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T.Y.B.Tech. Elect Sem V

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Examination

November 2017

Max. Marks: **100** Duration: **03 Hours**

Class: **T.Y. B.Tech** Semester: **V** Program: **B.Tech**

Name of the Course: **Electrical Machines-II** Course Code : **BTE 303**

Master file.

Instructions:

- Question no.1 is compulsory
- Solve any four from remaining questions
- Answers to all sub questions should be grouped together
- Figures to the right indicates full mark
- **Assume suitable data if required and justify the same.**

Ques. No.	Description	Max. Marks	C.O. No.	Mod. No.
Q.1 a)	The stationary rotor of salient pole synchronous machine is excited by the dc source. Draw the mmf waveform as a function of time and space.	05	01	05
b)	The cylindrical pole synchronous generator is supplying isolated load. The mechanical input of the synchronous generator is maintained constant and excitation is increased. What is the effect on: i) Frequency (ii) Terminal voltage (iii) Armature current (iv) Power Factor (v) Reactive power	05	01	01
c)	The torque produced by three phase induction motor is steady while the torque produced by single phase induction motor has double frequency harmonic component. Justify.	05	01	06
d)	Prove that the difference in input power and output power of synchronous machine is copper loss in stator.	05	01	03
Q.2 a)	An 6.6 kV, 3 phase, 50 Hz, star connected alternator gave the following data for open circuit, short circuit and full load zero power factor tests: (see table below) Per phase armature resistance is 0.2 Ohm. Calculate the voltage regulation at full load current of 500 A at 0.8 pf lag by: (i) EMF Method (ii) MMF method and (iii) ZPF method	16	02	02
b)	The synchronous reactance of an alternator is not constant over the entire operating range. What is this so? What value would you use.	04	02	02

Table for Q.2 a):

I_f in A	3.2	5.00	7.50	10.00	14.00
E_f in kV	3.10	4.90	6.60	7.50	8.24
Isc in A	500	778	1170	----	----
z.p.f. terminal voltage in kV	-----	1.85	4.24	5.78	7.00

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Q.3 a)	What is the need of parallel operation of synchronous generators? What are the conditions to connect two generators in parallel? Discuss the parallel operation of synchronous generator supplying common load.	03+03 +06	02	04
b)	A three phase synchronous generator feeds into a 22 kV grid. It has a synchronous reactance of 8 ohm/phase and delivering 12 MW and 6 MVAR to the system. Determine: (i) the phase angle of the current (ii) the power angle (iii) the generated emf	08	02	04
Q.4 a)	What is the condition to make single phase induction motor "self-starting"?. Prove that (mathematically or graphically) the magnetic field produced by two winding of single phase induction motor excited by the same source is rotating.	02+06	03	06
b)	Compare permanent magnet synchronous machines and conventional synchronous machines.	04	03	07
c)	A salient pole synchronous alternator has the following per unit parameters $X_d = 1.2$, $X_q = 0.8$ and $R_a = 0.025$. Calculate the excitation voltage on per unit basis when the alternator is delivering rated kVA, at rated voltage at 0.8 pf lagging and leading.	08	02	05
Q.5 a)	How to start the synchronous motor with mechanical load connected to the shaft.	07	01	03
b)	A 22 kV, 3 phase star-connected synchronous generator with synchronous impedance of (0 +j1.2) ohm per phase is delivering 230 MW at UPF to 22 kV grid. With the turbine power remaining constant, the alternator excitation is increased by 30%. Determine machine current and power factor.	08	02	04
c)	"Unloaded synchronous motor can be made to act as a Capacitor or Inductor". Justify your statement.	05	01	03
Q.6 a)	Derive the power equation of salient pole synchronous machine and draw the power angle characteristics	12	02	05
b)	The full load current of a 3.3 kVA, star connected synchronous motor is 160A at 0.8pf lagging. The resistance and synchronous reactance of the motor are 0.8ohm and 5.5ohm per phase respectively. Calculate the excitation emf, torque angle , efficiency and shaft output power of motor. Assume the mechanical stray load loss to be 30 kW.	08	02	03
Q.7a)	What is hunting phenomenon in case of synchronous machines?	07	02	03
b)	Salient pole synchronous generator supplying power to infinite bus. Suddenly the excitation of the generator fails. Comment on the operation of generator after its excitation fails.	07	01	05
c)	Differentiate the salient pole and cylindrical pole synchronous generator.	06	01	01

