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15MAT11

First Semester B.E. Degree Examination, June/July 2016

**Engineering Mathematics – I**

Time: 3 hrs.

Max. Marks: 80

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

**Module-1**

- 1 a. Find the  $n^{\text{th}}$  derivative of  $y = e^{-3x} \cos^3 x$ . (06 Marks)
- b. Find the angle of intersection between the curves  $r = a(1 + \sin \theta)$  and  $r = a(1 - \cos \theta)$ . (05 Marks)
- c. Find the radius of curvature at the point  $\left(\frac{3a}{2}, \frac{3a}{2}\right)$  on the curve  $x^3 + y^3 = 3axy$ . (05 Marks)

**OR**

- 2 a. If  $y = \sin(\log(x^2 + 2x + 1))$ , prove that  $(x+1)^2 y_{n+2} + (2n+1)(x+1)y_{n+1} + (n^2+4)y_n = 0$ . (06 Marks)
- b. Find the pedal equation for the curve  $r^m \cos m\theta = a^m$ . (05 Marks)
- c. Find the radius of curvature of the curve  $x^4 + y^4 = 2$  at the point (1, 1). (05 Marks)

**Module-2**

- 3 a. Expand  $\sin x$  in powers of  $x - \frac{\pi}{2}$  upto 4<sup>th</sup> degree terms using Taylor's series. (05 Marks)
- b. Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{\tan x}{x} \right)^{\frac{1}{x^2}}$ . (05 Marks)
- c. If  $u = \tan^{-1} \left( \frac{x^2 + y^2}{x + y} \right)$  prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \sin 2u$ . (06 Marks)

**OR**

- 4 a. Expand  $\log(1 + e^x)$  using Maclaurin's series upto 3<sup>rd</sup> degree terms. (06 Marks)
- b. If  $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$  then prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$ . (05 Marks)
- c. If  $x = r \sin \theta \cos \phi$ ,  $y = r \sin \theta \sin \phi$ ,  $z = r \cos \theta$ , find  $J\left(\frac{x, y, z}{r, \theta, \phi}\right)$ . (05 Marks)

**Module-3**

- 5 a. A particle moves along the curve  $x = 2t^2$ ,  $y = t^2 - 4t$ ,  $z = 3t - 5$ , where  $t$  is the time, find the component of its velocity and acceleration in the direction of the vector  $i - 3j + 2k$  at  $t = 1$ . (06 Marks)
- b. Show that  $\vec{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$  is irrotational, find  $\phi$  such that  $F = \nabla\phi$ . (05 Marks)
- c. Prove that  $\text{div}(\text{curl } u) = 0$ . (05 Marks)

OR

- 6 a. If  $\vec{r} = x_i + y_j + z_k$ , then prove that : i)  $\nabla \times \vec{r} = 0$  ii)  $\nabla^2 r^n = n(n+1)r^{n-2}$ . (06 Marks)
- b. Prove with usual notations  $\text{Curl}(\text{grad } \phi) = 0$  (05 Marks)
- c. Find  $\text{div } \vec{f}$  and  $\text{curl } \vec{f}$  of  $\vec{f} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$ . (05 Marks)

**Module-4**

- 7 a. Obtain the reduction formula of  $\int \sin^m x \cos^n x \, dx$ . (06 Marks)
- b. Solve  $(x^2 + y^3 + 6x) \, dx + y^2 x \, dy = 0$ . (05 Marks)
- c. Find the orthogonal trajectory of  $r^n = a^n \cos n\theta$ , where  $a$  is the parameter. (05 Marks)

OR

- 8 a. Obtain the reduction formula of  $\int \cos^n x \, dx$  and hence evaluate :  $\int_0^{\pi/2} \cos^n x \, dx$ . (06 Marks)
- b. Solve  $\frac{dy}{dx} = xy^3 - xy$ . (05 Marks)
- c. If the temperature of the air is  $30^\circ\text{C}$  and the substance cools from  $100^\circ\text{C}$  to  $70^\circ\text{C}$  in 15 minutes, find when the temperature reaches at  $40^\circ\text{C}$ . (Use Newton's law of cooling). (05 Marks)

**Module-5**

- 9 a. Find the rank of the matrix
- $$A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}.$$
- (06 Marks)
- b. Find the largest eigen value and the corresponding eigen vector of the matrix
- $$A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$$
- by power method, use
- $[1, 0, 0]^T$
- as initial vector, take five iterations. (05 Marks)
- c. Reduce the matrix  $A = \begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$  to the diagonal form. (05 Marks)

OR

- 10 a. Use Gauss – Siedel iteration method upto 3 iterations to solve with  $(0, 0, 0)$  as initial values
- $$\begin{aligned} 10x + y + z &= 12 \\ x + 10y + z &= 12 \\ x + y + 10z &= 12. \end{aligned}$$
- (06 Marks)
- b. Show that the transformation :
- $$\begin{aligned} y_1 &= 2x_1 + x_2 + x_3 \\ y_2 &= x_1 + x_2 + 2x_3 \\ y_3 &= x_1 - 2x_3 \end{aligned}$$
- is regular. Write down the inverse transformation. (05 Marks)
- c. Reduce the quadratic form  $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$  to the canonical form. (05 Marks)

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**First/Second Semester B.E. Degree Examination, June/July 2016**  
**Engineering Physics**

Time: 3 hrs.

