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21EE32

**Third Semester B.E. Degree Examination, Jan./Feb. 2023**  
**Analog Electronic Circuits and Op-Amps**

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

Module-1

- 1 a. The parameters of voltage Divider Biasing circuit are as  $V_{CC} = 16V$ ,  $R_1 = 62K\Omega$ ,  $R_2 = 9.1K\Omega$ ,  $R_c = 3.9K\Omega$ ,  $R_E = 680\Omega$ ,  $\beta = 80$  and  $V_{BE} = 0.7V$ . Find the quiescent base current, collector current and  $V_{CE}$ . Also determine the values of collector voltage, Emitter voltage and base voltage with respect to ground. (12 Marks)
- b. Draw and explain the working of clamper circuit which clamps the positive peak of a signal to zero. (08 Marks)

OR

- 2 a. Derive the expression for stability factor for voltage Divider Biasing circuit with respect to  $I_{CO}$  and  $V_{BE}$ . (10 Marks)
- b. Derive an expression for input impedance, output impedance, current gain and voltage gain for Emitter follower configuration. (10 Marks)

Module-2

- 3 a. Explain the need of cascading Amplifier. Draw and explain the block diagram of three stage cascade amplifier. (08 Marks)
- b. For the voltage series feedback Amplifier, derive an expression for transfer gain, input resistance and output resistance. (12 Marks)

OR

- 4 a. The parameters of Darlington Emitter follower configuration are as  $V_{CC} = 18V$ ,  $R_B = 3.3\mu\Omega$ ,  $R_E = 390\Omega$ ,  $r_i = 5K\Omega$ ,  $\beta_D = 8000$  and  $V_{BE} = 1.6V$ . Calculate Input and output impedances, voltage gain and current gain. Also draw its circuit diagram, Also find  $V_0$  for  $V_i = 120mV$ . (12 Marks)
- b. For the current shunt feedback amplifier, derive an expression for Input resistance and output resistance. (08 Marks)

Module-3

- 5 a. Explain the operation of class B pushpull amplifier. Prove that the maximum efficiency of class B configuration is 78.5%. (10 Marks)
- b. With neat circuit diagram, explain working and characteristics of N-channel JFET. (10 Marks)

OR

- 6 a. Explain the operation of Class A transformer coupled power amplifier and prove that the maximum efficiency is 50%. (10 Marks)

- b. With the help of neat diagrams, explain the construction, working and characteristics of N-channel Depletion type MOSFET. (10 Marks)

**Module-4**

- 7 a. Design an active high pass filter to meet the following specification  
 i) Butterworth response  
 ii) Cutoff frequency = 6KHz and use  $C_2 = C_3 = C = 1000\text{PF}$   
 iii) Decay rate in the stop band = 40dB/decade  
 Also draw the designed circuit diagram. (10 Marks)
- b. Draw the practical voltage regulator using LM337 and justify the use of each component. Write three applications of IC LM337. (10 Marks)

**OR**

- 8 a. Design a second order low pass filter for cut-off frequency of 100Hz and draw its circuit diagram. (10 Marks)
- b. What is Instrumentation Amplifier? Find the expression for output of three op-amp instrumentation Amplifier. (10 Marks)

**Module-5**

- 9 a. Design the capacitor coupled zero crossing detector using op-amp 741 having  $I_{B(\text{max})} = 500\text{nA}$  and minimum signal frequency is 500Hz. The supply voltages are  $\pm 12\text{V}$ . Also draw the design circuit. (12 Marks)
- b. Sketch the circuit of triangular/rectangular waveform generator. Draw the output waveforms from the circuit and explain its operation. (08 Marks)

**OR**

- 10 a. Design an inverting Schmitt trigger to have trigger voltages of  $\pm 4\text{V}$ . Use op-amp 741 with supply of  $\pm 15\text{V}$ . Draw the designed circuit. Write three differences between Schmitt trigger and comparator. (12 Marks)
- b. Sketch the circuit of sawtooth wave generator. Draw its waveforms and explain its operation. (08 Marks)

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21EE33

## Third Semester B.E. Degree Examination, Jan./Feb. 2023 Electric Circuit Analysis

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. Using source transformation and source shifting techniques, find voltage across  $2\Omega$  resistor in the Fig.Q1(a).