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Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058

END SEMESTER EXAMINATION
November 2017

Program: T.Y. B. Tech. Electrical Engineering. Semester: **V** Date: 20/11/2017
Course code: **BTE 304** Duration: 03 Hr
Name of the Course: **POWER SYSTEM ANALYSIS** Maximum Marks: 100

Master file.

Instructions:

1. **Attempt any 5 questions from 7 (Qs.I to QsVII).**
2. **Assume suitable data if necessary.**
3. **Draw relevant neat circuit diagrams wherever required.**

Qs No.		Max. Mark	CO	Module No.
Qs I.	**a)** For the power system single line diagram shownm in Fig.1.1, 1. Draw the oriented graph 2. Obtain: **(i)** Element-node incidence matrix & **(ii)** Bus incidence matrix.	08	02	03
	b) Table 1.1 below gives the line impedances identified by the buses on which these terminate. The shunt admittance at all the buses is assumed to be negligible. Find Bus admittance matrix, Y_{Bus}.	12	02	03

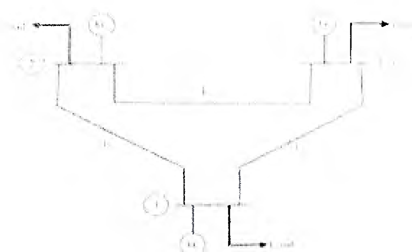

Fig. 1.1

Line,bus to bus	R, pu	X, pu
1-2	0.05	0.15
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15

Table 1.1

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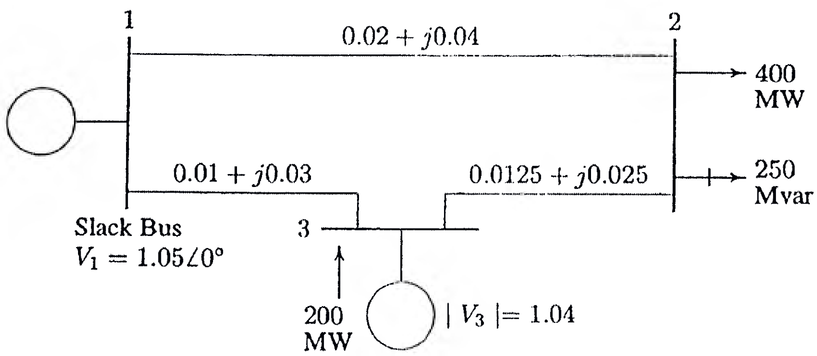
	If a new line is added to the existing configuration between buses 2&3, having impedance same as that of the existing line, what modifications need to be carried out in Y_{Bus}.			
Qs II.	Figure 2.1 shows the one line diagram of a simple three bus power system with generation at bus 1. The magnitude of voltage at bus 1 is adjusted to 1.05 pu. The scheduled loads at buses 2 and 3 are as marked on the diagram. Line impedances are marked in pu on a 100-MVA base and the line charging susceptances are neglected. **a)** Using the Gauss-Siedel method, determine the phasor values of the voltage at the load buses 2 and 3 (P-Q buses) at the end of 1^{st} iteration. **b)** Find the slack bus real and reactive power. **c)** Determine the line flows and line losses.  **Fig 2.1**	**20**	**02**	**04**
Qs III.	**a)** Write the iterative algorithm for the solution of load flow problem by Newton-Raphson (NR) method. **b)** Obtain the Power Angle Equation, for a lossless system having single machine connected to an infinite bus, under stability study.	**10** **10**	**02**	**04** **05**
Qs IV.	**a)** Obtain an expression for critical clearing time, when a three-phase fault occurs near the generator bus that is connected to an infinite bus through a single transmission line. **b)** A synchronous generator is feeding 250MW power to a lagrge 50Hz netwok (infinite bus) over a double circuit transmission line. Maximum steady state power that can be transmitted over the line with both circuitsin operation is 500MW and is 350MW with any one of the circuits. A solid three-phase fault occuring near the infinite bus at one of the lines causes it to trip. Estmate the critical clearing angle in which the circuit breakers must trip so that the system remains stable.	**10** **10**	**03** **03**	**06** **06**