Max. Marks: 80

**Note: 1. Answer any FIVE full questions, choosing one full question from each module.**  
**2. Physical Constants: Planck's constant  $h = 6.63 \times 10^{-34}$  JS, Mass of electron  $m = 9.11 \times 10^{-31}$  kg, Boltzmann constant  $K = 1.38 \times 10^{-23}$  JK<sup>-1</sup>, Avogadro number  $N_A = 6.025 \times 10^{26}$ /K mol, Velocity of light  $C = 3 \times 10^8$  ms<sup>-1</sup>.**

**Module-1**

- 1 a. Mention the assumptions of Planck's law. Arrive at the relation for Wien's law from Planck's law. (06 Marks)
- b. State Heisenberg's uncertainty principle. Show that electrons cannot exist inside the nucleus. (06 Marks)
- c. Calculate the deBroglie wavelength associated with neutron of mass  $1.674 \times 10^{-27}$  kg with one tenth part of the velocity of light. (04 Marks)

**OR**

- 2 a. What is phase velocity and group velocity? Show that group velocity is equal to particle velocity. (06 Marks)
- b. Obtain normalized wave function, with respect to a particle inside an one dimensional potential well. (06 Marks)
- c. An electron is bound in one dimensional potential well of width 0.18 nm. Find the energy value in eV of the second excited state. (04 Marks)

**Module-2**

- 3 a. Explain the failure of classical free electron theory. (06 Marks)
- b. State law of mass action and derive the expression for electrical conductivity of a semiconductor. (06 Marks)
- c. A superconducting tin has a critical field of 306 gauss at 0 K and 217 gauss at 2 K. Find the critical temperature of superconducting tin. (04 Marks)

**OR**

- 4 a. What is Fermi factor? Discuss the variation of fermifactor with temperature. (06 Marks)
- b. Write a note on High temperature super conductors. (06 Marks)
- c. Calculate the mobility of electrons in copper assuming that each atom contribute one free electron for conduction. Resistivity of copper =  $1.7 \times 10^{-8}$  Ωm, atomic weight = 63.54, density =  $8.96 \times 10^3$  kg/m<sup>3</sup>. (04 Marks)

**Module-3**

- 5 a. Explain the construction and working of semiconductor laser. (06 Marks)
- b. Discuss the three different types of optical fibres. (06 Marks)
- c. The ratio of population of two energy levels out of which one corresponds to metastable state is  $1.059 \times 10^{-30}$ . Find the wavelength of light emitted at 330 K. (04 Marks)



OR

- 6 a. Describe the recording and reconstruction process in holography with the help of suitable diagrams. (06 Marks)
- b. What is attenuation? Explain the factors contributing to the fibre loss. (06 Marks)
- c. The refractive indices of the core and cladding of a step-index optical fibre are 1.45 and 1.40 respectively and its core diameter is 45  $\mu\text{m}$ . Calculate its fractional refractive index change and numerical aperture. (04 Marks)

**Module-4**

- 7 a. Define unit cell. Derive the expression for the interplanar spacing in terms of Miller indices. (06 Marks)
- b. Calculate the glancing angle for incidence of X-rays of wave length 0.058 nm on the plane (1 3 2) of NaCl which results in 2<sup>nd</sup> order diffraction maxima taking the lattice spacing as 3.81 Å. (06 Marks)
- c. Calculate the atomic packing factor for SC, bCC and fCC. (04 Marks)

OR

- 8 a. Describe the construction and working of a Bragg's X-ray spectrometer. (06 Marks)
- b. Explain the crystal structure of diamond with neat sketch and calculate its atomic packing factor. (06 Marks)
- c. Monochromatic X-rays of wavelength 0.82 Å undergo first order Bragg reflection from a crystal of cubic lattice with lattice constant 3 Å at a glancing angle of 7.855°. Identify the possible planes which give rise to this reflection in terms of their Miller indices. (04 Marks)

**Module-5**

- 9 a. What is Mach number? Define subsonic and supersonic with Mach number and give example. (06 Marks)
- b. Describe the synthesis of carbon nanotubes using Pyrolysis method. (06 Marks)
- c. In a Reddy tube experiment, it was found that, the time taken to travel between the two sensors is 195  $\mu\text{s}$ . If the distance between the two sensors is 100 mm, find the Mach number. (04 Marks)

OR

- 10 a. Describe the construction and working of Reddy's shock tube. (06 Marks)
- b. Explain the structure of carbon nanotube. (06 Marks)
- c. Calculate the wavelength of an electron accelerated under a potential difference of 100 V in scanning electron microscope. (04 Marks)

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15CHE12/22

**First/Second Semester B.E. Degree Examination, June/July 2016**  
**Engineering Chemistry**

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Explain the construction and working of silver-silver chloride electrode. (05 Marks)
- b. What are ion selective electrodes? Discuss the construction and working of a glass electrode. (06 Marks)
- c. Explain the construction and working of Zinc-Air cell. (05 Marks)

OR

- 2 a. Derive Nerst expression for single electrode potential. (05 Marks)
- b. Explain the following battery characteristics ; (06 Marks)
  - i) Energy efficiency
  - ii) Shelf life
  - iii) Cycle life
- c. Explain the construction and working of Methanol - Oxygen fuel cell with  $H_2SO_4$  electrolyte. (05 Marks)

Module-2

- 3 a. Explain electrochemical theory of corrosion with an example. (05 Marks)
- b. Discuss the differential metal corrosion with an example. (05 Marks)
- c. What is electroless plating? Mention the differences between electroplating and electroless plating. (06 Marks)

OR

- 4 a. Discuss the following factors influencing nature of electrodeposit. (06 Marks)
  - i) Brighteners
  - ii) Levellers and
  - iii) pH
- b. Explain electroplating of Decorative chromium. (05 Marks)
- c. Discuss the process of Galvanization of Iron sheet. (05 Marks)

