

2014 - 15

INTRODUCTION TO COMPUTING**CS - 01**

Time - Three Hours

Full Marks - 70

Strictly specify the Group name before answering any question.
 All the parts of a question should be grouped together under
 the question number.

Group A

1. Answer all the questions : 1×10=10

(i) void main()

{

```
int const * p=5;
printf("%d",++(*p));
}
```

- (a) Compiler error (b) Garbage value (c) 5 (d) 6

(ii) void main()

```
{ int a=10, b=11, c=13, d;
  d = (a = c, b+ = a, c = a+b+c);
  printf("%d", d);
}
```

- (a) 34 (b) 50 (c) Compiler Error (d) Garbage value

(iii) void main()

```
{ int a;  
for(a = -2; a<3; a++)  
{ if(a)  
    printf("%d", a);  
a++;  
}  
}  
(a) -2-1 0 1 2 (b) -2 0 2 (c) -2 -1 (d) None of these
```

(iv) void main()

```
{  
change();  
change();  
}  
change()  
{  
static int i=10;  
printf("%d", i);  
i++;  
}  
(a) 10 10 (b) 11 10 (c) 10 11 (d) 11 11
```

(v) $x = a > b ? a : b;$

when $a=10$ and $b=20$, what will be the value of x ?

(a) 10 (b) 20 (c) 30 (d) 0

(vi) Among the following which one is not a keyword in C ?

(a) switch (b) break (c) type (d) goto

(vii) void main()

```
{ int x=6;  
printf("%d %d %d", x++, ++x, x++, x- );  
}
```

(a) 6 8 8 8 (b) 7 7 5 6 (c) 8 7 6 5 (d) None of these

(viii) Suppose float *p is given. How many bytes of memory will be allocated for p ?

(a) 8 (b) 4 (c) 2 (d) 6

(ix) #define SQR(A) A*A

```
main()  
{  
int x=7, y;  
y=SQR(x-3);  
printf("%d", y);  
}
```

(a) 16 (b) 64 (c) -17 (d) -52

(x) In hexadecimal number system, F is equivalent to the number in decimal:

(a) 10 (b) 12 (c) 16 (d) 15

Group B

#Answer any three questions.

$3 \times 5 = 15$

2. (a) Write a C function call to generate Fibonacci series up to N terms.

(b) What are the differences between break and continue statement ?

$3+2$

3. (a) Write a recursive function to determine the sum of digits of a given non-negative integer.

(b) What are the differences between while loop and do-while loop ? 3+2

4. Write a C program to check whether a given character is vowel or consonant. 5

5. (a) What do you mean by function prototyping ?

(b) Write a C program to swap two integer value using call by reference. 1+4

6. (a) Write a 'C' program using switch to print the grade corresponding to marks (m) obtained by a student considering the following rules: $m \leq 49$ (Fail grade) and $m \geq 50$ (Pass grade).

(b) Write down the differences between function call and macro call. 2+3

Group-C

#Answer any three questions. $3 \times 15 = 45$

7. (a) Write down the differences between compiler and interpreter.

(b) What are the functions of CPU and cache memory in digital computer system? Perform $(24)_{10} - (45)_{10}$ using 2's complement method.

(c) Perform the following conversions.

(i) $(1011.0011)_2$ to Octal

(ii) $(17.75)_{10}$ to Binary

(iii) $(3AB)_{16}$ to Decimal

(iv) $(10110)_2$ to $(?)_{16}$

2+5+8

8. (a) What is array of structure? Differentiate between structure and union.

(b) How is a member of a union variable assigned an initial value? How does the initialization of union variable differ from initialization of a structure variable ?

(c) Define a structure called **Cricket** that will contain the following members:

player_name, team_name and player_information.

Define another structure **player_information** which stores the relevant information about player (e.g. player_name, score, age and ph_no.).

Write a C program that can store the information about 15 players and display the information. 4+5+6

9. (a) What is the purpose of realloc()? Explain with an example.

(b) What is the difference between NULL pointer and void pointer ? What do you mean by self-referential structure? Provide a suitable declaration to store an array of pointer to integers.

(c) Write a C program to convert all lower case alphabets to upper case in a line of text. 4+6+5

10. (a) What happens when a pointer to a structure is incremented? What type of danger is associated with this type of operation?

(b) Distinguish between (i) puts() and printf() function, (ii) function pointer and pointer to a function.

(c) Write C program to multiply two-dimensional arrays and display it. 3+5+7

11. Write short note (any three):

3×5

(a) Enumerated data type

(b) Dynamic memory allocation

(c) Pointer Arithmetic

(d) Storage class.