Qs V.

a) A 20MVA, 50Hz generator, having transient reactance=0.35pu and internal emf=1.1pu, delivers 18MW over a double circuit line to an infinite bus of voltage=1.0∠0°. At rated speed, the kinetic energy of the machine is 2.52MJ/MVA. The transmission line is assumed lossless and its reactance=0.2pu on a 20MVA base. A three-phase fault occurs at the middle of one of the transmission lines. By step-by-step solution method determine the stability of the system using swing curve, when the fault is cleared by simultaneous opening of breakers at both ends of the line at 6.25 cycles after the occurance of the fault. **20** **03** **06**

OR

b) With referene to travelling waves in transmission lies explain the following: (i) wave equation (ii) reflection and refraction coefficients at different line terminations (iii) Bewely lattice diagram. **04** **07**

Qs VI

(a) Figure 6.1 shows a power system network. The system data is as below. Draw positive, negative & zero sequence network. **15** **01** **01**

Rating	G1	G2	M	T1	T2	T3
MVA	25	15	25	25	12.5	10
Voltage (kV)	11	11	11	11Δ/120Y	11Δ/120Y	120Y/11Δ
X_1old (pu)	0.2	0.2	0.1	0.1	0.1	0.1
X_2old (pu)	0.15	0.15	0.1	0.1	0.1	0.1
X_0old (pu)	0.03	0.05	0.1	0.1	0.1	0.1

For transmission line 1 & 2 $X_1=X_2=j25\Omega$ and $X_0=j75\Omega$

Choose a base of 50 MVA, 11kV in generator G1 circuit.

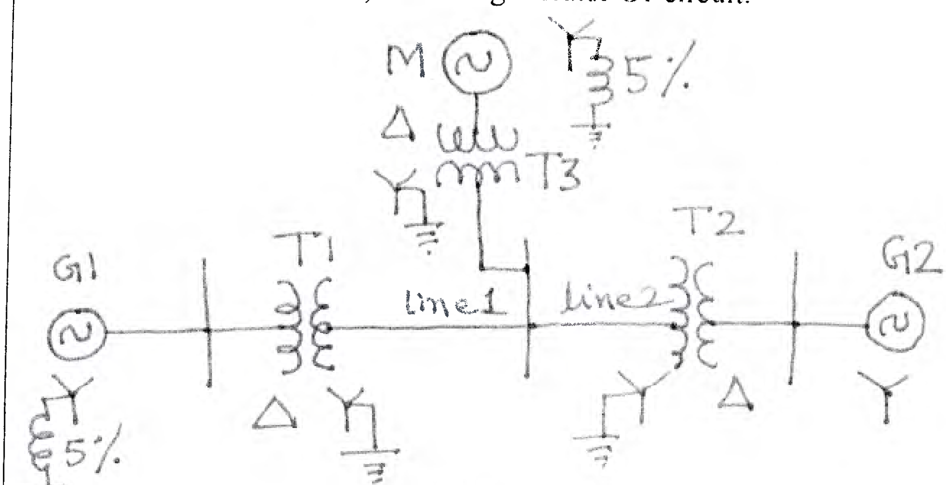


Figure 6.1

(b) Show that the symmetrical component transformation is power invarient. **05** **01** **01**