Module-3

- 5 a. How Calorific value of a solid fuel is determined using bomb calorimeter? (05 Marks)
- b. What is meant by cracking? Describe with a neat diagram, fluidized bed cracking method. (06 Marks)
- c. Explain the construction and working of a photovoltaic cell. (05 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. 0.75g of coal containing 2% hydrogen, when burnt in a bomb calorimeter, increased the temperature of 2.7kg water from 27.2°C to 29.7°C. If the water equivalent of calorimeter is 1.2kg. Calculate gross and net calorific value (specific heat of water 4.187kJ/kg/°C, latent heat of steam 2457 kJ/kg). (06 Marks)
- b. Explain production of solar grade silicon by union carbide process. (05 Marks)
- c. Discuss the zone refining process of purification of silicon. (05 Marks)

Module-4

- 7 a. Explain free radical mechanism of addition polymerization of vinyl chloride. (05 Marks)
- b. Give the synthesis and applications of the following polymers ;  
i) PMMA  
ii) Polycarbonate. (06 Marks)
- c. What are polymer composites? Explain synthesis, properties and applications of Kevlar. (05 Marks)

OR

- 8 a. A polymer sample contains 200 molecules of molecular mass 2000, 300 molecules of molecular mass 3000 and 500 molecules of molecular mass 5000. Calculate number average and weight average molecular masses of the polymer. (06 Marks)
- b. What is glass transition temperature? Explain any THREE factors that influence the glass transition temperature. (05 Marks)
- c. What are conducting polymers? Give the mechanism of conduction in polyaniline and two applications. (05 Marks)

Module-5

- 9 a. Explain the scale and sludge formation in boiler. (06 Marks)
- b. What is desalination? Explain reverse osmosis process of desalination of sea water. (05 Marks)
- c. Explain synthesis of nano-material by sol-gel process. (05 Marks)

OR

- 10 a. Define COD. Calculate COD of 25CC of an effluent sample which requires 8.3CC of 0.001M  $K_2Cr_2O_7$  for its complete oxidation. (05 Marks)
- b. Explain treatment of sewage by activated sludge process. (06 Marks)
- c. Explain synthesis of nano materials by precipitation method. (05 Marks)

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## First/Second Semester B.E. Degree Examination, June/July 2016 Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

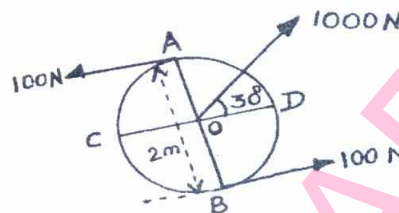
Max. Marks:80

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

### MODULE - 1

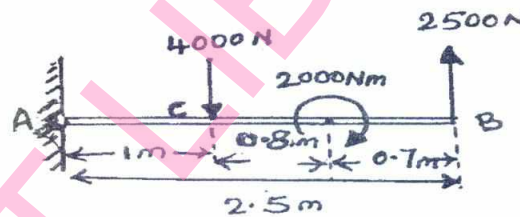
- 1 a. What is the role played by a Civil Engineer in the infrastructure development of a country? (08 Marks)
- b. Replace the force couple system by a single force with respect to AB and CD as shown in fig.1(b). (06 Marks)

Fig.Q1(b)



- c. Define Moment of a Force. (02 Marks)
- 2 a. What is the scope of (1) Environmental Engineering (2) Surveying? (06 Marks)
- b. Distinguish between Rigid pavement and Flexible pavement. (06 Marks)
- c. Fig.Q2(c) shows a cantilever beam with two forces and a couple i) Determine the resultant of a system ii) Determine an equivalent system through A. (04 Marks)

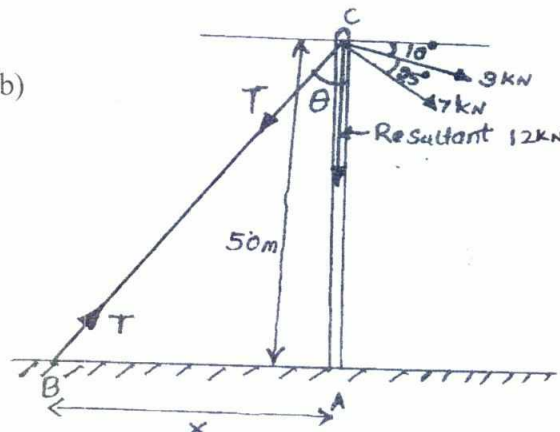
Fig.Q2(c)



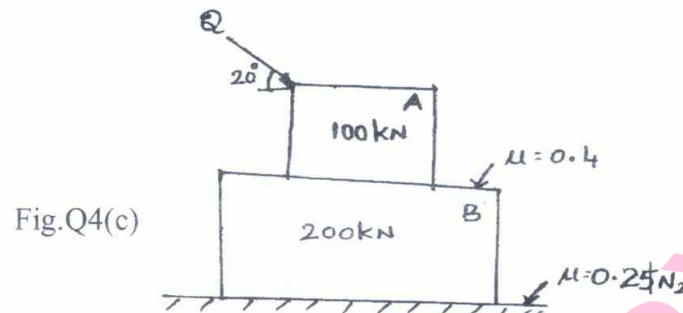
### MODULE - 2

- 3 a. Define the following : i) Equilibrant ii) Resultant force iii) Angle of friction iv) Angle of Repose. (08 Marks)
- b. A vertical mast AC as shown in fig.Q3(b) supports two cables with tension 3kN and 7kN at the angles shown. BC is a guy wire to be situated at a distance X from the mast base. The resultant of the force system is limited to 2kN maximum and must acts vertically down the mast. Calculate the value of the distance X. (08 Marks)

