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Bharatiya Vidya Bhavan's
Sardar Patel College of Engineering
(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058

End Semester Examination.

November 2016

Program: M. Tech Electrical Engineering **Date: 21/11/2016**

Course code: MTPX 113 **Duration: 4 hr.**

Maximum Marks: 100

Name of the Course: Modelling and Analysis of Electrical Machine **Semester: I**

Master file.

Instructions: **(i) Question No-1 is compulsory.**

(ii) Attempt any four questions from remaining six questions.

(ii) Assume any data if required.

Q. No.		Description	Marks	C.O. No	Mod. No.
1.0	(a)	An electromechanical system has two electrical inputs. The flux linkages may be expressed as. $\lambda_1(i_1, i_2, x) = x^2 i_1^2 + x i_2$ $\lambda_2(i_1, i_2, x) = x^2 i_2^2 + x i_1$ Express $W_f(i_1, i_2, x)$ and $W_e(i_1, i_2, x)$.	5	1	1
	(b)	With a suitable diagram and Necessary Expression show that, $L_d = \frac{3}{2}\{L_A + L_B\}$; $L_q = \frac{3}{2}\{L_A - L_B\}$	5	2	3
	(c)	With Necessary Expression and suitable diagram prove that $\vec{i}_s(t) = \vec{i}_s^{\,a}(t) e^{-j\theta_{da}(t)}$. and $\vec{v}^{\alpha}_{s\_\alpha\beta} = \vec{v}_{s\_dq} \cdot e^{j\theta_{da}}$	5	2	6
	(d)	Explain Principle of Operation of Permanent Magnet synchronous machine with suitable diagram and expression.	5	1	7

2.0	(a)	A 3 Phase 64 Pole Hydro turbine generator is rated at 325 MVA, with 20 kV Line to line voltage, and a power factor of 0.85, the machine parameters in Ohms at 50 Hz are $r_s = 0.00234$, $X_q = 0.709$, $X_d = 1.256$, for balanced steady state rated conditions calculate (a) $\widetilde{E_a}(b)\quad E'^{r}_{xfd}$ (c) T_e	8	2	4
	(b)	Show that when the stator currents of a poly phase electric machine, which is equipped with symmetrical stator windings, are unbalanced in amplitude and/or in phase, the total air-gap MMF consists of two oppositely rotating MMFs.	7	2	2
	(c)	Consider a two coupled-coil system, one on the stator and the other on the rotor. Derive the electromagnetic torque expression by energy considerations and then generalize it in terms of three-phase stator and rotor currents.	5	1	5
3.0	(a)	Give a brief Description of space vectors and Derive flux-linkage and voltage equations.	10	1	6
	(b)	Using Dynamic analysis in terms of dq windings for stator and rotor derive an expression for Inductance, voltage equations and electromagnetic torque.	10	2	5
4.0	(a)	Derive an expression for the air-gap MMF in a 2-pole, 3-phase, Y-connected salient pole synchronous machine.	15	1	2
	(b)	Write a short note on Reference Frame Theory.	5	1	3
5.0	(a)	Derive an Expression for Voltage and torque equation of Synchronous machine.	15	1	2
	(b)	Write a short note on Transformation to Rotor Reference Frames for PM Type Synchronous machine.	5	1	7
6.0	(a)	Derive the induction machine model in arbitrarily rotating reference frame.	15	1	3
	(b)	Write a short note on Transformation of stationary circuit variables to the arbitrary reference frame for resistive and inductive elements.	5	1	3

7.0	(a)	Explain in detail analysis of Induction Machine for steady state operation.	15	2	4
	(b)	Derive the expression for Electromagnetic torque using dynamic Model and Steady state voltage Equation for PM Type Synchronous machine.	5	1	7

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Munshi Nagar, Andheri (West), Mumbai – 400058.
Endsemester examination
November 2016

Q. P. Code: MTPS-11
Max. Marks: 100
Duration: 4 hours
Class: M. Tech. Semester: I
Program: Electrical Engg
Name of the Course: Dynamics of Linear Systems
Course Code :MPTX114

Instructions:

Master file.