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Qs VII	**(a)** A 3-phase system consists of a generator & motor that is connected together through two transformers and a transmission line. The ratings of each components are given below: Generator: 25 MVA, 12.4 kV, $X = 10\%$ Motor: 20 MVA, 3.8 kV, $X = 15\%$ Transformer (T1) at generator side: 25 MVA, 11/33 kV, $X = 8\%$ Transformer (T2) at motor side: 20 MVA, 33/3.3 kV, $X = 10\%$ Transmission Line: 20 Ω reactance. The system is loaded so that the motor is drawing 15 MW at 0.9 p.f. lead. The motor terminal voltage being 3.1 kV, find the fault current contribution from generator & motor side when a 3-phase fault occurs at generator bus. Select generator MVA and kV as base values.	**12**	**01**	**02**
	(b) Derive the expression of fault current when double line to ground (LLG) fault occur at the terminals of an unloaded alternator with neutral solidly grounded **considering fault impedance Z_f.** Also, draw the sequence network connections diagram for the simulation of **LLG** fault.	**06 + 02**	**01**	**02**

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Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058

END SEM

Program: Electrical Engg

Date: Nov. 2017

Duration: 3 hrs.

Course code: BTE306

Maximum Marks: 100

Semester: V

Course Name: Power Electronics

Instructions: Question number 1 is compulsory, solve any four questions from question number 2 to 7 and Use graph paper page wherever mentioned Master file.

Q.No.	Questions	Max point	CO No.	Module No.
Q1a)	What are the arrangements in obtaining three phase output voltages in VSI?	5	4	5
b)	Explain the effect of source side inductance on rectifier output.	5	2	3
c)	Explain with circuit diagram the application of inverter in power factor improvement.	5	4	5
d)	What are the purposes of filter in rectifier circuit?	5	2	3
Q2a)	Explain working of step up DC to DC regulator using waveforms like voltage across inductor, current through inductor and voltage across capacitor. Derive critical value of inductor and capacitor.	12	3	6
b)	A boost regulator has an input voltage of V_s=5 V. The average output voltage V_0=15 V and average load current I_a = 0.5 A. The switching frequency is 25 KHz. If L=150μH and C=220 μF, determine (a) duty cycle (b)The ripple current of inductor ΔI (c) The ripple voltage of filter capacitor ΔV_c (D) critical values of L & C	8	3	6
Q3a)	Draw input voltage, output voltage, output current and 'a' phase source current waveforms of three phase full wave controlled converter with continuous conduction nature RLE load with $\alpha=90^0$. Consider V_{ab} as reference voltage. (use only one graph page)	12	2	3

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b)	Explain performance parameters of Inverter.	8	4	5
Q4)	Draw circuit diagram, output phase voltages, output line currents and input voltage of voltage source inverter with star connected R load when each semiconductor switch conducts for 180^0. Derive the phase voltage by considering load R=1 Ω. (use graph paper for input and output voltage waveforms, line current waveforms should be drawn on answer sheet)	16	4	5
	What are the advantages of Space Vector Modulation (SVM)?	4		
Q5a)	Write short note on any of the fully controlled power electronics switch using following points (a) Principle of operation, (b)characteristics, (c)rating (d) applications	12	1	2
b)	What is frequency modulation and pulse width modulation in concern with choppers? Explain with waveforms.	8	3	6
Q6)a)	Draw circuit diagram of 3 phase current source inverter and its output current waveform of any one phase with proper getting signals shown.	10	4	5
b)	Draw the single phase bidirectional ac voltage controller with R-L load and explain its working principle with voltage and current waveforms	10	1	7
Q7)a)	What is pulse width modulated inverter? Explain sine triangular PWM inverter. How voltage is controlled using sine triangular PWM?	11	4	5
b)	Draw output voltage, output current and source current of following circuit combinations • Single phase half wave controlled rectifier with pure L load • Single phase uncontrolled rectifier with RL load and freewheeling diode	9	2	3

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T.Y.B.Tech Elect. Sem V

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(Govt. Aided Autonomous Institute under University of Mumbai)

Academic Year 207 – 18

End Semester Exam [November 2017]

Program: B. Tech. Electrical
Course: Digital Signal Processing
Total Marks: 100

Class: T. Y. Sem. V
Course Code: BTE305
Date: 22nd Nov 2017

Master file.