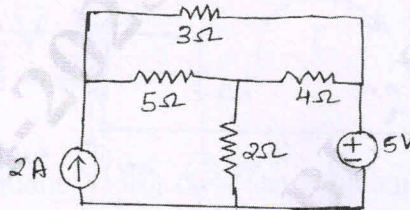


Fig.Q1(a)

(06 Marks)

- b. Using star delta transformation find equivalent resistance between AB in the Fig.Q1(b).

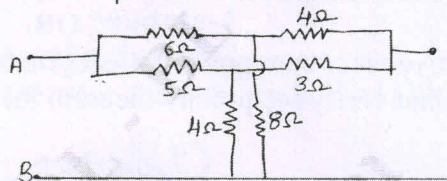


Fig.Q1(b)

(08 Marks)

- c. Use node analysis and find the value of  $V_x$  in the Fig.Q1(c) circuit such that the current through the impedance  $(2 + j3)\Omega$  is zero.

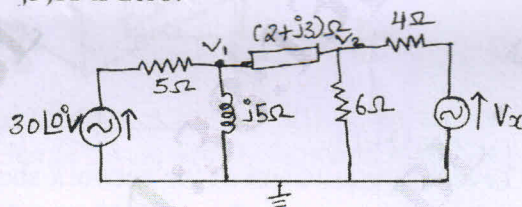


Fig.Q1(c)

(06 Marks)

### OR

- 2 a. Find the loop currents  $I_1$ ,  $I_2$  and  $I_3$  in the circuit shown in Fig.Q2(a).

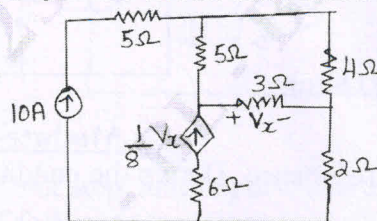


Fig.Q2(a)

(06 Marks)

- b. For the networks shown in Fig.Q2(b) find the node voltages  $V_d$  and  $V_c$ .

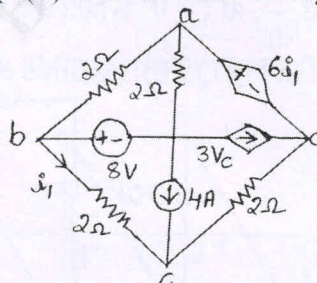


Fig.Q2(b)

(08 Marks)

- c. Explain with circuit diagram how to find loading effect of different voltmeter in an electric circuit.

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

**Module-2**

- 3 a. State and explain superposition theorem. (06 Marks)  
 b. Obtain the Thevenin's and Norton's equivalent circuits at terminals AB for network. Find the current through  $10\Omega$  resistor across AB in the Fig.Q3(b).

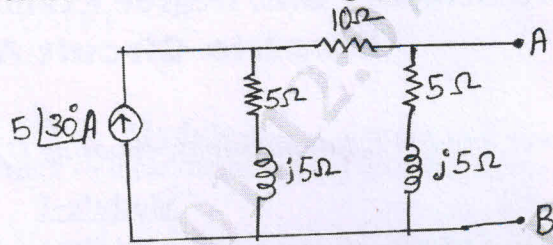


Fig.Q3(b)

(08 Marks)

- c. Using Millman's theorem, find  $I_L$  through  $R_L$  for the network shown in Fig.Q3(c).

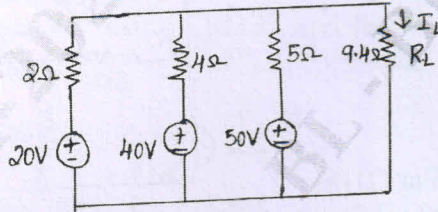


Fig.Q3(c)

(06 Marks)

**OR**

- 4 a. State and prove maximum power transfer theorem for AC network. (06 Marks)  
 b. Calculate  $i_x$  and verify reciprocity theorem for the Fig.Q4(b).

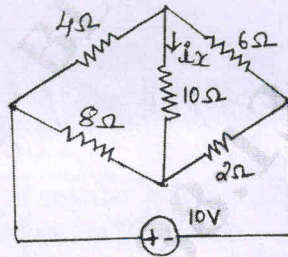


Fig.Q4(b)

(08 Marks)

- c. Find the Thevenin's equivalent of the network shown in Fig.Q4(c).