1. Question No 1 is compulsory
2. Attempt any 4 questions from Q No.2 to Q.No.7
3. Assume suitable data if necessary

Q No		Max Marks	Module	Course Outcome
1	a. Given the system represented in the state space as follows: $\dot{X} = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & 3 \\ -2 & -1 & -3 \end{bmatrix} X + \begin{bmatrix} 7 \\ 1 \\ -2 \end{bmatrix} U$ $Y = \begin{bmatrix} 1 & -3 & 4 \end{bmatrix} X$ Convert the system to one where the new state vector Z, is $Z = \begin{bmatrix} 1 & 3 & -2 \\ 4 & -1 & 0 \\ 2 & 5 & 1 \end{bmatrix} X$	[8]	1	CO 2
	b. Are the homogenous state equations i) $\dot{X} = \begin{bmatrix} -1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} X$ ii) $\dot{X} = \begin{bmatrix} -1 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} X$ Marginally stable? Asymptotically stable?	[7]	4	CO 1
	c. Fundamental matrices are given as follows. Find its state transition matrix? 1. $X(t) = \begin{bmatrix} e^{-t} & e^{t} \\ 0 & 2e^{-t} \end{bmatrix}$	[5]	3	CO 2

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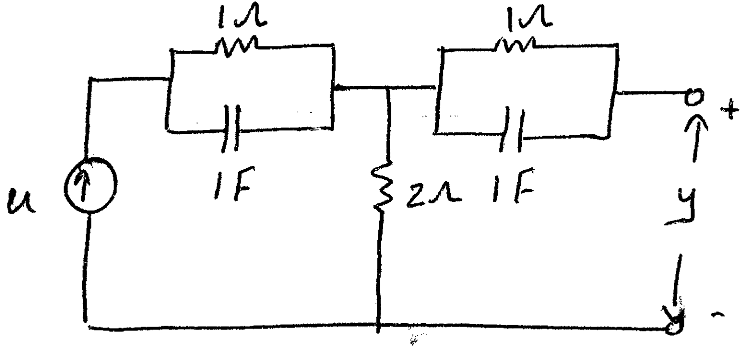
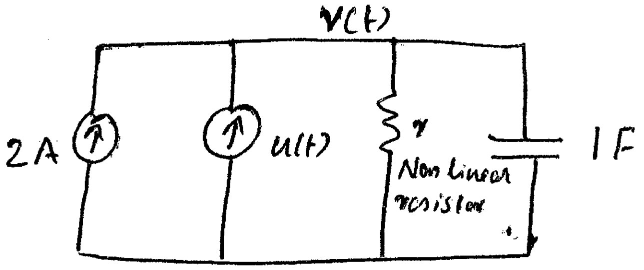
	2. $X(t)=\begin{bmatrix} e^{-t} & \frac{1}{2}e^{t} \\ 0 & e^{-t} \end{bmatrix}$			
2	a. Design an observer for the plant$G(s)=\frac{10}{(s+2)(s+6)(s+12)}$. Operating with 10% overshoot and 2 sec peak time. Design an observer to respond 10 times as fast as the plant. Place the observer 3rd pole 20 times as far from the imaginary axis as the observer dominant poles. Assume the plant is represented in observer canonical form.	[10]	7	CO 2
	b. Explain different canonical realization	[10]	4	CO 2
3	a. What will be the output of a system which is BIBO stable and impulse response g(t), when the inputs are 1. $u(t)=a$ 2. $u(t)=sin\ \omega_0 t$, for $t\geq 0$ Prove it.	[5]	4	CO 1
	b. A system is represented in state space model as $X\dot{(t)}=AX(t)+Bu(t)$ $y(t)=CX(t)+Du(t)$ Where A=$\begin{bmatrix} -4 & 8 & -1.5 \\ 0 & 0 & 1 \\ -8 & 14 & -3 \end{bmatrix}$, B=$\begin{bmatrix} 1 & 0.5 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}$ C=$\begin{bmatrix} 1 & 0 & -0.5 \\ 0 & 1 & 0 \end{bmatrix}$, D=$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ Find the feedback gain matrix so as to keep the eigen values at{-2,-3,-4}	[15]	6	CO 2
4	a. If A=$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 0 \\ 3 & 1 & -1 \\ 4 & 0 & 3 \end{bmatrix}$,where each column of A are linearly independent vectors in R^4. Find the orthonormal set using Gram-Schmidt method.	[8]	1	CO 1
	b. Reduce the state equation $\dot{X}=\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}+\begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}u$ $y=[1\quad 1\quad 1]X$	[7]	5	CO 1