Note: Solve any **FIVE** questions of the following. All questions carry equal marks.

Que. No.		Question	CO No. / Mod. No.	Points
1		Design an analog lowpass filter using Butterworth, Chebyshev and inverse Chebyshev approximation to meet following specifications: $A_p \leq 1\ dB$ for $\Omega_p \leq 4\ rad/s$ and $A_s \geq 20\ dB$ for $\Omega_s \geq 8\ rad/s$.	3/7	(20)
2	a	Determine 8-point DFT of the sequence $x(n) = \{2,1,2,1,1,2,1,2\}$ using radix-2 DIF FFT algorithm.	2/4	(10)
	b	Determine IDFT of the following sequence using radix-2 DIT-FFT algorithm: $X(k) = \{36, -4 + j9.656, -4 + j4, -4 + j1.656, -4, -4 - j1.656, -4 - j4, -4 - j9.656\}$	2/4	(10)
3	a	Design a low pass half band FIR filter using Hamming window to meet following specifications: Passband edge = 8 kHz, Stopband edge = 16 kHz.	3/6	(10)
	b	Design a linear phase FIR highpass filter using Hanning window function, for the specifications given below: Stopband edge = 2 kHz, Stopband attenuation ≥ 40 dB, Passband edge = 9.5 kHz, Passband attenuation < 1 dB, Sampling frequency = 25 kHz.	3/6	(10)
4	a	Convert the analog filter with system function, $H(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$ into a digital IIR filter using impulse invariance method, with $T_s = 1\sec$.	3/7	(10)
	b	A simple LRC notch filter has following normalized, s-plane transfer function: $$H(s) = \frac{s^2+1}{s^2+s+1}$$ Determine the transfer function of an equivalent digital filter using BLT. Assume a notch frequency of 60 Hz and sampling frequency of 960 Hz	3/7	(10)

5	a	Determine 8-point DFT of the sequence $x(n)=\begin{cases}1 & 0\le n\le 3\\ 0 & 4\le n\le 7\end{cases}$. Using DFT properties only determine, DFT of, $x_1(n)=\begin{cases}1 & n=0\\ 0 & 1\le n\le 4;\\ 1 & 5\le n\le 7\end{cases}$ $x_2(n)=\begin{cases}0 & 0\le n\le 1\\ 1 & 2\le n\le 5;\\ 0 & 6\le n\le 7\end{cases}$	2/3	(10)
	b	For the sequences $x_1(n)=\{1,1,2,2\}$ and $x_2(n)=\{1,2,3,4\}$, determine: *i*. linear convolution *ii*. circular periodic convolution using DFT / IDFT.	1, 2 / 3, 1	(10)
6	a	For a causal discrete-time LTI system, which is described by a difference equation $y(n)+\frac{1}{4}y(n-1)=x(n)+\frac{1}{2}x(n-1)$, determine its, *i.* impulse response, *ii.* system transfer function *iii.* frequency response and *iv.* magnitude and phase response	1/ 1, 2	(10)
	b	The impulse response of an LTI system is $h(n)=\{1, 2, 2, 1\}$. Find the response of the system for the input $x(n)=\{1, 2, 3, 4\}$ using the method of DTFT.	1, 2 / 1, 2	(10)
7	a	Design an FIR lowpass filter using Kaiser Window Function to satisfy following specifications: $A_p\le 0.1dB$ at 20 *rad/sec* and $A_s\ge 44\,dB$ for 30 *rad/sec*. Assume sampling frequency of 100 *rad/sec*.	3/6	(20)