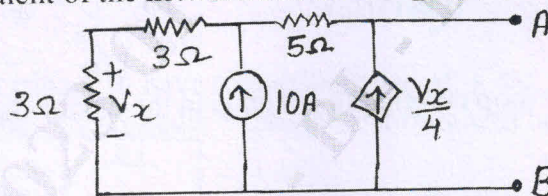


Fig.Q4(c)

(06 Marks)

**Module-3**

- 5 a. Explain parallel resonance. Derive the condition for parallel resonance when RL connected parallel to RC. (06 Marks)  
 b. Determine  $i$ ,  $\frac{di}{dt}$  and  $\frac{d^2i}{dt^2}$  at  $t = 0^+$  when the switch K is moved from position 1 to 2 at  $t = 0$  for the network shown in Fig.Q5(b). Assume capacitor is initially uncharged.

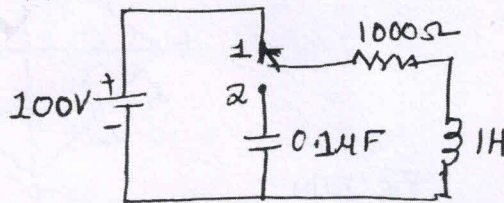


Fig.Q5(b)

(08 Marks)

- c. A series RLC circuit has  $R = 4\Omega$ ,  $L = 1\text{ mH}$  and  $C = 10\text{ }\mu\text{F}$ . Calculate Q factor, bandwidth, resonant frequency and the half power frequencies  $f_1$  and  $f_2$ . (06 Marks)

OR

- 6 a. What are initial conditions? Show the behavior of R, L, C elements at the time of switching at  $t = 0$  both at  $t = 0^+$  and  $t = \infty$ . (06 Marks)
- b. In the network shown in Fig.Q6(b)  $V = 10V$ ,  $R = 10\Omega$ ,  $L = 1H$ ,  $C = 10\mu F$  and  $V_C(0) = 0$ . Find  $i(0^+)$ ,  $\frac{di}{dt}(0^+)$  and  $\frac{d^2i}{dt^2}(0^+)$ .

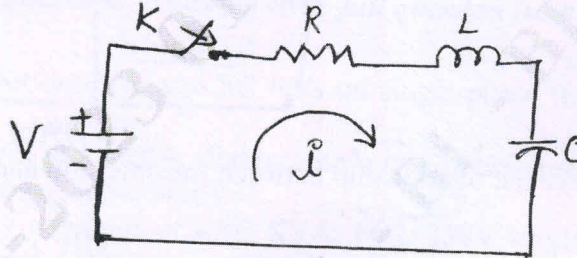


Fig.Q6(b)

- c. Derive the expression for quality factor (Q – factor) in a parallel resonant circuit. Explain its utility in comparing resonant circuits, selectivity. (08 Marks)

**Module-4**

- 7 a. State and prove initial and final value theorem. (08 Marks)
- b. Find the Lapace transform of the wave form shown in Fig.Q7(b).

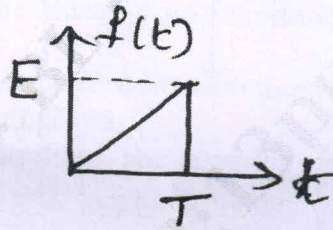


Fig.Q7(b)

- c. For the circuit shown Find an expression for  $i(t)$  when the switch K is closed at  $t = 0$ . Assume there is no initial charge on capacitor, shown in Fig.Q7(c).

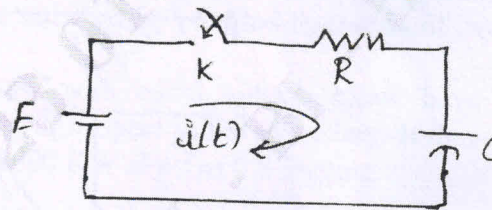


Fig.Q7(c)

OR

- 8 a. Find the Laplace transform of unit step, unit impulse and unit ramp functions. (06 Marks)
- b. Find initial and final values of following functions : (06 Marks)
- i)  $i(t) = 3e^{-t} - e^{-2t}$
- ii)  $i(t) = 5u(t) - 3e^{-2t}$
- c. Determine the Laplace transform of the periodic saw tooth waveform. Shown in Fig.Q8(c).

