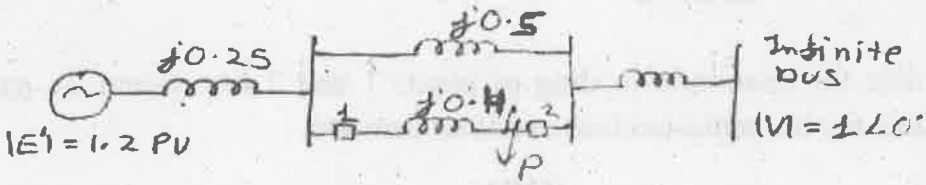


Fig. 1

Find the critical clearing angle for clearning the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated on the diagram. The generator is delivering 1.0 Pu power at the instant proceeding the fault.

## Unit - IV

4. a) Draw and describe the separately excited A.C. excitation system. **(8)**

   b) Write the advantages of inter connected power system. Define cold reserve. **(6+2)**

**(OR)**

4. a) Explain the DC excitation system with fundamental block diagram and their brief description. **(8)**

   b) Define various types of reserve capacities used in power systems. **(8)**

## Unit - V

5. a) Discuss the method of voltage control in power system using tap changing transformers. **(8)**

   b) Define normal operating state, emergency operating state and restorative operating state of power system. **(8)**

**(OR)**

5. a) Explain phase shifting transformer with its applications. **(8)**

   b) Write short note on :

      i) Shunt capacitor

      ii) Series capacitor. **(8)**

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7E7131

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7E7131

**B.Tech. VII - Semester (Main & Back) Examination, Nov. 2019**
**Electrical Engg.**
**7EE6.1A Electromagnetic Field Theory**

**Time : 3 Hours** **Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used / calculated must be stated clearly.*

**UNIT - I**

**1.** a) Express the *del*$(\nabla)$ operator in cylindrical and spherical coordinate system and find the value of $\nabla . A$ and $\nabla \times A$ if $A = 100r^2 a_r + 10 \sin\theta \hat{a}_2$ **[8]**

b) Prove divergence theorem and write its applications. **[8]**

**(OR)**

**1.** a) Convert vector $\vec{R} = 100x^2 y\, i + 40\, j$ in cylindrical coordinate and find its gradient at point (20,30°,0). **[8]**

b) Prove the stokes theorem and write its uses in Em field. **[8]**

**UNIT- II**

**2.** Develop the relation between

i) Electric field intensity and electric flux density in a medium.

ii) Normal electric field $E_{N_1}$ *and* $E_{N_2}$ across a boundary in medium one & two

iii) Electric field intensity and electric potential.

iv) Work done and potential difference in electric field. **[4×4=16]**

**(OR)**

**2.** a) Find the expression of electric field energy density and capacitance. **[8]**

b) If 20 microcoulomb are placed at point $P_1(0,0,1)$ and $P_2(0,1,0)$ then find the work done in moving -2/cc between point $P_3(0,-1,0)$ to $P_4(0,0,-1)$. **[8]**

## UNIT - III

3. a) If magnetic vector potential $\vec{A}$ is $\vec{A} = 2x^2yi + y^2z\hat{K}$ then find the expression of magnetic field intensity and magnetic flux density at a point P(0,2,0) [8]

   b) Find the expression of energy density inside a solenoid. [8]

**(OR)**

3. a) State boundary conditions for magnetic field and find the magnetic field in medium 1 if its value in medium 2 is

   $\vec{H}_2 = 20i + 20x^2y\hat{K}$ as shown in fig 3(a) [10]

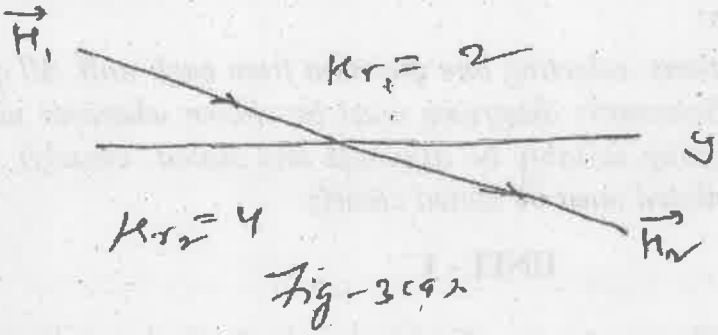


Fig-3(a)

   b) State Amper's law and define the value of one Ampere. [6]