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Sardar Patel College of Engineering

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Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam

November 2017

Max. Marks: **100**

Duration: **3.00 Hrs**

Class: **T.Y. B.Tech. (Electrical)** Semester: **V**

Program: **Electrical Engineering**

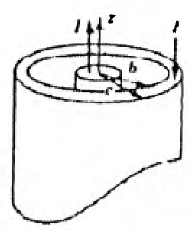
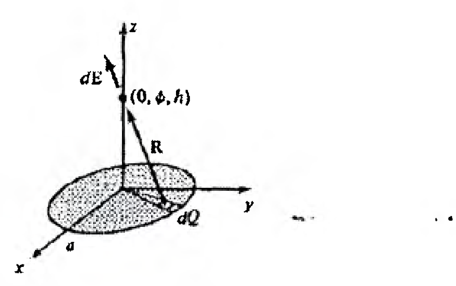
Name of the Course: **Electromagnetic fields and waves**

Course Code : **BTE301**

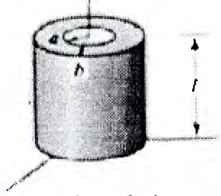
Master file.

Instructions:

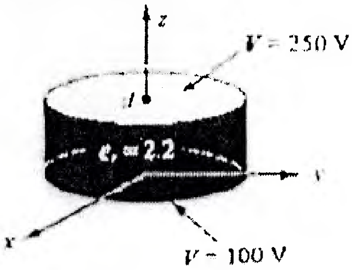
1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No		Maximum Marks	Course outcome No.	Module No.
Q1(a)	The polarization within a region having $\varepsilon_R = 2.26$ has the uniform value $\bar{P} = -2\bar{a}_x + 7\bar{a}_y + 3\bar{a}_z\ nC/m^2$ Find : (a) $\bar{E}$ (b) $\bar{D}$ (c) Magnitude of voltage gradient	**05**	**02**	**04**
(b)	Current in the inner and outer conductors of fig.1.1 are uniformly distributed. Use Ampere circuital law to derive expression of magnetic field intensity (H) for $b \leq r \leq c$  Fig.: 1.1	**05**	**01**	**03**
(C)	Find the force on a point charge of 50 μC at (0, 0, 5) m due to a charge of 500π μC that is uniformly distributed over a circular disk as shown in fig.1.2 with r<= 5 m and z=0.  Fig.1.2.	**05**	**01**	**02**
(d)	Given, $\bar{D} = D_m Sin(\omega t + \beta z)\overline{a_x}$ in free space. Find E, B and H. Sketch E and H at t=0	**05**	**02**	**05**

T.Y.B.Tech. Elect. Sem V

Q2(a)	Find the potential function and the electric field intensity for the region between two concentric right circular cylinders, where V= 0 at r =1 mm and V= 150 V at r = 20 V.	05	02	04
(b)	Define line, surface & volume charge density	03	01	01
(c)	A charge configuration in cylindrical co-ordinates is given by $\rho = 5r\, e^{-2r}\ C/m^3$ use Gauss' law to find D.	04	01	02
(d)	Derive the electric field due to an infinite uniformly charged sheet.	08	01	02
Q3(a)	Write explicit form of Laplace equations in cartesian, cylindrical and spherical co-ordinate system.	05	01	04
(b)	Find the capacitance of co-axial cable of length 'l', where inner conductor has radius 'a' and the outer conductor has radius 'b' (refer fig. 3.1)  Fig.: 3.1	05	02	04
(c)	Find the force on straight conductor of length 0.30 m carrying a current of 5A in the $-\bar{a}_z$ direction where the field is $3.50 \times 10^{-3}(\bar{a}_x - \bar{a}_y)\ T$	05	01	03
(d)	Define Divergence and Divergence theorem.	05	01	01
Q4(a)	Starting with Ampere's circuital law, derive Maxwell's equation in integral form. Obtain the corresponding relation by applying the Stoke's theorem.	10	02	03
(b)	Show that at the boundary between two dietetic the normal component of D and tangential component of E are continuous.	05	01	04
(c)	Explain FEM method. How to find capacitance of two parallel plate capacitor using FEM technique?	05	03	07
Q5(a)	Derive Coulomb's Law starting from Gauss Theorem. State assumptions if necessary for derivation.	8	01	02
(b)	Find the work done in moving a point charge Q= 5μC from the origin to (2m,π/4,π/2) spherical co-ordinates,in the field $E = 5e^{-\frac{r}{4}}\bar{a}_r + \frac{10}{r\sin\theta}\bar{a}_\phi$ V/m	8	01	02
(c)	Express four Maxwell's equations in point form and integral form.	4	02	05