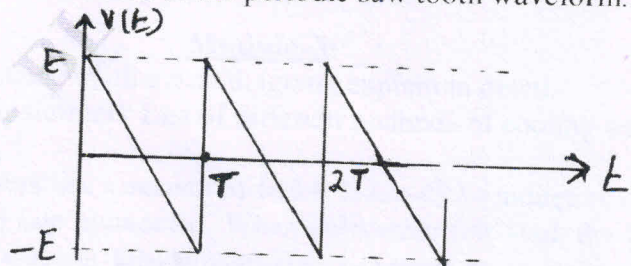


Fig.Q8(c)

3 of 4

(08 Marks)

**Module-5**

- 9 a. Define [Z] and [T] parameters and derive [Z] in terms of [T]. (06 Marks)  
 b. Find y parameters for the networks shown in Fig.Q9(b).

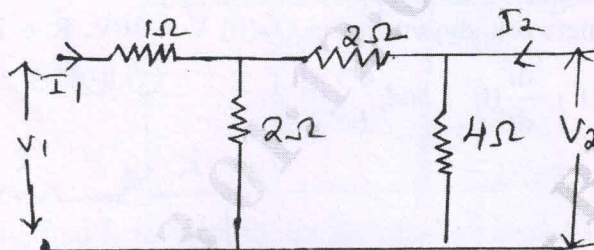


Fig.Q9(b)

- c. Derive the relationship between transmission and Z – parameters. (08 Marks)  
 (06 Marks)

**OR**

- 10 a. Find the Z-parameter of the circuit shown in Fig.Q10(a).

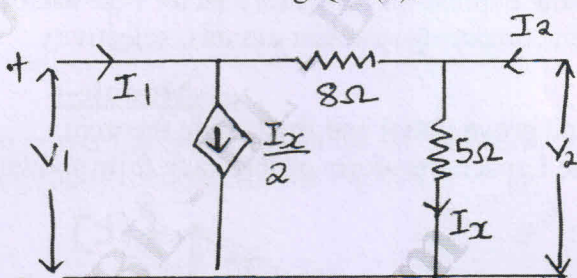


Fig.Q10(a)

- b. Determine the line currents and total power supplied to a delta connected load of  $Z_{AB} = 10\angle 60^\circ$ ,  $Z_{BC} = 20\angle 90^\circ$ , and  $Z_{CA} = 25\angle 30^\circ$ . Assume a 3φ 400V, ABC system shown in Fig.Q10(b). Draw phasor diagram also. (10 Marks)

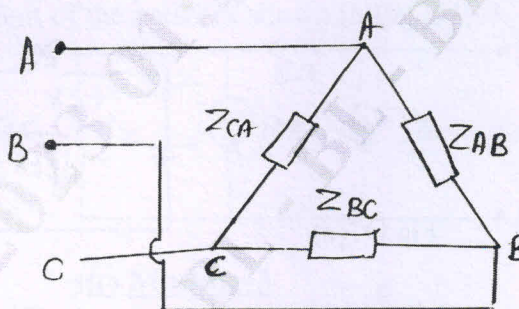


Fig.Q10(b)

(10 Marks)

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# CBCS SCHEME

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21EE34

## Third Semester B.E. Degree Examination, Jan./Feb. 2023 Transformers and Generators

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Discuss in detail how to perform OC and SC tests on single phase transformer with neat circuit diagram. (08 Marks)
- b. Explain with circuit diagram and phasor diagram how two transformers are connected in open delta can supply the power successfully. (06 Marks)
- c. The primary and secondary windings of a 40 KVA, 6600/250V single phase transformer have resistances of  $10\Omega$  and  $0.02\Omega$  respectively. The leakage reactance of transformer referred to primary side is  $35\Omega$ . Calculate the percentage voltage regulation of the at 0.8 p.f lagging. (06 Marks)

OR

- 2 a. Explain how SCOTT connections are used to obtain two phase from three phase mains with the help of connection and phase diagrams. (06 Marks)
- b. State the advantages of single three phase transformer over a bank of single phase transformers. (04 Marks)
- c. Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15KVA at UPF and loaded as follows :
  - i) 12 hours – 2 KW at 0.5 pf lagging
  - ii) 6 hours – 12 KW at 0.8 pf lagging
  - iii) 6 hours – No load. (10 Marks)

### Module-2

- 3 a. Derive an expression for saving of copper when an auto transformer is used. (07 Marks)
- b. What are the conditions to be satisfied for paralld operation of two transformers? Explain briefly. (04 Marks)
- c. Two single phase transformers with equal voltage ratios have impedances of  $(0.819 + j2.503)\Omega$  and  $(0.8 + j2.31)\Omega$  with respect to the secondary. If they operate in parallel, how they will share a total load of 2000 KW at p.f of 0.8 lagging. (09 Marks)