Fig.Q3(b)

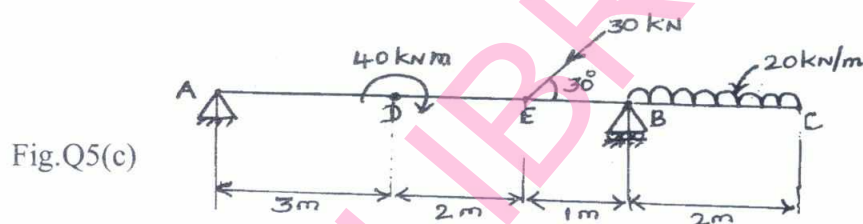


- 4 a. Explain different types of frictions. (04 Marks)  
 b. State and prove Lami's theorem. (04 Marks)  
 c. Figure Q4(c) shows two blocks along with values of  $\mu$ . Determine the force  $Q$  to be applied for impending motion between A and B. Will this force cause movement between B and the ground? (08 Marks)

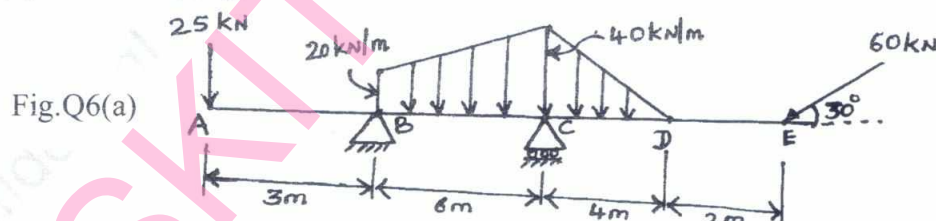


### MODULE - 3

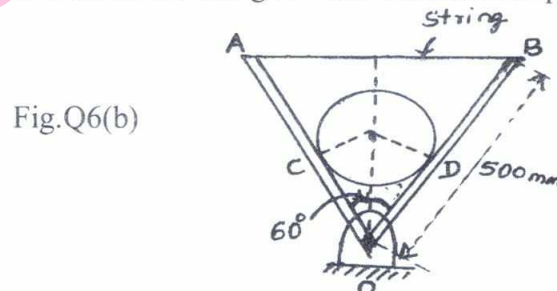
- 5 a. Mention the different types of supports with neat sketch. (04 Marks)  
 b. Explain different types of horizontal members which generally placed on supports. (04 Marks)  
 c. Determine the reactions at A and B of the overhanging beam as shown in fig. Q5(c). (08 Marks)



- 6 a. A beam ABCDE is hinged at supports B and has roller at C carries load as shown in fig. Q6(a). Determine supports reactions. (08 Marks)



- b. A cylinder of radius 50mm and weighing 200N is kept in equilibrium position as shown in fig. Q6(b). Find tension in the string AB and reaction component at hinge O. (08 Marks)

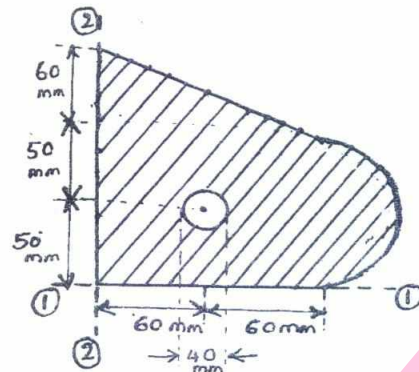




MODULE - 4

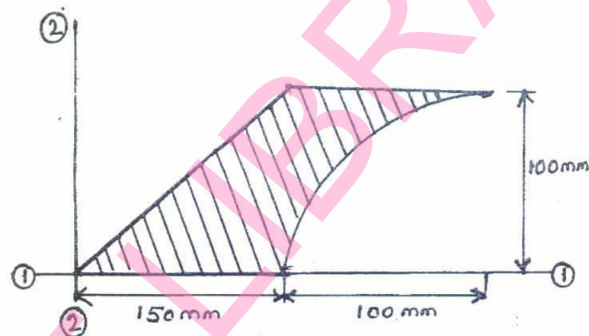
- 7 a. State and prove parallel axis theorem. (06 Marks)  
 b. Determine the position of centroid of the lamina with circular cutout as shown in fig. Q7(b). (10 Marks)

Fig.Q7(b)



- 8 a. Determine Centroid of a triangle by method of Integration. (06 Marks)  
 b. Find the moment of Inertia of the region in fig. Q8(b) about horizontal axis ①-① and also find the radius of gyration about the same axis. (10 Marks)

Fig.Q8(b)

MODULE - 5

- 9 a. Define the following : i) Kinematics ii) Kinetics iii) Motion iv) Path. (04 Marks)  
 b. What is Super elevation and what is its necessity? (04 Marks)  
 c. A projectile is projected from a point at an angle of elevation of  $30^\circ$  with a velocity of 600m/sec. Find the velocity and direction of motion of the particle at the end of  
 i) 25 seconds ii) 40 seconds. (08 Marks)
- 10 a. Define the following : i) Uniform velocity ii) Rectilinear motion iii) Curvilinear motion iv) Projectile. (04 Marks)  
 b. A particle falling under gravity falls 30 meters in a certain second. Find the time required to cover the next 30 meters. Take  $g = 9.8\text{m/sec}^2$ . (04 Marks)  
 c. A vehicle carrying a vertical rocket launcher moves to the right at a constant velocity 35m/s along horizontal track. It launches a rocket vertically upwards with an initial velocity of 45m/s relative to the vehicle.  
 i) How high will the rocket go up?  
 ii) Where will the rocket land relative to the vehicle?  
 iii) How far does the vehicle move while the rocket is in the air?  
 iv) At what angle relative to the horizontal is the rocket travelling just when it leaves the vehicle as observed by an observer at rest on the ground? (08 Marks)

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**First/Second Semester B.E. Degree Examination, June/July 2016**  
**Programming in C and Data Structures**

Time: 3 hrs.