2014-15

ENGINEERING CHEMISTRY**CY - 01**

Time - Three hours

Full Marks - 70

Answer *any five* questions (at least *one* from *each group*).**Group - A**

1. Derive the concentration of the final product for the reaction mentioned below having rate constants k_1 and k_2 respectively. From the expression show that the slowest step is the rate determining step.



10+4=14

2. (a) Derive the expression for the efficiency of Carnot cycle using one mole of ideal gas.

(b) Define the thermodynamic terms : U, S, G and state the significances of change of these terms during phase transition.

7+7=14

3. (a) For the following electrochemical cell, write down individual electrode reactions, the overall cell reaction and derive the expression of cell emf :



- (b) Describe the Joule-Thomson experiment. Define Joule-Thomson coefficient and prove that this process is isoenthalpic in nature.

- (c) Explain the phase diagrams of water and toluene.

4+6+4=14

Group - B

4. (a) For simplifying the mathematical solution of a wave function ψ , how the Cartesian coordinate of a point $A(x, y, z)$ can be transformed to a polar coordinate (r, θ, ϕ) .

(b) Considering Bohr's quantization of angular momentum show that the total energy E_n of an electron, rotating in first Bohr's orbit of an atom, is $-(2\pi^2 Z^2 e^4 m)/(n^2 h^2)$.

(c) Write down the magnetic orbital angular momentum quantum number, m_l values for d orbital electrons and explain the significance of these values. $5+5+4=14$

5. (a) What is lattice energy ? Describe Born-Haber's cycle to determine the lattice energy of an ionic solid like NaCl. Which 'enthalpy change' terms are negative those are involved to determine the lattice energy of an ionic solid using this cycle ?

(b) Calculate the packing efficiency for bcc and fcc systems.

(c) In a LiI crystal, I^- ions form the fcc lattice and Li^+ occupy 'Oh' holes. What is the relationship between the edge length of unit cell and radius of I^- ions ? Calculate the ionic radius of Li^+ and I^- ions if edge length $a = 600$ pm.

$$6+4+4=14$$

6. (a) The d orbital splitting in octahedral coordination geometry is exactly opposite to the splitting in tetrahedral coordination geometry. Explain.

(b) Considering VBT and CFT explain the occurrence of Oh, Td, TBP geometries in transition metal complexes.

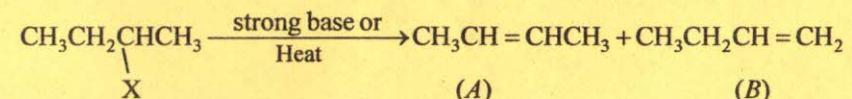
(c) Write the definition of CFSE. Calculate the CFSE of the d^4 , d^5 , d^6 systems in both spin states in a 'Oh' coordination geometry. $3+5+6=14$

Group - C

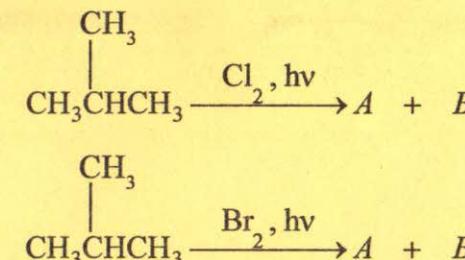
7. Predict the products (as major and minor) with brief explanation.

(a) when 1, 3-Butadiene is treated with one equivalent of Br_2 in CCl_4 .

(b)



(c) When $X = F, Cl, Br, I$, and $N(CH_3)_3$



$$4+6+4=14$$

8. Write short notes on :

$$3.5 \times 4 = 14$$

(i) Nylon-6, 6 (ii) Aromatic nucleophilic substitution reaction (iii) E_1CB mechanistic path (iv) Aldol condensation reaction.

9. (a) What do you mean by fractional distillation ? Describe the method of fractional distillation of crude petroleum oil.

(b) Name the different fractions with their boiling point range obtained during the fractional distillation of petroleum oil.

(c) What are Octane number and Cetane number ?

$$3+6+5=14$$

Q. No. EC - 01 / **64****B. Tech./Even**
2014-15/Reg**2014-15****BASIC ELECTRONICS****EC - 01**

Full Marks : 70

Time : Three Hours

The figures in the margin indicate full marks.

Answer any five questions.

1. (a) Explain the formation of holes in semiconductor with band diagram. 4
 (b) Draw the band diagram of p-n junction diode under forward and reverse biased condition and explain its V-I characteristics. 7
 (c) The reverse saturation current of a Si p-n junction is 5 nA at room temperature. What are the static and dynamic resistances of the junction for an applied forward biasing of 0.6 volt. 3

2. (a) A diode of forward resistance 20Ω is used to rectify a sinusoidal voltage of amplitude 40V, the load resistance being $1\text{ K}\Omega$. Determine (i) The DC load current, (ii) rms value of ripple (ac) current in the load, (iii) the DC voltage across the diode, (iv) the total input power and (v) the conversion efficiency. 7

P.T.O.