OR

- 4 a. Explain with diagram, the Sumpner's test on transformer. (07 Marks)
- b. What is tap changing transformer, explain with neat figure. (07 Marks)
- c. Two transformers A and B are joined in parallel to same load. Determine the current delivered by each transformer having given : Open circuit emf. 6600V for A and 6400V for B equivalent leakage impedance in terms of secondary is  $(0.3 + j3)\Omega$  for A and  $(0.2 + j1)\Omega$  for B. The load impedance is  $(8 + j6)\Omega$ . (06 Marks)

### Module-3

- 5 a. What is armature reaction? With a neat diagram, explain in detail. (08 Marks)
- b. What is cooling of transformer? List of different methods of cooling and explain any two of them. (06 Marks)
- c. A 4 – pole generator supplies a current of 143A. If has 492 conductors :
  - i) Wave connected ii) Lap connected. When delivering full load, the brushes are given an actual lead of  $10^\circ$ . Calculate the demagnetizing ampere-turns /pole. The field winding is shunt connected and takes 10A. Calculate the number of extra shunt field turns necessary to neutralize this demagnetization. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.



OR

- 6 a. What is commutation? Explain different methods available for improving commutation. (08 Marks)
- b. Derive an E.M.F equation of synchronous generator. (06 Marks)
- c. A 3- phase, 16 pole synchronous generator has a star connected winding with 144 slots and 10 conductor per slot. The flux per pole is 0.03wb, sinusoidally distributed and the speed is 375rpm. Calculate : i) The frequency ii) Line induced emf. (06 Marks)

Module-4

- 7 a. Define voltage regulation of the alternator and explain the ampere – turn method of predetermination of regulation. (08 Marks)
- b. The effective resistance of a 2200V, 50Hz, 440KVA, I – phase alternator is  $0.5\Omega$  on short circuit a field current of 40A gives the full load current of 200A. The voltage on open circuit with same field excitation is 1160V. Calculate :  
i) Synchronous impedance ii) Synchronous reactance. (04 Marks)
- c. Explain the zero power factor method of predetermination of regulation of an alternator. (08 Marks)

OR

- 8 a. Enumerate the various methods available for determining the voltage regulation. Explain in detail emf method. (08 Marks)
- b. A 3.5MVA Y-connected alternator rated at 4160 volts at 50Hz has open circuit characteristics given by the following data :

Field current (amps)	50	100	150	200	250	300	350	400
Line emf (volts)	1620	3150	4160	4750	5130	5370	5550	5650

A field current of 100A is found necessary to circulate full – load current on short circuit of the alternator. Calculate by : i) Synchronous impedance method ii) Ampereturn method the full-load voltage regulation at 0.8 pf lagging. Neglect armature resistance. (12 Marks)

Module-5

- 9 a. What is synchronization? Explain with the help of neat sketch the three lamps dark method of synchronization. (08 Marks)
- b. Explain about synchronizing power. (04 Marks)
- c. A 2MVA, 3 phase, 8 pole alternator is connected to 6000V, 50Hz bus bars and has a synchronous reactance of  $4\Omega$  per phase. Calculate the synchronizing power and synchronizing torque per mechanical degree of rotor displacement at no-load. Assume normal excitation. (08 Marks)

OR

- 10 a. What is hunting in synchronous machines? (06 Marks)
- b. Describe the parallel operation of alternators. (06 Marks)
- c. A three phase star connected synchronous generator supplies a current of 10A having phase angle of  $20^\circ$  lagging at 400V (phase voltage). Find : i) the load angle ii) components  $I_d$  and  $I_q$  of armature current iii) voltage regulation. Given  $X_d = 10\Omega$  and  $X_q = 6.5\Omega$ . Neglect armature resistance. (08 Marks)

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Question Paper Version : B

**Third Semester B.E. /B.Tech. Degree Examination, Jan./Feb. 2023**  
**Balake Kannada**

[Time: 1 hrs.]