Max. Marks: 80

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

**Module-1**

- 1 a. Define Pseudo code. Write a Pseudo code to find sum and average of given three numbers. (05 Marks)
- b. What is an identifier? What are the rules to construct identifier? Classify the following as Valid/Invalid Identifiers.  
 i) num2    ii) \$num1    iii) +add    iv) a\_2 (06 Marks)
- c. Write a C program to find area of rectangle. (05 Marks)

**OR**

- 2 a. Explain printf and scanf functions with example. (04 Marks)
- b. List all the operators used in C. Give examples. (08 Marks)
- c. Write the output of the following C code  
 i) void main ( )  
 {  
   int a = 5, b = 2, res1 ;  
   float f1 = 5.0, f2 = 2.0, res2 ;  
   res1 = 5/2.0 + a/2 + a/b ;  
   res2 = f1/2 \* f1 - f2 ;  
   printf ("res1 = %d res2 = %f", res1, res2) ;  
 }  
 ii) void main ( )  
 {  
   int i = 5, j = 6, m, n ;  
   m = ++ i + j ++ ;  
   n = -- i + j -- ;  
   printf ( "m = %d    n = %d", m, n) ;  
 } (04 Marks)

**Module-2**

- 3 a. List all the conditional control statements used in C. Write a C program to find the biggest of three numbers. (08 Marks)
- b. Write a C program to find the reverse of an integer number NUM and check whether it is PALINDROME or NOT. (08 Marks)

**OR**

- 4 a. Explain the switch statement with syntax and example. (08 Marks)
- b. List the differences between the while loop and do – while loop. Write a C program to find sum of Natural numbers from 1 to N using for loop. (08 Marks)

**Module-3**

- 5 a. What is an array? Explain the declaration and initialization of single and double dimensional arrays with example. (08 Marks)
- b. Write a C program to search a name in a list of names using Binary searching technique. (08 Marks)

**OR**

- 6 a. Explain any Five string manipulation library functions with example. (08 Marks)
- b. Write a C program to read N elements and find biggest element in the array. (08 Marks)

**Module-4**

- 7 a. What is structure? Explain the syntax of structure declaration and initialization with example. (05 Marks)
- b. Write a C program to maintain a record of 'n' employee detail using an array of structures with three fields (id, name, salary) and print the details of employees whose salary is above 5000. (07 Marks)
- c. Explain fprintf and fscanf functions with syntax. (04 Marks)

**OR**

- 8 a. Explain structure with in a structure with an example. (07 Marks)
- b. What is a file? Explain fopen and fclose functions. (05 Marks)
- c. Explain fgets and fputs functions. (04 Marks)

**Module-5**

- 9 a. What is a pointer? Explain how the pointer variable is declared and initialized. (04 Marks)
- b. Explain any two preprocessor directives in C with example. (06 Marks)
- c. Write a C program to swap two numbers using call by pointers (address) method. (06 Marks)

**OR**

- 10 a. What is dynamic memory allocation? Write and explain the different dynamic memory allocation functions in C. (06 Marks)
- b. Explain stack and Queue data structures along with their applications. (06 Marks)
- c. Explain how pointers and arrays are related with example. (04 Marks)

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# CBCS Scheme

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15EME14/24

## First/Second Semester B.E. Degree Examination, June/July 2016 Elements of Mechanical Engineering

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. Explain the working of a hydroelectric power plant with a neat sketch. (10 Marks)
- b. Distinguish between renewable and non-renewable sources of energy with suitable examples. (06 Marks)

OR

- 2 a. With a neat sketch, explain the working of a water tube boiler. Show the path of flue gases. (10 Marks)
- b. Draw a neat sketch of temperature-Enthalpy diagram and indicate the following on it:  
Latent heat of evaporation, Amount of super heat, Sensible heat, Degree of superheat, Saturation temperature. (06 Marks)

### Module-2

- 3 a. Discuss the advantages of steam turbines over other prime movers. (10 Marks)
- b. Draw a neat sketch of a simple impulse water turbine indicating the parts. Explain its working. (06 Marks)

OR

- 4 a. Explain the working of a four stroke petrol engine with neat sketches. (10 Marks)
- b. A 4-cylinder two stroke engine develops 30 kW at 2500 rpm. Calculate the diameter and stroke of each cylinder if the stroke to bore ratio is 1.5. The mean effective pressure on each piston is 6 bar and its mechanical efficiency is 80%. (06 Marks)

### Module-3

- 5 a. Explain the process of taper turning by swiveling of the compound rest with a neat sketch. (10 Marks)
- b. Differentiate between:  
(i) Drilling and reaming.  
(ii) Boring and counter boring. (06 Marks)

OR

- 6 a. Explain the Cartesian co-ordinate configuration and spherical co-ordinate configuration of robots with neat sketches. (10 Marks)
- b. Mention the advantages and limitations of automation. (06 Marks)

### Module-4

- 7 a. Define composite materials. How are composites classified? (10 Marks)
- b. Mention the applications of composite materials in aerospace and automotive industries. (06 Marks)