(2)

- (b) What is a double diode clipper? Draw the circuit diagram of a double diode clipper and explain its operation. 7

3. (a) Draw the common emitter circuit of a junction transistor. Sketch and explain its output characteristics by indicating three regions of operation. 2+6

- (b) Derive the relationship $I_C = \beta I_B + (\beta + 1) I_{CO}$. For a transistor $I_C = 7mA$, $I_{CO} = 25\mu A$ and $I_B = 0.1mA$. Calculate α , β and I_E . 3+3

4. (a) Explain why transistor is to be biased. Draw the circuit diagram for the collector-feedback basing arrangement of an n-p-n transistor and briefly explain how physically the biasing stability is improved for this circuit arrangement. 3+5

- (b) Sketch the basic structure of n-channel JFET. Draw the typical drain characteristic curve of JFET and explain the shape of the curve qualitatively. 2+4

5. (a) In the circuit of Fig. 1, if $V_i = 0.5V$, determine (i) the output voltage V_o and (ii) the current ' i_1 ' through the resistor R_1 . 5

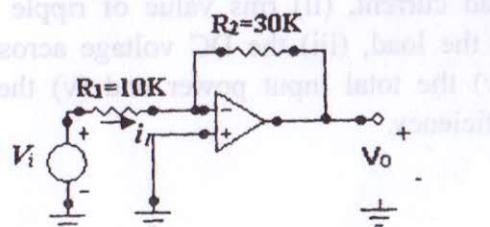


Fig. 1

(3)

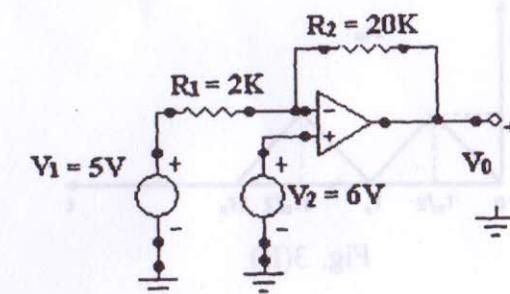


Fig. 2

- (b) For the Op-Amp circuit of Fig. 2, find out the output voltage V_o . 4

- (c) In the circuit of Fig. 3(A), $R = 2K\Omega$, $C = 100\mu F$. The voltage waveform of Fig. 3(B), with period $T_0 = 10ms$ is applied to the input, ' v_{in} ' of Fig. 3(A). Draw the waveform at the output V_o . 5

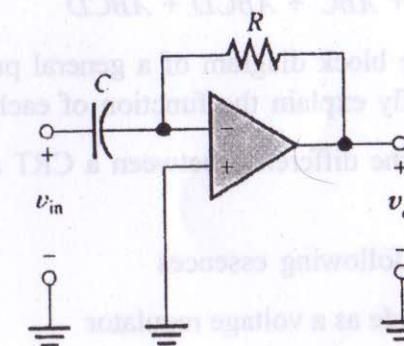


Fig. 3(A)

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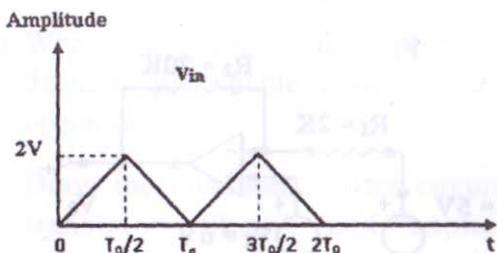


Fig. 3(B)

6. (a) Derive the expression for transfer gain of a feedback amplifier. 3

(b) Explain with a circuit diagram the action of a Wien-bridge oscillator. Find an expression for the frequency of oscillation. Show that for a Wien-bridge oscillator the minimum closed loop gain of the amplifier should be 3. 4+4+3

7. (a) Simplify the following logic expression and realize it using NAND gates

$$F = AB + ABC + ABCD + ABCD$$

- (b) Draw the block diagram of a general purpose CRO and briefly explain the function of each block.

- (c) Discuss the difference between a CRT and a CRO. 6+6+2

8. Explain the following essences

- (i) Zener diode as a voltage regulator
- (ii) Operation of a clamping circuit.
- (iii) Realization of the logic gates NOT, OR, AND and NAND using NOR gate. 4+5+5

2014-15

ELECTRICAL TECHNOLOGY

EE - 01

Full Marks : 70

Time : Three Hours

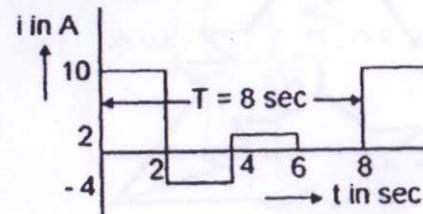
The figures in the margin indicate full marks.