	to a controllable one. Is the reduced equation observable? c. Explain separation principle?	[5]	7	CO 2
5	a. $\dot{X}(t) = \begin{bmatrix}0 & 0\\ t & 0\end{bmatrix}X(t)$. Find the solution $X(t)$ if $X(0)=\begin{bmatrix}1\\ 2\end{bmatrix}$	[5]	3	CO 1
	b. Find a state equation to describe the network shown in fig. and check its controllability and observability  	[10]	5	CO 1
	c. Check the matrices given below are positive definite or positive semidefinite? 1. A=$\begin{bmatrix}2 & -1 & 0\\ -1 & 2 & -1\\ 0 & -1 & 2\end{bmatrix}$ 2. B=$\begin{bmatrix}1 & 0\\ 0 & 2\end{bmatrix}$ 3. C=$\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$	[5]	1	CO 1
6	a. Find the linearized transfer function, G(s) = V(s) / I(s), for the electrical network shown in fig. the network contains a nonlinear resistor whose voltage current relationship is defined by $i_r = e^{v_r}$. The current source ,i(t), is a small signal generator.  	[10]	1	CO 1

	b. Given the following open loop plant. $G(s)=\dfrac{20(s+2)}{s(s+4)(s+6)}$ Design a controller to yield a 10% overshoot with a peak time of 2 seconds.	[10]	6	CO 2
7	a. Find the Jordan form representations of following matrices 1. $\begin{bmatrix} -1 & -1 & 0 \\ 0 & -1 & -2 \\ 0 & 0 & -1 \end{bmatrix}$ 2. $\begin{bmatrix} 4 & 0 & 1 \\ 2 & 3 & 2 \\ 1 & 0 & 4 \end{bmatrix}$	[7]	2	CO 1
	b. Find rank, nullity and null space of A $A=\begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix}.$	[8]	1	CO 2
	c. State and prove Lyapunov theorem	[5]	3	CO 1

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Munshi Nagar, Andheri (West), Mumbai – 400058

End sem exam

November 2016

Program: M. Tech (Power Electronics and Power System) **Date : 18/11/2016**

Course code : MTPX112 **Semester : I**

Maximum Marks : 100 **Duration : 4hr.**

Master file.

Name of the Course : Protection in power systems

Instructions:1. Attempt any 5 full questions.

Q. No.	Description	Marks	C.O. No.	Module No.
Q.1	a) What is meant by selectivity, sensitivity, reliability between adjacent relay locations? b) What is the basic difference between measuring and protective CTs? c) Explain why the current transformers ratios have to be identical for the bus-bar differential scheme?	10 5 5	1 1 2	1 1 4
Q.2	a) A 3 phase 10MVA 6.6Kv generator is delivering a load of 8MW at 0.8pf.Find the value of neutral resistance R, if 10% of the winding is unprotected. The relay setting is 20%.The per phase resistance is 10% b) In generator protection Why is the field winding grounded? What is the effect of ground fault? How is the relay connected?	10 10	2 2	4 4
Q.3	a) For an internal fault with a source at only one end prove that the slope is 200% on an restraining torque verses operating torque. b)With neat block diagram explain the WAMS architecture.	10 10	1 2	4 7
Q.4	a) Derive the inputs to B-C phase faults using distance relay measuring unit so that it correctly measures the positive sequence impedance upto B-C fault point	10	2	3