OR

- 8 a. Explain the principle of arc welding with a neat sketch. (10 Marks)  
b. List the different types of oxyacetylene flames and state their applications. (06 Marks)

**Module-5**

- 9 a. Explain the working principle of a vapour compression refrigeration system with a neat sketch. (10 Marks)  
b. List the desirable properties of a refrigerant. (06 Marks)

**OR**

- 10 a. With a neat sketch, explain the working of a room air conditioner. (10 Marks)  
b. Distinguish between refrigeration and air conditioning. (06 Marks)

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## First/Second Semester B.E. Degree Examination, June/July 2016 Basic Electrical Engineering

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. State and explain Kirchoff's laws. (05 Marks)
- b. Find the currents in the various branches of the given network shown in Fig. Q1 (b). (06 Marks)

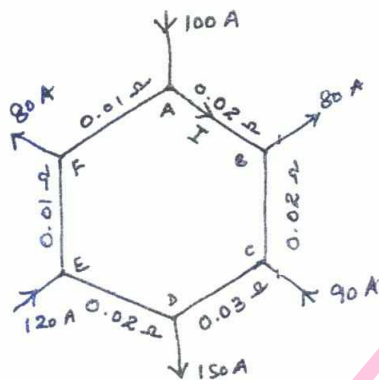


Fig. Q1 (b)

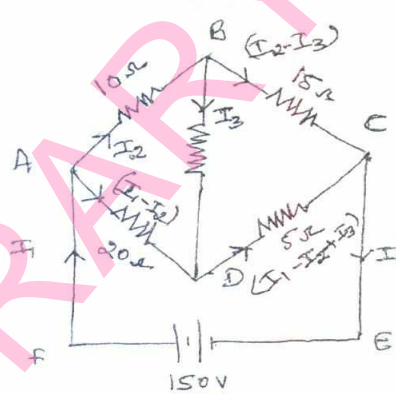


Fig. Q2 (b)

- c. Define the co-efficient of coupling and find its relation with  $L_1$ ,  $L_2$  and  $M$ . (05 Marks)

OR

- 2 a. State ohm's law and mention its limitations. (05 Marks)
- b. In the network shown in Fig. Q2 (b), find the currents flowing in each branch using Kirchoff's laws. (06 Marks)
- c. Define mutual inductance and explain with respect to two coils placed very close to each other. (05 Marks)

### Module-2

- 3 a. With a neat sketch, explain the construction of the various parts of a D.C. generator. (05 Marks)
- b. What is the significance of back EMF in a D.C. motor? (05 Marks)
- c. With a neat figure, explain the construction and working principle of a dynamometer type wattmeter. (06 Marks)

OR

- 4 a. Derive the EMF equation of a D.C. generator. (05 Marks)
- b. Derive an equation for the torque developed in the armature of a D.C. motor. (05 Marks)
- c. With a neat figure, explain the construction and working principle of an induction type single phase energy meter. (06 Marks)



**Module-3**

- 5 a. Derive an expression for average value of an alternating quantity. (05 Marks)
- b. A circuit consists of a resistance of  $10\ \Omega$ , an inductance of  $16\ \text{mH}$  and a capacitance of  $150\ \mu\text{F}$  connected in series. A supply of  $100\ \text{V}$  at  $50\ \text{Hz}$  is given to the circuit. Find the current, pf and power consumed by the circuit. Draw the vector diagram. (06 Marks)

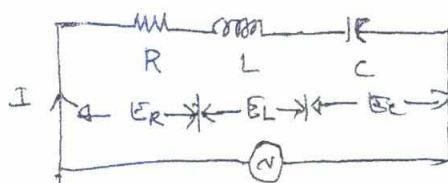


Fig. Q5 (b)

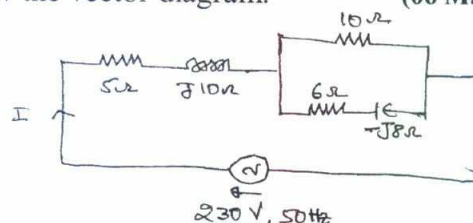


Fig. Q6 (b)

- c. With a circuit diagram, explain the working of a three way control of lamp. (05 Marks)

**OR**

- 6 a. Define RMS value of a sinusoidally varying current and find its relation with its maximum value. (05 Marks)
- b. Find the total current, power and power factor of the circuit given in Fig. Q6 (b). (05 Marks)
- c. With a neat figure, explain plate earthing. (06 Marks)

**Module-4**

- 7 a. In a three phase star connection, find the relation between line and phase values of currents and voltages. Also derive the equation for three phase power. (05 Marks)
- b. Show that the two wattmeters are sufficient to measure three phase power. Also derive an expression for the power factor in terms of wattmeter readings. (06 Marks)
- c. A 6 pole, 3 phase, star connected alternator has an armature with 90 slots and 12 conductors per slot. It revolves at  $1000\ \text{rpm}$ , the flux per pole being  $0.5\ \text{web}$ . Calculate the emf generated, if the winding factor is  $0.97$  and all the conductors in each phase are in series. The coil is full pitched. (05 Marks)

**OR**

- 8 a. In a 3 phase delta connection, find the relation between line and phase values of currents and voltages. Also derive an equation for three phase power. (05 Marks)
- b. Explain the effect of power factor on the two wattmeter readings connected to measure three phase power. (06 Marks)
- c. A 6 pole, 3 phase,  $50\ \text{Hz}$  alternator has 12 slots per pole and 4 conductors per slot. The winding is  $5/6$  full pitched. A flux of  $25\ \text{mWb}$  is sinusoidally distributed along the air gap. Determine the line emf, if the alternator is star connected. (05 Marks)