Answer question no. 1 and any five from the rest.

All parts of a question should be answered at same place.

1. Answer in brief: 10×2=20

- (i) What is the condition of resonance in RLC series circuit?
- (ii) Determine the r.m.s. value of the current waveform shown in following Fig ?



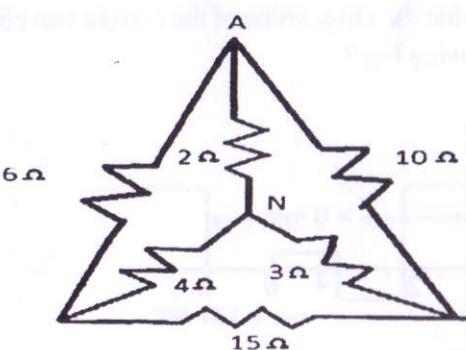
- (iii) What is the hysteresis loss?
- (iv) What are the basic differences between shunt and series field windings of dc machines?
- (v) What is the leakage reactance of transformer?

P.T.O.

(2)

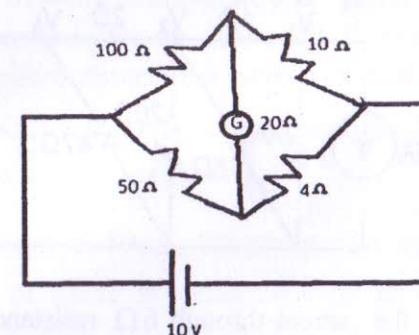
- (vi) A battery of 5V with internal resistance 0.3Ω supplies power to capacitor of $0.2\mu F$ with internal resistance 1.7Ω in parallel. What will be voltage across capacitor at steady state?
- (vii) Draw the connection diagram of wattmeter to measure the power in a three phase three wire system?
- (viii) Define and describe "Power factor"?
- (ix) How are Thevenin's Theorem and Norton's Theorem correlated?
- (x) Why is low power factor wattmeter used for open circuit test of single phase transformer?

2. (a) Find R_{AN} from the following figure :



(3)

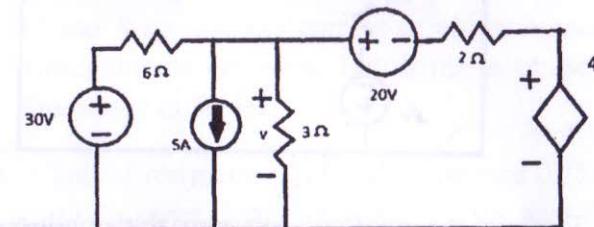
- (b) With the help of Thevenin's theorem find the current through galvanometer shown below :



5+5

3. (a) State and explain Superposition theorem.

- (b) Find the voltage v across 3Ω resistance by using superposition theorem.

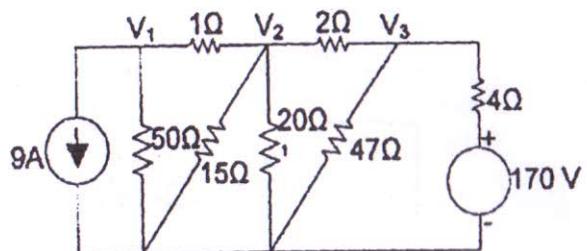


3+7

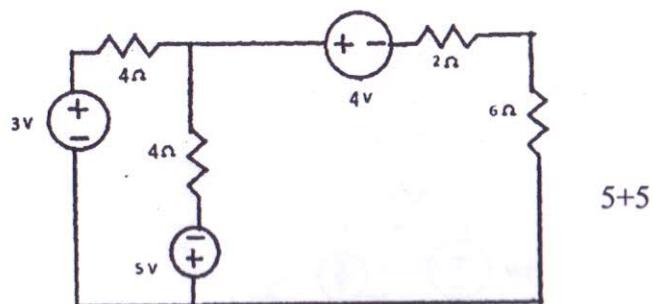
P.T.O.

(4)

4. (a) Determine voltages v_1 , v_2 , v_3 by node analysis method.



- (b) Find the current through 6Ω resistance with the help of Norton's Theorem as shown below :



5+5

5. (a) Explain the analogy between the conductance in electrical circuit to the permeance in the magnetic circuit.
(b) A magnetic circuit comprises three parts in series. They are
(i) a length of 80 mm and cross-sectional area 50 mm^2 ,
(ii) a length of 60 mm and cross-sectional area 90 mm^2 ,

(5)

- (iii) an air gap of 0.5 mm and cross-sectional area 150 mm^2 .