T.Y.B.Tech. Elect. Sem V

Q6(a)	Derive an expression for potential energy stored in static electric field of n point charges.	**10**	**01**	**02**
(b)	Two parallel conducting disks in fig.6.1 are separated by 5mm and contain a dielectric for which $\epsilon_r = 2.2$. Determine the charge density on disk.  Fig.: 6.1	**5**	**02**	**04**
(c)	Given $\bar{A} = 5sin\theta\overline{a_\theta} + 5sin\phi\overline{a_\phi}$, Find $V.A$ at $(0.5, \pi/4, \pi/4)$	**3**	**01**	**01**
(d)	Find the angle between $A = (5.8\,\bar{a}_y + 1.55\bar{a}_z)$ and $B = (-6.93\bar{a}_y + 4.0\bar{a}_z)$ using both dot product and cross product.	**2**	**01**	**01**
Q.7 (a)	State and prove Poynting theorem and give its physical interpretation.	**8**	**02**	**06**
(b)	Derive Maxwell equations for time varying fields.	**8**	**02**	**05**
(c)	Distinguish electric potential and potential difference?	**4**	**01**	**05**

T.Y.B.Tech. Elect., sem V

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End Semester Exam

November 2017

Max. Marks: **100** — Duration: **3.00 Hrs**

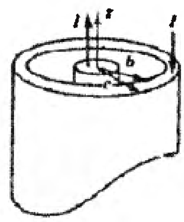
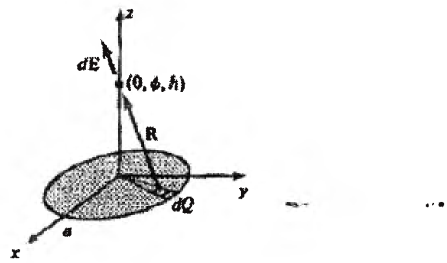
Class: **T.Y. B.Tech. (Electrical)** Semester: **V** — Program: **Electrical Engineering**

Name of the Course: **Electromagnetic fields and waves** — Course Code : **BTE301**

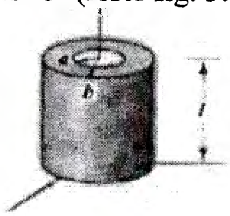
Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No		Maximum Marks	Course outcome No.	Module No.
Q1(a)	The polarization within a region having $\varepsilon_R = 2.26$ has the uniform value $\bar{P} = -2\bar{a}_x + 7\bar{a}_y + 3\bar{a}_z\ nC/m^2$ Find : (a) $\bar{E}$ (b) $\bar{D}$ (c) Magnitude of voltage gradient	**05**	**02**	**04**
(b)	Current in the inner and outer conductors of fig.1.1 are uniformly distributed. Use Ampere circuital law to derive expression of magnetic field intensity (H) for $b \le r \le c$  Fig.: 1.1	**05**	**01**	**03**
(C)	Find the force on a point charge of 50 μC at (0, 0, 5) m due to a charge of 500π μC that is uniformly distributed over a circular disk as shown in fig.1.2 with r<= 5 m and z=0.  Fig.1.2.	**05**	**01**	**02**
(d)	Given, $\bar{D} = D_m Sin(\omega t + \beta z)\overline{a_x}$ in free space. Find E, B and H. Sketch E and H at t=0	**05**	**02**	**05**