## UNIT - IV

4. State maxwell's all equations for a time varying field in
   i) Differential form and
   ii) Integral form for a medium whose conductivity is non zero. [8+8=16]

**(OR)**

4. Derive the expression for poynting vector and using it find the stored & dissipated energy in a Em field whose electric field is given by $\vec{E}_{(x,y,z)} = 100e^{-0.2x}\sin(10^9t - 0.2x)\hat{a}_y$ [16]

## UNIT - V

5. Draw the LCR model of transmission line and approximate it at
   i) Power frequency (50 Hz) and
   ii) Radio frequency (50 GHz)
   also define the propagation constant , attenuation constant and characteristic impedance of transmission line. [16]

**(OR)**

5. a) Define reflection and transmission constant of a transmission line and find these value if line has $z_0$=20+i10 and terminated with $z_i$=20-j10 [12]

   b) State the condition of lossless transmission line and infinite line. [4]

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7E7047

Roll No. _____ [Total No. of Pages : 3

**7E7047**

**B.Tech. VII Semester (Main&Back) Examination, Nov. - 2019**
**Electrical Engg.**
**7EE6.2A Computer Aided Design of Electrical Machines**
**(Common for EE,EX)**

**Time : 3 Hours** **Maximum Marks : 80**
**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

## UNIT - I

1. a) What are the properties of insulating material used in electrical machine design also write the classification and application of insulating material. **(8)**

   b) Calculate the mmf required for the air gap of a machine having core length = 0.32 m including 4 ducts of 10 mm each, pole arc = 0.19 m; slot pitch = 65.4 mm; slot opening = 5 mm; air gap length = 5 mm; flux per pole = 52 mWb. Give carter's is 0.18 for opening/gap = 1, and is 0.28 opening/gap = 2. **(8)**

**OR**

1. a) Explain the factors affecting the design of electrical machine design also write the factors affecting the size of machine. **(8)**

   b) Determine the apparent flux density in the teeth of a d.c. machine when the real flux density is 2.15 Wb/m; slot pitch 28 mm; slot width 10 mm and the gross core length 0.35 m. The number of ventilating ducts is 4, each 10 mm wide. The magnetising force for a flux density of 2.15 $Wb/m^2$ is 55000 A/m. The iron stacking factor is 0.9. **(8)**

## UNIT- II

2. a) Derive the expression for quantity of cooling medium for air, hydrogen, water and oil. **(8)**

b) ASO MVA turbo - alternator has a total loss of 1500 kW. Calculate the volume of air required per second and also the fan power if the temperature rise in the machine is to be limited to 30°C. The other data given is

Inlet temperature of air = 25°C,

Barometric height = 760 mm of mercury,

Pressure = 2 kN/m$^2$, Fan efficiency = 0.4. **(8)**

**OR**

**2.** a) Explain the various modes of heat dissipation, State the newton's law of cooling. **(8)**

b) Explain the hydrogen cooling of turbo alternator also write its advantages. **(8)**

**UNIT- III**

**3.** a) What is the difference between the power transformer and distribution transformer. Drive the output equation of transformer. **(8)**

b) Show that the output of a 3 phase core type transformer is $Q = 5.23 f B_m H d^2 H_w \times 10^{-2} kVA$

Where f = frequency. Hz; $B_m$ = maximum flux density Wb/m$^2$; d = effective diameter of core m ; H = magnetic potential gradient in links A/m; $H_w$ = height of limb (window) m **(8)**

**OR**

**3.** a) Calculate approximate overall diameter for a 200 kVA, 6600/440 V, 50 Hz, 3 phase core type transformer. The following data may be assumed ; emf per turn = 10V; maximum flux density = 1.3 Wb/m$^2$; current density = 2.5 A/mm$^2$, window space factor = 0.3, overall height = overall width, stocking factor = 0.9, Use a 3 stepped core.

For a three stepped core.