A coil of 4000 turns is wound on part (ii), and the flux density in the air gap is 0.3 T. Assuming all the fluxes passes through the given circuit, and that relative permeability μ_r is 1300, estimate the coil current to produce such a flux density. 3+7

6. (a) A capacitor of $50 \mu\text{F}$, shunted across a non-inductive resistor of 100Ω is connected in series with a resistor of 50Ω to a 200 V 50 Hz supply. Calculate the current in the shunted resistor.
(b) A coil having a resistance of 4Ω and an inductance of 1 H is connected in parallel with a circuit comprising a similar coil in series with a capacitor C and a non-inductive resistor R . Calculate the values of C and R so that the current in either branch of the arrangements are equal but differ in phase by 90° . Frequency is 50 Hz. 4+6
7. (a) A coil of resistance 40Ω and inductance 0.75 H forms part of a series circuit for which the resonant frequency is 55 Hz. If the supply is 250 V, 50 Hz find the power consumed by the circuit.
(b) Establish the relation between the phase voltage and line voltage for a star connected three phase balanced load when supplied from a three phase balanced supply. 5+5

P.T.O.

(6)

8. (a) Three equal star connected inductors take 8 kW at power factor 0.8 lagging when connected to 400 V, 50 Hz, 3 phase, 3 wire supply. Find the line current if each inductors are connected with 20Ω resistors in series.
- (b) Three equal star connected resistors of 20Ω are connected to 400 V, 50 Hz, 3 phase, 3 wire supply. Find the line current if one resistor is shorted. 5+5
9. Answer any two of the following : $5 \times 2 = 10$
- (a) What are the differences between core type and shell type transformers?
 - (b) Draw a neat sketch of a DC machine and explain the function of its main parts.
 - (c) Write short note on extension of instrument range.
- _____

2014-15

ENVIRONMENTAL STUDIES**ES - 01**

Time - Two hours

Full Marks - 70

Answer Q.No.1 and *any five* from the rest.*The figures in the margin indicate full marks.*

1. (a) Fill in the banks with suitable words : $\frac{1}{2} \times 10 = 5$

(i) Aurora _____ appears in the southern hemisphere.

(ii) In an effluent river water table lies at a _____ level than the river bed.

(iii) _____ is the most abundant element in the earth's crust.

(iv) The slope of continental shelf region is _____.

(v) Herbivores belong to _____ trophic level.

(vi) All solar heat is absorbed within top of ocean water.

(vii) An earthquake originates at the _____.

(viii) _____ is an important ore of Manganese.

(ix) Average density of the materials of the earth is _____ gm/cc.

(x) Rate of decomposition of organic matter may _____ due to global warming.

(b) Find out whether the following statements are true. If true, write "True" and if false, write "False" against the question number.

$$\frac{1}{2} \times 10 = 5$$

(i) India can be divided into three biogeographic regions.

(ii) Temperature decreases in Mesosphere with increase in altitude.

(iii) Copper is one of the big six macronutrients.

(iv) Granite is an acid igneous rock.

(v) Nektons are swimmers.

(vi) Feldspar is the most abundant mineral in the earth's crust.

(vii) Prey species have lower reproduction rate than predators.

(viii) Rivers account for about 0.01% of the total Hydrosphere.

(ix) Most of the marine organisms live in the littoral zone.

(x) Photic zone in the ocean extends upto a depth of 100m.

2. (a) Briefly describe the characteristics of the earthquake waves.

(b) What are the important effects of earthquake?

(c) State the important social and physical adjustments to be made in regard to natural hazards.

$$4+3+5=12$$

3. (a) Define water table. Briefly describe the different types of water that occur above the water table.

(b) Describe the thermal layers of the oceans.

(c) Explain the terms 'salinity' and 'chlorinity' of sea water.

$$5+3+4=12$$

4. (a) How CO_2 rich atmosphere transformed into O_2 rich atmosphere during the evolution of the earth?

(b) Why ozone depletion is most conspicuous over Antarctica?

(c) Write a brief note on ionosphere.

$$4+4+4=12$$

5. (a) Briefly describe the characteristics of the divergent plate boundaries.

(b) State the classification of igneous rocks according to $\text{SiO}_2\%$. Give examples of each type.

(c) Classify sedimentary rocks according to origin.

$$4+4+4=12$$

6. (a) Explain 'greenhouse effect'. What are the effects of global warming?

(b) What are the divisions of the atmosphere based on composition?

(c) How pressure changes with altitude in the atmosphere?

$$6+3+3=12$$

7. (a) Briefly discuss the different levels of describing biodiversity. Why is it necessary to preserve biodiversity?

(b) Define 'ecosystem'. How energy flows through an ecosystem?

(c) Define 'Biome'. What are the factors on which distribution of biomes depend? How biomes are classified?

$$5+3+4=12$$

8. (a) What is 'biogeochemical cycle' ? State the processes on which biogeochemical cycle depends. Classify nutrients according to their importance.