T.Y.B.Tech. Elect. Sem V

Q2(a)	Find the potential function and the electric field intensity for the region between two concentric right circular cylinders, where V= 0 at r =1 mm and V= 150 V at r = 20 V.	05	02	04
(b)	Define line, surface & volume charge density	03	01	01
(c)	A charge configuration in cylindrical co-ordinates is given by $\rho = 5r\, e^{-2r}\ C/m^3$ use Gauss' law to find D.	04	01	02
(d)	Derive the electric field due to an infinite uniformly charged sheet.	08	01	02
Q3(a)	Write explicit form of Laplace equations in cartesian, cylindrical and spherical co-ordinate system.	05	01	04
(b)	Find the capacitance of co-axial cable of length 'l', where inner conductor has radius 'a' and the outer conductor has radius 'b' (refer fig. 3.1)  Fig.: 3.1	05	02	04
(c)	Find the force on straight conductor of length 0.30 m carrying a current of 5A in the $-\bar{a}_z$ direction where the field is $3.50 \times 10^{-3}(\bar{a}_x - \bar{a}_y)\, T$	05	01	03
(d)	Define Divergence and Divergence theorem.	05	01	01
Q4(a)	Starting with Ampere's circuital law, derive Maxwell's equation in integral form. Obtain the corresponding relation by applying the Stoke's theorem.	10	02	03
(b)	Show that at the boundary between two dietetic the normal component of D and tangential component of E are continuous.	05	01	04
(c)	Explain FEM method. How to find capacitance of two parallel plate capacitor using FEM technique?	05	03	07
Q5(a)	Derive Coulomb's Law starting from Gauss Theorem. State assumptions if necessary for derivation.	8	01	02
(b)	Find the work done in moving a point charge Q= 5μC from the origin to (2m,π/4,π/2) spherical co-ordinates,in the field $E = 5e^{-\frac{r}{4}}\bar{a}_r + \frac{10}{r\sin\theta}\bar{a}_\phi$ V/m	8	01	02
(c)	Express four Maxwell's equations in point form and integral form.	4	02	05

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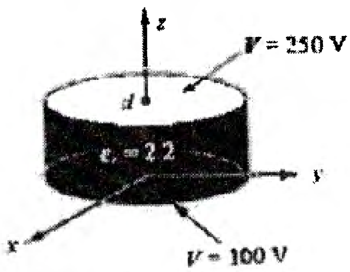
Q6(a)	Derive an expression for potential energy stored in static electric field of n point charges.	**10**	**01**	**02**
(b)	Two parallel conducting disks in fig.6.1 are separated by 5mm and contain a dielectric for which $\epsilon_r = 2.2$. Determine the charge density on disk.  Fig.: 6.1	**5**	**02**	**04**
(c)	Given $\bar{A} = 5sin\theta\overline{a_\theta} + 5sin\phi\overline{a_\phi}$, Find $\nabla.A$ at $(0.5, \pi/4, \pi/4)$	**3**	**01**	**01**
(d)	Find the angle between $A = (5.8\,\bar{a}_y + 1.55\bar{a}_z)$ and $B = (-6.93\bar{a}_y + 4.0\bar{a}_z)$ using both dot product and cross product.	**2**	**01**	**01**
Q.7 (a)	State and prove Poynting theorem and give its physical interpretation.	**8**	**02**	**06**
(b)	Derive Maxwell equations for time varying fields.	**8**	**02**	**05**
(c)	Distinguish electric potential and potential difference?	**4**	**01**	**05**