	b) In a three stepped distance scheme explain with characteristics why is 1) zone 1 adjusted to less than 100% of line under protection 2) zone 2 adjusted to reach 25-50% of the shortest adjoining line 3) zone 3 adjusted to reach beyond the longest length	10	1	3
Q.5	a) With a neat diagram explain the computer architecture of numerical relay b) Explain any one relay based on travelling waves.	10 10	2 2	2 5
Q.6	a) A 3 phase, 1000KVA, 33Kv/11KV transformer is connected in delta star. The C.Ts on low voltage side have turns ratio of 500/5.determine the CT ratio on high voltage side. Also obtain the circulating current when the fault of 600A of following types occur on the low voltage side a) Earth fault within the protective zone b) Earth fault outside the protective zone c) Phase to phase fault within the protective zone b) What is the purpose of supervisory relay?	15 5	2 2	4 4
Q.7	a) Explain the application of WAMS based adaptive relaying. b)Derive the traveling wave equation for a loss-less transmission line. Also show that the general solution of this equation constitutes a forward wave and backward wave.	10 10	2 2	6 5

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Munshi Nagar, Andheri (West), Mumbai – 400058

End Semester Examination.

November 2016

Program: M. Tech Electrical Engineering **Date: 25/11/2016**

Course code: MTPX 117 **Duration: 4 hr.**

Maximum Marks: 100

Name of the Course: Power System Planning and Reliability **Semester: I**

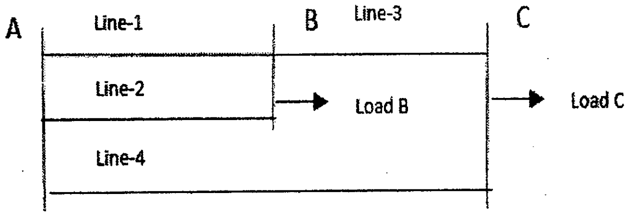
Master file.

Instructions:
- **(i) Question No-1 is compulsory.**
- **(ii) Attempt any four questions from remaining six questions.**
- **(ii) Assume any data if required.**

Q. No.		Description	Marks	C.O. No	Module No
1.0	(a)	Explain Seasonal and annual Forecast with Necessary Expression.	5	1	1
	(b)	A generation system has one unit of 30MW having F.O.R. = 0.03. (a) Prepare a capacity outage probability table for this single unit system. (b) Combine this table with the table calculated in previous example so as to give the capacity outage probability table for the combined system having 2 units of 40 MW each and one unit of 30MW, each unit having F.O.R. = 0.03.	5	1	5
	(c)	Derive an Expression for Expected Value of Demand and Energy	5	1	2
	(d)	Derive an Expression for Hazard rate and Establish a relation with Reliability.	5	1	3
2.0	(a)	Define MTTF.	5	1	3

<table>
<tr><td></td><td></td><td>A circuit is formed by three components of A Two components of B and one component of C the failure rate of components are,
$\lambda_A = 3 * \frac{10^{-3}F}{hr}, \lambda_A = 2 * \frac{10^{-3}F}{hr}, \lambda_A = 4 * \frac{10^{-3}F}{hr}$
Find the reliability of the circuit for an operating time of 20 hours and also find MTTF.</td><td></td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>Explain In detail, Weather Load Model, Weather Sensitive forecast, Non Weather Sensitive and Total Forecast.</td><td>10</td><td>1</td><td>1</td></tr>
<tr><td></td><td>(c)</td><td>Explain Factor to be considered and Fundamental relations while executing Planning of Power Systems.</td><td>5</td><td>1</td><td>2</td></tr>
<tr><td>3.0</td><td>(a)</td><td>A generation system consists of 4 identical units each 50 MW and having F.O.R. = 0.02. The load duration curve can be assigned to be linear with a load factor of 60 per cent and a peak load of 150 MW. (a) Prepare a capacity outage probability table. (b) Combine this table with the load duration curve and determine the loss of load probability.</td><td>8</td><td>1</td><td>5</td></tr>
<tr><td></td><td>(b)</td><td>Explain Reliability of Combined Series Parallel System with Suitable example.</td><td>6</td><td>1</td><td>4</td></tr>
<tr><td></td><td>(c)</td><td>Explain in Brief Loss of Load Indices, Consider a system of 100 MW, for which load data for a period of 365 days is given Below.
<table>
<tr><td>Daily Peak Load in MW</td><td>57</td><td>57</td><td>46</td><td>41</td><td>34</td></tr>
<tr><td>No's of Occurrences</td><td>12</td><td>83</td><td>107</td><td>116</td><td>47</td></tr>
</table>
Calculate LOLE. (Given P(X<50) =0.020392, Given P(X>50) = 0.000792</td><td>6</td><td>1</td><td>5</td></tr>
<tr><td>4.0</td><td>(a)</td><td>Explain Average Interruption Method in Transmission</td><td>10</td><td>1</td><td>6</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>
Line, Consider system below using the above mentioned method, Calculate Average Annual Customer Interruption rate (AACIR). (Assuming that System is first composed of lines 1,2,3 and then of line 1,2,3,4)