(b) What are the important sources of water pollution ?

(c) Define 'sustainable harvest of a resource' and 'carrying capacity'.
 $4+5+3=12$

9. (a) "Rapid rate of growth of human population is behind most of the environmental problems we face today" – discuss.

(b) Explain the term 'environmental unity'.

(c) What are 'aquifer' and 'aquiclude' ?

(d) Explain the term 'porosity' of rocks.
 $4+3+3+2=12$

G Q. No. HS 01 / 318

B.Tech / Even
(14-15) / Reg

2014-15

ENGLISH

HS 01

Full Marks : 70

Time : 3 hours

The figures in the margin indicate full marks.

1. Attempt any two of the following questions : $12 \times 2 = 24$

(a) What is the significance of the day, 'August 20' in *The Calcutta Chromosome* by Amitav Ghosh ? What is 'Life Watch' ? How is malaria related to the entire process of 'interpersonal transference' ? What is 'Calcutta Chromosome' ?
 $2 + 2 + 6 + 2 = 12$

(b) Why do the 'cult members' maintain silence ? How do they attain 'immortality' through their own unique way ? How does the Bengali culture intervene the plot of the novel ?
 $4 + 4 + 4 = 12$

(c) How does Lutchman enter the life of Ronald Ross ? What was the plan behind this meeting ? How does J.W.D. Grigson suspect the identity of Lutchman ?
 $4 + 4 + 4 = 12$

(d) How does Amitav Ghosh assimilate history with science in his novel *The Calcutta Chromosome* ?
 12

2. Answer any four of the following questions in not more than 200 words for each answer :— $6 \times 4 = 24$

(a) Which god is invoked at the beginning of the play, *Hayavadana* ? Write the significance of the invocation.
 $1 + 5 = 6$

(2)

- (b) In which city is the action of the play located ? Who is the ruler of that city ? What kind of a king was he ? Who are the two youths living in that city ? Who were their fathers ?

$$1 + 1 + 2 + 1 + 1 = 6$$

- (c) How does Girish Karnad present the character of Devadatta in Hayavadana ?

6

- (d) Narrate the incidents that brought Hayavadana to his present stage.

6

- (e) "My dear daughter, there should be a limit even to honesty."

Who says this ? Who is the addressee ? Why does the speaker say this ?

$$1 + 1 + 4 = 6$$

3. Write an essay on any *one* of the following : $12 \times 1 = 12$

(A) Imagination behind Scientific Invention.

(B) Cleanliness is Next to Godliness.

(C) Use of Technology among the Poor.

4. Find out the error (if any), and write the sentence again.

$$1 \times 5 = 5$$

(A) Neither story is labelled as true.

(B) Judith and Hamneth are almost the same in height, but the later is slightly taller.

(C) The concerned students are asked by the Dean to attend the games.

(D) Asif, and not his brothers, are guilty.

(E) Many a man have ruined their career through laziness.

(3)

5. Point out the differences in meaning between the pair of sentences below :

$$1 \times 5 = 5$$

A) I never sleep on train.

and

I never sleep in train.

B) Dispense your charities fairly well.

and

Dispense with your charities.

C) Let us repair the house.

and

Let us repair to the house.

D) The fish are circling in the water.

and

The fishes are circling in the water.

E) I do not believe this man

and

I do not believe in this man.

2014-15

ENGINEERING ECONOMICS AND ACCOUNTANCY

HS 02

Full Marks : 70

Time : 3 hours

The figures in the margin indicate full marks.

GROUP A

(Micro Economics & Macro Economics)

Marks : 50

Answer any five from this Group. $10 \times 5 = 50$

1. Explain, with examples, different components of national income and comment on its usefulness in measuring a country's development. Examine the effect of tax on national income calculation.
2. Derive the consumption and saving function. Discuss, with suitable examples, the role of the factors, other than income which influence consumption and saving.
3. Explain the process of determination of equilibrium level of output of a country. Examine the effect of a change in autonomous consumption expenditure on equilibrium output.
4. Explain different components of demand for money and supply of money.
5. Explain the process of maximizing utility by a consumer subject to his budget constraint.