[Max. Marks: 50]

### INSTRUCTIONS TO THE CANDIDATES

1. Answer all the Fifty questions, each question carries one mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners on the OMR sheets are strictly prohibited.**

**Note : Translate the English question to Kannada :**

1. Where is he?  
a) avanu elliddane?    b) nanu yellige bande?    c) AvaLu yaaru?    d) idu yaavadu?
2. Where shall we meet?  
a) NaVu yaaru?    b) Sanje barattiya?  
c) enu MaDuttiddiya?    d) naavu elli bheTi aagoNO?
3. When is the physics class?  
a) physics class yaavagaa?    b) Sanje physicedeyan?  
c) physic Lab elli ede?    d) yaavadu alla
4. When are you going to College?  
a) Neenu yaavaaga Kalejige hoguttiya?    b) Yalli huguttiya?  
c) neenu yavagu hogutitya?    d) enu MaDuttiddiya?
5. Had your breakfast?  
a) YaaVagu Tindi?    b) TinDi ayitaa?  
c) oota ayta?    d) TinDi yestu beku?

**Note : Write the English word for the given Kannada word :**

6. Aangla : \_\_\_\_\_  
a) Kannada    b) English    c) Telugu    d) Tamil
7. Vidyarthi : \_\_\_\_\_  
a) Student    b) Teacher    c) Principal    d) HOD
8. SamSkruti : \_\_\_\_\_  
a) Culture    b) festival    c) Haritage    d) Weep

Ver - B - 1 of 4

9. huTTu : \_\_\_\_\_  
a) Good                      b) die                      c) Birth                      d) bed
10. aalugeDDe : \_\_\_\_\_  
a) fruits                      b) Cabbage                      c) Potato                      d) Tomato
11. daKShiNa : \_\_\_\_\_  
a) West                      b) East                      c) South                      d) North
12. Navilu : \_\_\_\_\_  
a) Hen                      b) Peacock                      c) Ant                      d) Parrot
13. MaNNU : \_\_\_\_\_  
a) Soil                      b) Stone                      c) Air                      d) Hill
14. HeNDati : \_\_\_\_\_  
a) Sun                      b) aKka                      c) Wife                      d) sister
15. granthalaya : \_\_\_\_\_  
a) House                      b) office                      c) college                      d) Library
16. baNna : \_\_\_\_\_  
a) White                      b) Banana                      c) Colour                      d) Red
17. HaNNU : \_\_\_\_\_  
a) seeds                      b) flower                      c) Tree                      d) Fruit
18. pramaana : \_\_\_\_\_  
a) promise                      b) very good                      c) purpse                      d) Thankyou
19. tangi : \_\_\_\_\_  
a) Aunti                      b) Uncle                      c) Sister                      d) Mother
20. gaNita : \_\_\_\_\_  
a) Biology                      b) Physics                      c) English                      d) Mathematics
21. biLi : \_\_\_\_\_  
a) red                      b) Black                      c) White                      d) Green
22. doDDa : \_\_\_\_\_  
a) Big                      b) Small                      c) fat                      d) thin
23. Aarogya : \_\_\_\_\_  
a) Tomarrow                      b) Health                      c) wealth                      d) cold
24. gurugaLu  
a) Former                      b) Teacher                      c) Father                      d) Uncle
25. uuTa : \_\_\_\_\_  
a) Meals                      b) Drinks                      c) Get up                      d) breakfast

26. KoDabeDa : \_\_\_\_\_  
a) Give me                      b) Give us                      c) give                      d) Don't give

27. Kaagada : \_\_\_\_\_  
a) Mouse                      b) Computer                      c) Paper                      d) Chair

**Note : Substitute the word from the following each sentence in appropriate places :**

28. idu : idakke then adu \_\_\_\_\_  
a) adakke                      b) idakke                      c) Horakke                      d) Horakkee

29. Uuru : Urige then avaru \_\_\_\_\_  
a) ivarige                      b) avarige                      c) Nimage                      d) Nawage

30. Mane : maneyalli then Pustaka  
a) Pustakadalli                      b) peuninalli                      c) rajeyalli                      d) nammalli

31. Raja : Rajanaddu, then Raani \_\_\_\_\_  
a) Raviyaddu                      b) Ruehiyaddu                      c) Raniyaddu                      d) Hudugiyaddu

**Note : Translate the Question Kannada to English :**

32. eshTu ganTe Saar?  
a) Can I go Sir?                      b) will I come Sir?  
c) 8 Clock Sir                      d) What is the time Sir?