Width of largest stamping = 0.9 d and

Net iron area = 0.6 d$^2$, where d is the diameter of circumscribing circle. **(8)**

b) Write various steps for L.V winding design of transformer. **(8)**

**UNIT- IV**

**4.** a) Explain the choice of specific electric and magnetic loading. **(8)**

b) Find the main dimensions of a 2500 kVA, 187.5 rpm, 50 Hz, 3 phase, 3 kV, salient Pole synchronous generator. The generator is to be a vertical, water wheel type. The Specific magnetic loading is 0.6 W/bm$^2$ and the specific electric loading is 34000 A/m. Use circular Poles with ratio of core length to pole pitch = 0.65. Specify the types of pole construction used if the run - away speed is about 2 times the normal speed. **(8)**

**OR**

4. a) Draw the flow chart for design of synchronous machine

   a) Main dimension.

   b) Length of air gab

   c) Stator

   d) Number of slots **(16)**

**UNIT - V**

5. a) What are the factors to be considered for estimating the length of air gap. Also write relation for calculation of air gap. **(8)**

   b) Find the main dimensions of a 15 kW, 3 phase, 400 V, 50 Hz, 2810 r.p.m. squirrel cage induction motor having an efficiency of 0.88 and a full loadpower factor of 0.9. Assume **(8)**

   specific magnetic loading = 0.5 Wb/m$^2$, specific electrical loading = 25000

   A/m, Take the rotor peripherial speed as approximately 20 m/s at synchronous speed. **(8)**

**OR**

5. a) Write general rules for selecting rotor slots also write the methods used for reduction of harmonies torque. **(8)**

   b) Explain the choice of average flux density in air gap and choice of ampere conductor per meter in design of induction motor. **(8)**

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7E7132

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**7E7132**

**B.Tech. VII - Semester (Main & Back) Examination, Nov. - 2019**
**Electrical Engg.**
**7EE6.3A Economic Operation of Power System**

**Time : 3 Hours** **Maximum Marks : 80**

**Min. Passing Marks : 26**

***Instructions to Candidates:***

*Attempt any **five questions,** selecting one **question** from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used / calculated must be stated clearly.*

## UNIT - I

**Q.1** a) Explain the factors effecting economic generations and distributions, generating cost **[8]**

b) Explain the concept of power plant cost analysis and also the factors effecting it. **[8]**

**(OR)**

a) Describe the selection mythology for thermal types of generation and types of equipments employed in it? **[8]**

b) Explain Economics of Power Generation and cost of electrical energy? **[8]**

## UNIT -II

**Q.2** a) For Economical Operations of Thermal Power Plants explain the Methods of loading turbo generators? **[8]**

b) By help of graph explain input, output and heat rate characteristics? **[8]**

**(OR)**

a) For a simple two unit system the loss coefficients are:
$B11=0.001MW^{-1}$ ; $B12= -0.0005MW^{-1}$ ; $B22=0.0024MW^{-1}$
The incremental production cost of the two units are:

$\frac{dc1}{dp1} = 0.08P1 + 16$ Rs/MW-hr

$\frac{dc2}{dp2} = 0.08P2 + 12$ Rs/MW-hr

b) Find the generation P1 and P2 for $\lambda$ =20; also compute the transmission loss and received power. **[16]**

## UNIT - III

**Q.3** A) Explain the phenomena of cogeneration, with help of a neat and label diagram explain the process of cogeneration of Hydro & Thermal Power Plant with its Advantages and Disadvantages? **[8]**

B) Explain the phenomena of short term hydro thermal coordination? **[8]**

**(OR)**

A) For Hydro thermal cogeneration explain base load peak load operation requirement? **[8]**

B) For reservoirs hydro plants and thermal plants explain the combined working of run-off river and steam plant? **[8]**

## UNIT - IV

**Q.4** A) Explain Parallel Operations of Generators? **[8]**

B) Explain Infinite bus bars, active and reactive power control for synchronizing of the generator ? **[8]**

**(OR)**

A) During the parallel operation of generator explain effect of change in excitation, load sharing, sharing of load currents? (8)

B) Explain operating characteristics of cylindrical alternator rotor. (8)

## UNIT - V

**Q.5** With reference to Economics for Electrical Engineers explain the concepts of physical and financial efficiencies of electrical goods and services as well as its effect on supply and demand? [16]

**(OR)**

**Q.5** Write short note on : (8+8=16)

a) min cist analysis

b) linear and nonlinear break even

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