6. (a) The demand for a commodity does not change with the increase in its price from Rs. 5 to Rs. 10. What is its elasticity of demand ? Explain this with the help of the definition of price elasticity of demand.
- (b) What is price elasticity of supply ? When the price of a doll is Rs. 4 per doll, a doll maker supplies 8 dolls per day. If the price increases to Rs. 5 per doll, he is willing to supply 10 dolls per day. Calculate the price elasticity of supply of doll.
7. (a) Explain the law of variable proportions with the help of total and marginal product curves.
- (b) The cost schedule of a firm is given below. Its total fixed cost is Rs. 100. Calculate average variable cost and marginal cost at each given level of output :

Output : 1 2 3 4
Total Cost : 350 450 610 820

GROUP B

(Accountancy)

Marks : 20

Answer any two from this Group. $10 \times 2 = 20$

1. (a) Put the following transactions in a double column cash book : Figures are in Rupees
- 1) Opening balances : Cash 10,000
Bank (Cr) 2000
- 2) Deposited in bank from cash 3000

- 3) Sold goods and received a cheque for 5000. The cheque deposited in bank on the same day
- 4) Received commission in cash 1000
- 5) Withdrawn cash from bank and put in cash 2000 for making small payments.

Obtain the cash account balance and bank account balance.
5

- (b) Assume some trading organisation which is involved in transactions with Mr. 'X'. Put the following transactions with Mr. 'X' in the Mr. 'X' account, maintained by the organisation :
- 1) Mr. 'X' had a debit balance of Rs. 2000.
- 2) The organisation sold goods to Mr. 'X' on credit Rs. 3000
- 3) Mr. 'X' paid cash Rs. 1000 to the organisation
- 4) Mr. 'X' returned a part of the purchased goods to the organisation, Rs. 500.
- 5) Mr. 'X' supplied furniture on credit to the organisation for Rs. 10,000.

Obtain the balance in Mr. 'X' account after transaction No. 5.
5

2. (a) Journalise the following transactions of some trading organisation :
- 1) Business was started with Rs. 100,000
- 2) Rs. 50,000 was deposited in bank.
- 3) Purchased computer for Rs. 10,000 on credit from some party.

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- 4) Purchased goods in cash for Rs. 5000
- 5) Sold goods in cash for Rs. 6000. 5
- (b) On the last day of some financial year Building Account in the Ledger showed a Debit balance of Rs. 20,000. Profit and Loss account is to be prepared on the same day.
- Show the necessary Journal entries and Ledger Accounts for providing 10 percent depreciation on Building. 5
3. From the following Trial Balance and List of Adjustments, prepare a Trading Account, Profit and Loss Account and Balance Sheet of some Trading Organisation : Value are in Rupees.

Debit Balance	Credit Balance
Drawings 300	Capital 3600
Machinery 760	Purchase Return 250
Purchase 10,400	Sales 13700
Freight 30	Creditors 700
Carriage in 70	Bills payable 500
Sales Return 320	Adjustments :
Wage 700	a) Closing stock : 1700
Salary 650	b) Depreciation on Machinery:
Printing 110	10 percent of the value
Rent & taxes 90	c) Outstanding Expenses:
Debtors 740	Salary 100
Opening Stock 1000	Wage 100
Bills Receivable 340	d) Prepaid rent and taxes 30
Investment 1400	e) Bad debt : 10 percent of debtors
Cash at hand 1840	f) Interest accrued but not received @ 10% p.a. for 6 months 10

MATHEMATICS II**MA 02***Full Marks : 70**Time : 3 hours**The figures in the margin indicate full marks.**The given symbols have their usual meanings.**Answer Q.No. 1 and any five from the rest.*

1. (a) Find the $L\{f(t)\}$, when

$$f(t) = \begin{cases} \sin t & \text{if } 0 < t < \pi; \\ 0 & \text{if } t > \pi. \end{cases}$$

4

- (b) Show that the functions $e^x \sin x$ and $e^x \cos x$ are linearly independent solutions of a 2nd order linear ordinary differential equation. 2

- (c) Check the diagonalizability of the matrix $\begin{pmatrix} 2 & 0 \\ 5 & 2 \end{pmatrix}$ over the field of real numbers \mathbb{R} . 4

2. (a) (i) Whow that for $0 < n < 1$,

$$\int_0^\infty e^{-x} x^{n-1} dx$$

is convergent. 3

$$(ii) \text{ Evaluate } \int_0^1 x^7(1-x)^8 dx. 3$$

(2)

- (b) Solve the differential equation

$$\frac{d^2y}{dx^2} + a^2y = \sec ax$$

by the method of variation of parameters, where a is a constant.