**Module-5**

- 9 a. Derive the EMF equation of a transformer. (05 Marks)
- b. Find the number of turns on the primary and secondary side of a  $440/230\ \text{V}$ ,  $50\ \text{Hz}$  single phase transformer, if the net area of cross section of the core is  $30\ \text{cm}^2$  and the flux density is  $1\ \text{Wb/m}^2$ . (06 Marks)
- c. Define the slip of an induction motor and derive the relation between the supply frequency and rotor current frequency. (05 Marks)

**OR**

- 10 a. Explain the different losses occurring in a transformer. (05 Marks)
- b. A single phase,  $20\ \text{KVA}$  transformer has  $1000$  primary turns and  $2500$  secondary turns. The net cross sectional area of the core is  $100\ \text{cm}^2$ . When the primary winding is connected to  $550\ \text{V}$ ,  $50\ \text{Hz}$  supply, calculate (i) the maximum value of the flux density in the core, (ii) The voltage induced in the secondary winding and (iii) the primary and secondary full load currents. (06 Marks)
- c. With a circuit diagram, explain the working of a star-delta starter for a three phase induction motor. (05 Marks)

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**First/Second Semester B.E. Degree Examination, June/July 2016**  
**Basic Electronics**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, choosing at least two from each part.  
 2. Answer all objective type questions only in OMR sheet page 5 of the answer booklet.  
 3. Answer to objective type questions on sheets other than OMR will not be valued.

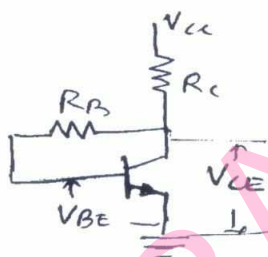
**PART – A**

- 1 a. Choose the correct answers for the following :
    - i) The cut in voltage of silicon PN Diode is about  
 A) 0.6mV                      B) 0.6V                      C) 1.2mV                      D) 1.2V
    - ii) The efficiency of full wave Rectifies is about  
 A) 40.6%                      B) 0.46%                      C) 121%                      D) 81.2%
    - iii) In Reverse Bias the diode acts as a  
 A) open circuit                      B) short circuit  
 C) a battery of 0.7V                      D) A current source.
    - iv) The peak inverse voltage of a FWR with centre tap transformer.  
 A)  $V_m$                       B)  $\sqrt[3]{V_s}$                       C)  $2V_m$                       D)  $2V_s$                       (04 Marks)
  - b. With a neat diagram and waveforms, explain the working principle of full wave Rectifier. (08 Marks)
  - c. A Zener Diode has breakdown voltage of 10V. It is supplied from a voltage source varying between 20-40V in series with a resistance of  $820\Omega$ . Using an ideal zener model. Obtain minimum and maximum zener currents. (08 Marks)
- 2 a. Choose the correct answers for the following :
    - i) In a transistor part heavily dope is  
 A) Emitter                      B) Base  
 C) Collector                      D) All are equally doped.
    - ii) The transistor operating point is chosen along the  
 A) X-axis                      B) Load line  
 C) Resistance line                      D) The characteristics
    - iii) In transistor the current conduction is due to  
 A) Majority                      B) Minority                      C) Both                      D) None of these
    - iv) In CE configuration, when collector current is zero  $V_{CE}$  equals  
 A)  $\frac{V_{CC}}{R_C / R_E}$                       B)  $V_{CE}$                       C)  $\frac{V_{CC}}{R_C}$                       D)  $V_{CC}/R_E$                       (04 Marks)
  - b. Draw the input and output characteristics of CE circuit. Explain Active saturation and cutoff Regions. (08 Marks)
  - c. Obtain the relation between  $\alpha_{dc}$  and  $\beta_{dc}$  (04 Marks)
  - d. If a transistor collector current is 1mA and basic current is  $10\mu A$ . Determine  $\alpha$  and  $\beta$ . (04 Marks)



- 3 a. Choose the correct answers for the following :
- The biasing circuit, which gives most stable operating point is  
 A) Basic Bias B) Collector Basic bias  
 C) Voltage divider bias D) None of these.
  - The reverse saturation current doubles for every \_\_\_\_\_ °C rise in temperature.  
 A) 40 B) 45 C) 10 D) 30
  - When used as a switch the transistor operates in  
 A) Active Region B) Saturation and cutoff  
 C) Cutoff region D) Active & Saturation
  - The stability factors is the rate of change of collector current with  
 A) Base current B) Reverse saturation current C) Emitter current D)  $V_{CC}$  (04 Marks)
- b. List the transistor biasing circuits. Explain with neat circuit the operation of basic bias. (08 Marks)
- c. Design a collector to base bias circuit for the specified conditions  $V_{CC} = 15V$ ,  $I_C = 5mA$ ,  $\beta = 100$ ,  $V_{BE} = 0.7V$ . (04 Marks)

Fig. Q3(c)



- d. Explain the D. C load line and operating point with example related to the transistor. (04 Marks)
- 4 a. Choose the correct answers for the following :
- An SCR is a \_\_\_\_\_ device  
 A) Amplifying B) Switching C) Negative D) Blocking
  - The FET is a \_\_\_\_\_ controlled device  
 A) Voltage B) Current C) Power D) None of these
  - The relaxation oscillator uses  
 A) MOSFET B) SCR C) VJT D) BJT
  - JFET is a \_\_\_\_\_ device  
 A) Bipolar B) Unipolar C) Uni-bipolar D) None of these (04 Marks)
- b. Explain the operation of SCR using the two transistor equivalent circuit. (08 Marks)
- c. Explain the basic construction and equivalent circuit of UJT. (08 Marks)