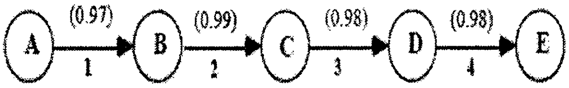
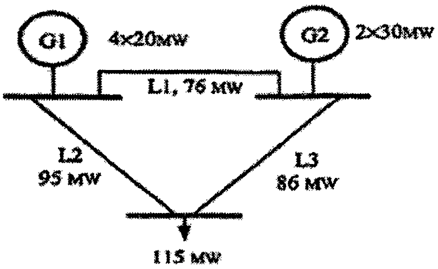
<table>
<tr><th>Line Section</th><th>Failure rate / Year</th></tr>
<tr><td>1</td><td>0.6</td></tr>
<tr><td>2</td><td>0.5</td></tr>
<tr><td>3</td><td>0.2</td></tr>
<tr><td>4</td><td>0.7</td></tr>
</table>
</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>
Explain In Brief Recursive Algorithm, With No Derated and Derated cases. Apply the method to system in the table below.

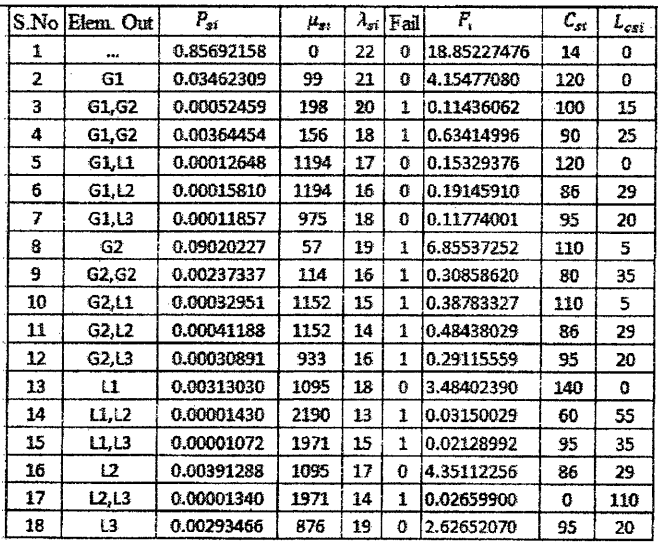
<table>
<tr><th>Unit No</th><th>Capacity (MW)</th><th>Failure rate (f/day)</th><th>Repair rate (r/day)</th></tr>
<tr><td>1</td><td>25</td><td>0.01</td><td>0.49</td></tr>
<tr><td>2</td><td>25</td><td>0.01</td><td>0.49</td></tr>
<tr><td>3</td><td>50</td><td>0.01</td><td>0.49</td></tr>
</table>

Consider a 3 state unit as below for 50 MW.