33. Ee pustaKa yaaraduu?  
a) Is that book yours                      b) whose book is this?  
c) This book belongs to me.                      d) none

34. ethaKKe hogidde?  
a) Why did you go?                      b) Where did you go?  
c) When you are going?                      d) None of these

35. nimma Kalejinaa hesarenu?  
a) What is your college name?                      b) Where is your college  
c) How old is your college?                      d) Which college are you studying?

36. naanu yenu MaDabhahudu?  
a) What did you do?                      b) What should we do?  
c) What can I do?                      d) None

37. eegale baa  
a) come immediatly                      b) Go immediatly                      c) come Tomorrow                      d) None

38. dayamaDi niiVu oLagaDe banni  
a) When you come                      b) Come inside  
c) Don't come hear                      d) you please come inside

39. Kallegige raje KoTTi ddare  
a) Holiday is given to college                      b) Don't come to college  
c) Today college is there                      d) None

40. Raamanu nanaginta doDDavanu  
 a) Rama is older than me  
 b) Rama is elder than me  
 c) Rama is my friend  
 d) None
41. VandneguLu Saar  
 a) Very good  
 b) Thank you sir  
 c) May I come Sir  
 d) Good morning Sir
42. baalehaNnu  
 a) Mango  
 b) Chicku  
 c) Banana  
 d) Orange
43. ToTa \_\_\_\_\_  
 a) Room  
 b) Bangle  
 c) House  
 d) Garden

Fill in the blank by translating the given English word to Kannada :

44. You : \_\_\_\_\_  
 a) neenu  
 b) Naanu  
 c) yaaru  
 d) Ivaru
45. His : \_\_\_\_\_  
 a) NeeVu  
 b) avaru  
 c) aVaLu  
 d) avana
46. What : \_\_\_\_\_  
 a) idu  
 b) adu  
 c) yenu  
 d) yelli
47. Friend : \_\_\_\_\_  
 a) Gumpu  
 b) Maava  
 c) Sneheta  
 d) GurugaLu
48. Drama : \_\_\_\_\_  
 a) naataka  
 b) Kate  
 c) haaDu  
 d) Yaavadu alla
49. Choose the Mathematical + Symbol in Kannada  
 a) Kale  
 b) Koodu  
 c) Jodisu  
 d) Bhagisu
50. Country in Kannada will be called as  
 a) D'weshu  
 b) Veshu  
 c) Desha  
 d) Vishesha

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# CBCS SCHEME

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21MAT31

## Third Semester B.E. Degree Examination, Jan./Feb. 2023 Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs.

Max. Marks: 100

**Note:** Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Find the Laplace transform of  $te^{2t} - \frac{2\sin 3t}{t}$ . (06 Marks)
- b. Given that  $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$   
where  $f(t+a) = f(t)$  show that  $L\{f(t)\} = \frac{E}{s} \tan h\left(\frac{as}{4}\right)$ . (07 Marks)
- c. Using convolution theorem obtain the inverse Laplace transform of the following function :  $\frac{1}{(s-1)(s^2+1)}$ . (07 Marks)

**OR**

- 2 a. Find the inverse Laplace transform of  $\frac{s+5}{s^2-6s+13}$ . (06 Marks)
- b. Express the following function in terms of unit step function and hence find their Laplace transform.  
 $f(t) = \begin{cases} 1, & 0 < t < 1 \\ t, & 1 < t \leq 2 \\ t^2, & t > 2. \end{cases}$  (07 Marks)
- c. Solve the following initial value problem by using Laplace transform :  $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ ,  $y(0) = 0$ ,  $y'(0) = 0$ . (07 Marks)

### Module-2

- 3 a. Obtain Fourier series of  $f(x) = \frac{\pi-x}{2}$  in  $0 < x < 2\pi$ . Hence deduce that  $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots = \frac{\pi}{4}$ . (06 Marks)
- b. Find a cosine Fourier series for  $f(x) = (x-1)^2$ ,  $0 \leq x \leq 1$ . (07 Marks)
- c. Obtain the Fourier series of  $y$  upto the First harmonic for the following values.