6

3. (a) Solve the simultaneous differential equations

$$\frac{dx}{x^2 + y^2 + yz} = \frac{dy}{x^2 + y^2 - xz} = \frac{dz}{z(x+y)}. \quad 6$$

- (b) Find the volume and the surface area of a sphere generated by rotation of the circle $x^2 + y^2 = 4$ about the x -axis. 6

4. (a) State Cayley-Hamilton theorem and hence express A^4 as $aA + bI_2$ for some $a, b \in \mathbb{R}$, where $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$. 2 + 4

- (b) Solve the ordinary differential equation $(D^3 + D^2 - D - 1)y = 25 \cos 2x + e^x$, where $D \equiv \frac{d}{dx}$. 6

5. (a) Use Laplace transform to solve the differential equation $(D^2 + 9)y = 1$, where $y(0) = 1, y'(0) = 0$. 6

- (b) Find the Laplace transform of $e^{-2t}(2\cos 3t - 3\sin 4t)$. 6

6. (a) Show that the set $S = \{(x, y, z) \in \mathbb{R}^3 | 2x + y - z = 0\}$ is a subspace of \mathbb{R}^3 . Then find a basis and the dimension of S . 6

- (b) Obtain the canonical (normal) form of the following quadratic form

$$x_1^2 + x_3^2 + 4x_1x_2 + 6x_1x_3 + 6x_2x_3.$$

Also determine its nature, rank, index, and signature. 6

(3)

7. (a) From the following data

x	1	2	3	4	5	6	7	8
$f(x)$	1	8	27	64	125	216	343	512

find the $f(1.5)$ and $f(7.2)$ using appropriate interpolation formula. 6

- (b) Compute a positive root of the equation $3x^2 + 2x - 9$ correct up to four significant figures using Newton-Raphson method. 6

8. (a) Given a system of linear equations :

$$x_1 + 4x_2 + x_3 = 1;$$

$$2x_1 + 7x_2 + 5x_3 = 2k;$$

$$4x_1 + mx_2 + 10x_3 = 2k + 1.$$

Find the values of k and m , for which the system of equations has (i) unique solution (ii) no solution (iii) infinitely many solutions. 6

- (b) Show that eigenvalues of a real symmetric matrix are all real and eigenvalues of a real skew-symmetric matrix are purely imaginary or zero. 6

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ENGINEERING PHYSICS

PH - 01

Time - Three Hours

Full Marks - 70

The figures in the margin indicate full marks.

Answer any five questions.

1. (a) Find the Lissajous figure traced out by a particle subjected to two perpendicular simple harmonic motions of unequal amplitudes, frequencies in the ratio 1:2 and phases differing by (i) zero and (ii) π . 10

(b) Distinguish between the mean lifetime and relaxation time of damped simple harmonic oscillator. What is the relationship between them ? 4

2. (a) What do you mean by reverberation and reverberation time ? Derive Eyring's formula for reverberation time of a dead room. Show that the Eyring's formula reduces to Sabine's formula for small absorption coefficient. 2+6+2

(b) Discuss the factors influencing acoustic properties of buildings. 4

3. (a) Discuss Planck's hypothesis. Using this hypothesis derive Planck's radiation law for black body. Derive Stefan-Boltzmann law from it. 2+4+4

(b) Using Heisenberg's uncertainty principle find the radius of hydrogen atom in the ground state. 4

4. (a) What do you mean by Bravais lattices? Describe briefly the seven systems of crystals. Copper has fcc structure and its atomic radius is 1.278 Å. Calculate its density. Take atomic weight of copper as 63.5.

1+7+2

(b) Define atomic packing fraction and find the atomic packing fraction of SC, BCC and FCC structure.

4

5. (a) Clearly state the Huygen's principle for light waves.

(b) What do you mean by Spatial and Temporal coherence?

(c) What are the methods to produce coherent sources of light?

(d) Discuss with schematic diagram and ray diagram how one can measure the wavelength of light using Michelson interferometer.

(e) In Michelson interferometer the readings for two maxima indistinctnesses are 0.6939 mm and 0.9884 mm. If average wavelength is 5893 Å, calculate the difference between two wavelengths.

1+2+1+7+3

6. (a) What do you mean by polarization of light wave?

(b) Is it possible to polarize sound waves? — discuss.

(c) Explain how plane, circularly and elliptically polarized light can be produced.

(d) What is the Brewster's law for polarization?

(e) Calculate the polarizing angle for light travelling from water of refractive index 1.33 to glass of refractive index 1.53.

2+2+6+2+2

7. (a) What are the basic differences between diffraction of light wave and sound wave?

(b) What do you mean by Fraunhofer diffraction and Fresnel diffraction?

(c) Find an expression for intensity distribution pattern due to a single slit Fraunhofer diffraction.

(d) If the width of a slit is doubled, what would be change in total width of the principal maxima?

(e) What do you mean by diffraction grating?

2+2+6+3+1

8. (a) What are the functions of the core and cladding in an optical fiber for propagation of a signal?

(b) Would it be possible for the signal to be guided without cladding?

(c) A step-index optical fiber has a core of refractive index 1.5, a cladding of refractive index 1.48 and a core diameter of 100 μm. If the fiber is kept in air, calculate the numerical aperture.

(d) What do you mean by spontaneous emission and stimulated emission of radiation?

(e) Clearly discuss the concept of population inversion in a LASER source.

2+2+3+3+4