<table>
<tr><th>State</th><th>Capacity Out</th><th>State Probability (pi)</th></tr>
<tr><td>1</td><td>25</td><td>0.01</td></tr>
<tr><td>2</td><td>25</td><td>0.01</td></tr>
<tr><td>3</td><td>50</td><td>0.01</td></tr>
</table>

Consider Availability as 0.98.
</td>
<td>10</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5.0</td>
<td>(a)</td>
<td>Explain the role of Power System Engineer in short long and Medium term planning.</td>
<td>9</td>
<td>1</td>
<td>2</td>
</tr>
</table>

<table>
<tr><td></td><td>(b)</td><td>Mathematical Expression of a Discrete State, Continuous Transition Markov Process.</td><td>7</td><td>1</td><td>4</td></tr>
<tr><td></td><td>(c)</td><td>The Reliability of component is 0.3, how many such component can be connected in parallel to achieve an overall all Reliability of 0.85.</td><td>4</td><td>1</td><td>4</td></tr>
<tr><td>6.0</td><td>(a)</td><td>A system has four components in series with reliabilities with p1 = 0.97, p2 = 0.99, p3 = p4 = 0.98, with find the system reliability with both the cut and path approaches.
 </td><td>5</td><td>1</td><td>4</td></tr>
<tr><td></td><td>(b)</td><td>For the system shown in the Figure Below.

<table>
<tr><th>Elem.</th><th>λ (f/y)</th><th>μ (r./y)</th></tr>
<tr><td>G1</td><td>1</td><td>99</td></tr>
<tr><td>G2</td><td>3</td><td>57</td></tr>
<tr><td>L1</td><td>4</td><td>1095</td></tr>
<tr><td>L2</td><td>5</td><td>1095</td></tr>
<tr><td>L3</td><td>3</td><td>876</td></tr>
</table>
Determine Annual adequacy indices FP, EENS, FF and FD using
(a) Available capacity Method.
(b) Load Curtailment Method.
Compare the Adequacy Indices for both the Methods.</td><td>15</td><td>1</td><td>7</td></tr>
</table>



S.No	Elem. Out	P_{si}	μ_{si}	λ_{si}	Fail	F_i	C_{si}	L_{csi}
1	...	0.85692158	0	22	0	18.85227476	14	0
2	G1	0.03462309	99	21	0	4.15477080	120	0
3	G1,G2	0.00052459	198	20	1	0.11436062	100	15
4	G1,G2	0.00364454	156	18	1	0.63414996	90	25
5	G1,L1	0.00012648	1194	17	0	0.15329376	120	0
6	G1,L2	0.00015810	1194	16	0	0.19145910	86	29
7	G1,L3	0.00011857	975	18	0	0.11774001	95	20
8	G2	0.09020227	57	19	1	6.85537252	110	5
9	G2,G2	0.00237337	114	16	1	0.30858620	80	35
10	G2,L1	0.00032951	1152	15	1	0.38783327	110	5
11	G2,L2	0.00041188	1152	14	1	0.48438029	86	29
12	G2,L3	0.00030891	933	16	1	0.29115559	95	20
13	L1	0.00313030	1095	18	0	3.48402390	140	0
14	L1,L2	0.00001430	2190	13	1	0.03150029	60	55
15	L1,L3	0.00001072	1971	15	1	0.02128992	95	35
16	L2	0.00391288	1095	17	0	4.35112256	86	29
17	L2,L3	0.00001340	1971	14	1	0.02659900	0	110
18	L3	0.00293466	876	19	0	2.62652070	95	20

7.0		**Write Short notes on**			
	(a)	Frequency Duration Method. .	5	1	6
	(b)	Bath Tub Curve.	5	1	3
	(c)	Probability Density Function of Forced Outage Capacity.	5	1	2
	(d)	Objective and Factor Effecting Generation Planning.	5	1	2

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2

End Semester Re Examination.

January 2017

Program: M. Tech Electrical Engineering **Date: 06/01/2017**

Course code: MTPX 117 **Duration: 4 hr.**

Maximum Marks: 100

Name of the Course: Power System Planning and Reliability **Semester: I**

Master file.