$x^\circ$	45	90	135	180	225	270	315	360
$y$	4.0	3.8	2.4	2.0	-1.5	0	2.8	3.4

(07 Marks)

1 of 3

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 4 a. Obtain Fourier series for

$$f(x) = \begin{cases} \pi x & \text{in } 0 \leq x \leq 1 \\ \pi(2-x) & \text{in } 1 \leq x \leq 2 \end{cases}$$

(06 Marks)

- b. Obtain the sine half range series for the function :

$$f(x) = 1 - \left(\frac{x}{\pi}\right) \text{ in } 0 \leq x \leq \pi.$$

(07 Marks)

- c. The following values of y and x are given. Find Fourier series of upto first harmonics.

x	0	2	4	6	8	10	12
y	9.0	18.2	24.4	27.8	27.5	22.0	9.0

(07 Marks)

**Module-3**

- 5 a. If
- $f(x) = \begin{cases} 1-x^2, & |x| < 1 \\ 0, & |x| \geq 1 \end{cases}$
- . Find Fourier transform of f(x) and hence find the value of

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} dx.$$

(06 Marks)

- b. Find the Fourier sine transform of
- $f(x) = e^{-|x|}$
- and hence evaluate

$$\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx, \quad m > 0.$$

(07 Marks)

- c. Solve by using Z-Transforms
- $U_{n+2} + 2U_{n+1} + U_n = n$
- with
- $U_0 = 0 = U_1$
- .

(07 Marks)

OR

- 6 a. Obtain the Fourier cosine transform of the function :

$$f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4-x, & 1 < x \leq 4 \\ 0, & x > 4. \end{cases}$$

(06 Marks)

- b. Obtain the Z-transform of
- $\cos n\theta$
- and
- $\sin n\theta$

(07 Marks)

- c. Compute the inverse Z-transform of
- $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$
- .

(07 Marks)

**Module-4**

- 7 a. Classify the following partial differential equations :

i)  $x^2 u_{xx} + (1-y^2) u_{yy} = 0, \quad -\infty < x < \infty, -1 < y < 1$

ii)  $(1+x^2) u_{xx} + (5+2x^2) u_{xt} + (4+x^2) u_{tt} = 0$

iii)  $(x+1) u_{xx} - 2(x+2) u_{xy} + (x+3) u_{yy} = 0.$

(10 Marks)

- b. Solve
- $u_t = u_{xx}$
- subject to the conditions
- $u(0, t) = 0 = u(1, t)$
- and
- $u(x, 0) = \sin(\pi x)$
- by taking
- $h = 0.2$
- for 5 levels. Further write down the following values from the table

i)  $u(0.2, 0.04)$

ii)  $u(0.4, 0.08)$

iii)  $u(0.6, 0.06).$

(10 Marks)

OR

- 8 a. Solve the elliptic equation  $u_{xx} + u_{yy} = 0$  for the following square Mesh with boundary values as shown. Find the iterative values of  $u_i(1$  to  $9)$  to the nearest integer.

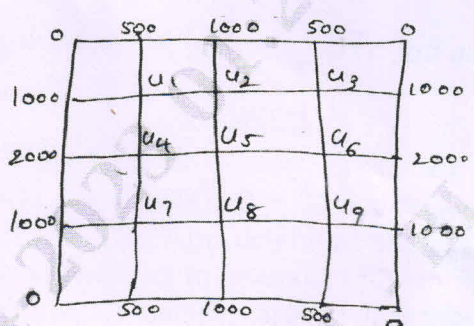


Fig.Q8(a)

- b. Solve  $25u_{xx} = u_{tt}$  at the pivotal points given  $u(0, t) = 0 = u(5, t)$ ,  $u_t(x, 0) = 0$  and  $u(x, 0) = \begin{cases} 20x, & 0 \leq x \leq 1 \\ 5(5-x), & 1 \leq x \leq 5 \end{cases}$  by taking  $h = 1$  compute  $u(x, t)$  for  $0 \leq t \leq 1$ . (10 Marks)

**Module-5**

- 9 a. Given  $y'' - xy' - y = 0$  with the initial conditions  $y(0) = 1$ ,  $y'(0) = 0$  compute  $y(0.2)$  using fourth order Runge - Kutta method. (06 Marks)
- b. Derive the Euler's equation. (07 Marks)
- c. Find the extremal of the functional. (07 Marks)
- $$\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x) dx$$

OR

- 10 a. Obtain the solution of the equation  $2 \frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$  by computing the value of  $y(1.4)$  by applying Milne's method using following data :

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y'	2	2.3178	2.6725	3.0657

- b. Find the curve on which the functional  $\int_0^1 [(y')^2 + 12xy] dx$  with  $y(0) = 0$  and  $y(1) = 1$  can be determined. (07 Marks)
- c. Prove that the shortest distance between two points in a plane is straight line. (07 Marks)

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