Instructions: **(i) Question No-1 is compulsory.**

(ii) Attempt any four questions from remaining six questions.

(ii) Assume any data if required.

Q. No.		**Description**	**Marks**	**C.O. No**	**Module No**
1.0	(a)	The Reliability of a system is given by $R(t) = \begin{cases} \left(1-\frac{t}{t_0}\right)^2 & 0 \le t \le t_0 \\ 0 & t \ge t_0 \end{cases}$ Determine (i) The failure rate (ii) Does failure rate increase or decrease with time (iii) Determine the MTTF.	5	1	1
	(b)	A generation system has one unit of 30MW having F.O.R. = 0.03. (a) Prepare a capacity outage probability table for this single unit system. (b) Combine this table with the table calculated in previous example so as to give the capacity outage	5	1	5

<table>
<tr><td></td><td></td><td>probability table for the combined system having 2 units of 40 MW each and one unit of 30MW, each unit having F.O.R. = 0.03.</td><td></td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>Derive an Expression for Expected Value of Demand and Energy</td><td>5</td><td>1</td><td>2</td></tr>
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A circuit is formed by three components of A Two components of B and one component of C the failure rate of components are,
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Find the reliability of the circuit for an operating time of 20 hours and also find MTTF.</td><td>5</td><td>1</td><td>3</td></tr>
<tr><td></td><td>(b)</td><td>Explain Seasonal and Annual Forecast, with Suitable Diagram and Expressions.</td><td>10</td><td>1</td><td>1</td></tr>
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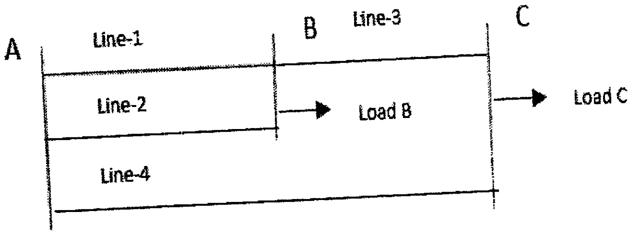
<tr><td>3.0</td><td>(a)</td><td>A generation system consists of 4 identical units each 50 MW and having F.O.R. = 0.02. The load duration curve can be assigned to be linear with a load factor of 60 per cent and a peak load of 150 MW. (a) Prepare a capacity outage probability table. (b) Combine this table with the load duration curve and determine the loss of load probability.</td><td>8</td><td>1</td><td>5</td></tr>
<tr><td></td><td>(b)</td><td>Explain Series and Parallel series system in Reliability</td><td>6</td><td>1</td><td>4</td></tr>
<tr><td></td><td>(c)</td><td>Explain in Brief Loss of Load Indices, Consider a system of 100 MW, for which load data for a period of 365 days is given Below.
<table><tr><td>Daily Peak Load in MW</td><td>57</td><td>57</td><td>46</td><td>41</td><td>34</td></tr></table></td><td>6</td><td>1</td><td>5</td></tr>
</table>

No's of Occurrences	12	83	107	116	47

Calculate LOLE. (Given P(X<50) =0.020392, Given P(X>50) = 0.000792

4.0 (a) Explain Average Interruption Method in Transmission Line, Consider system below using the above mentioned method, Calculate Average Annual Customer Interruption rate (AACIR). (Assuming that System is first composed of lines 1,2,3 and then of line 1,2,3,4)

10 | 1 | 6



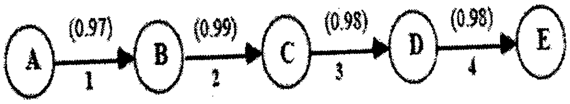
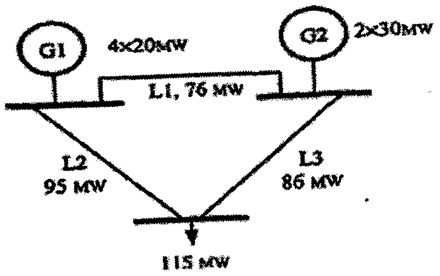
Line Section	Failure rate / Year
1	0.6
2	0.5
3	0.2
4	0.7

(b) Explain In Brief Recursive Algorithm, With No Derated and Derated cases. Apply the method to system in the table below.

10 | 1 | 5

Unit No	Capacity (MW)	Failure rate (f/day)	Repair rate (r/day)
1	25	0.01	0.49
2	25	0.01	0.49
3	50	0.01	0.49

State	Capacity Out	State Probability (pi)
1	25	0.01
2	25	0.01

<table>
<tr><td></td><td></td><td><table><tr><td>3</td><td>50</td><td>0.01</td></tr></table>Consider a 3 state unit as below for 50 MW.
Consider Availability as 0.98.</td><td></td><td></td><td></td></tr>
<tr><td>5.0</td><td>(a)</td><td>Explain the role of Power System Engineer in short long and Medium term planning.</td><td>10</td><td>1</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>Derive an expression for Failure rate and show that R(t) = 1- F(t).</td><td>5</td><td>1</td><td>4</td></tr>
<tr><td></td><td>(c)</td><td>The Reliability of component is 0.3, how many such component can be connected in parallel to achieve an overall all Reliability of 0.85.</td><td>5</td><td>1</td><td>4</td></tr>
<tr><td>6.0</td><td>(a)</td><td>A system has four components in series with reliabilities with p1 = 0.97, p2 = 0.99, p3 = p4 = 0.98, with find the system reliability with both the cut and path approaches.

</td><td>5</td><td>1</td><td>4</td></tr>
<tr><td></td><td>(b)</td><td>For the system shown in the Figure Below.

<table><tr><th>Elem.</th><th>λ (f/y)</th><th>μ (r/y)</th></tr><tr><td>G1</td><td>1</td><td>99</td></tr><tr><td>G2</td><td>3</td><td>57</td></tr><tr><td>L1</td><td>4</td><td>1095</td></tr><tr><td>L2</td><td>5</td><td>1095</td></tr><tr><td>L3</td><td>3</td><td>876</td></tr></table>Determine Annual adequacy indices FP, EENS, FF and FD using
(a) Available capacity Method.</td><td>15</td><td>1</td><td>7</td></tr>
</table>

(b) Load Curtailment Method.

Compare the Adequacy Indices for both the Methods.

S.No	Elem. Out	P_{si}	μ_{si}	λ_{si}	Fail	F_i	C_{si}	L_{csi}
1	...	0.85692158	0	22	0	18.85227476	14	0
2	G1	0.03462309	99	21	0	4.15477080	120	0
3	G1,G2	0.00052459	198	20	1	0.11436062	100	15
4	G1,G2	0.00364454	156	18	1	0.63414996	90	25
5	G1,L1	0.00012648	1194	17	0	0.15329376	120	0
6	G1,L2	0.00015810	1194	16	0	0.19145910	86	29
7	G1,L3	0.00011857	975	18	0	0.11774001	95	20
8	G2	0.09020227	57	19	1	6.85537252	110	5
9	G2,G2	0.00237337	114	16	1	0.30858620	80	35
10	G2,L1	0.00032951	1152	15	1	0.38783327	110	5
11	G2,L2	0.00041188	1152	14	1	0.48438029	86	29
12	G2,L3	0.00030891	933	16	1	0.29115559	95	20
13	L1	0.00313030	1095	18	0	3.48402390	140	0
14	L1,L2	0.00001430	2190	13	1	0.03150029	60	55
15	L1,L3	0.00001072	1971	15	1	0.02128992	95	35
16	L2	0.00391288	1095	17	0	4.35112256	86	29
17	L2,L3	0.00001340	1971	14	1	0.02659900	0	110
18	L3	0.00293466	876	19	0	2.62652070	95	20

7.0		**Write Short notes on**			
	(a)	Frequency Duration Method.	5	1	6
	(b)	Bath Tub Curve.	5	1	3
	(c)	Probability Density Function of Forced Outage Capacity.	5	1	2
	(d)	Objective and Factor Effecting Generation Planning.	5	1	2