### PART – B

- 5 a. Choose the correct answers for the following :
- In mid –frequency band the voltage gain is  
 A) Increasing B) decreasing C) constant D) None of these
  - The criteria for producing oscillations are known as  
 A) Doppler B) Barkhausen C) Miller D) Bandwidth
  - The stability of an amplifier \_\_\_\_\_ with negative feedback  
 A) Improves B) deteriorates  
 C) is not affected D) depends on negative feedback
  - The input capacitor in a CE amplifier blocks  
 A) AC signal B) DC component C) Both AC & DC D) Noise (04 Marks)
- b. With a neat circuit diagram, explain the working of single stage RC coupled amplifier and draw the frequency response curve and explain the curve. (08 Marks)
- c. Draw a neat diagram of Hartley's oscillator and explain its working. What is the frequency of oscillator? (08 Marks)



- 6 a. Choose the correct answers for the following :
- Ideal Op-AMP has a CMRR equal to  
A) Zero B) Infinity C) Unity D) None of these
  - The Op-AMP is basically a \_\_\_\_\_ amplifier  
A) Positive feedback B) Differential C) common emitter D) common signal
  - The Op-Amp can amplify  
A) AC signal only B) DC signal only  
C) Both AC & DC signal D) None of these
  - In an inverting amplifier  $R_1 = 1K$  and  $R_f = 2K$ . Input voltage is 2V. The output voltage  
A) -2V B) -0.5V C) 4V D) -4V
- (04 Marks)
- b. Explain the term OP-AMP. List the characteristics of an ideal OP-AMP. (08 Marks)
- c. Show with a circuit diagram how the OP -Amp can be used as
- Inverting amplifier
  - summer
  - Integrator
  - Differentiator.
- (08 Marks)
- 7 a. Choose the correct answers for the following :
- $(11011)_2 = ( \quad )_8$ .  
A)  $(33)_8$  B)  $(17)_8$  C)  $(25)_8$  D)  $(28)_8$
  - The binary equivalent of decimal number 6 is  
A) 100 B) 011 C) 110 D) 1001
  - The circuit that recovers the original modulating signal from AM signal is  
A) Modulator B) Mixer C) Demodulator D) oscillator
  - The BCD representation of decimal 10 is  
A) 0000 1010 B) 0000 1001 C) 000 10000 D) 1010 0000
- (04 Marks)
- b. Draw the block diagram of super heterodyne receiver and explain the function of each block. (08 Marks)
- c. A 500W, 100kHz carrier is modulated to a depth of 60% by modulating signal frequency of 1KHz. Calculate the total power transmitted. What are the sideband components of the AM wave? (08 Marks)
- 8 a. Choose the correct answers for the following :
- The output is high only when both inputs are zero to a gate, the gate is  
A) AND B) NOR C) OR D) NAND
  - De Morgan's theorem states that  $\overline{A + B} =$   
A)  $\overline{A} + \overline{B}$  B)  $\overline{A} \cdot \overline{B}$  C)  $\overline{AB}$  D) None of these
  - A NOT gate can be built using  
A) MOSFET B) Diode C) Zener diode D) BJT
  - The Boolean expression  $Y = A.B$  represents  
A) OR gate B) XNOR gate C) AND gate D) NOT gate
- (04 Marks)
- b. What are universal gates? Implement NOT, OR, AND using NAND gates. (08 Marks)
- c. Explain the working of parallel Binary adder with an example. (08 Marks)

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## CBCS Scheme

USN

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Question Paper Version : C

**First/Second Semester B.E Degree Examination, June/July 2016**  
**Environmental Studies**

**(COMMON TO ALL BRANCHES)**

Time: 2 hrs.]

[Max. Marks: 40

**INSTRUCTIONS TO THE CANDIDATES**

1. Answer all the forty 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.

1. Water use for irrigation of food crops, fodder crops and medical herbs is known as,  
a) Consumptive use    b) Commercial use    c) Auxiliary use    d) Productive use
2. Global warming could affect,  
a) Climate    b) Increase in sea level    c) Melting of Glaciers    d) All of the above
3. The average life expectancy around the world is currently,  
a) decreasing    b) increasing    c) not changing    d) stabilizing
4. The objective of integrated child development services (ICDS) are,  
a) Immunization    b) Health checkup and referral services  
c) Pre school non formal education    d) All of these
5. The universal declaration of Human rights was proclaimed by the UN in the year,  
a) 1946    b) 1947    c) 1948    d) 1949
6. The Leader of chipko movement is,  
a) Sunderlal Bahuguna    b) Medha Patkar  
c) Vandana Shiva    d) Suresh Heblikar

7. In an ecosystem the flow of energy is,  
a) Bidirectional      b) Unidirectional      c) Cyclic      d) None of these
8. E.I.A is related to,  
a) Resource conservation      b) Efficient equipment process  
c) Waste minimization      d) All of the above
9. Taj Mahal at Agra may be damaged by,  
a) Sulphur dioxide      b) Chlorine      c) Hydrogen      d) Oxygen
10. Minamata disease is caused due to  
a) Lead      b) Arsenic      c) Mercury      d) Codmium
11. The term ecosystem was proposed by,  
a) Jacob Van Verkul      b) A.G. Tansley  
c) Costanza      d) Marrie Gibbs
12. World Environment day is on,  
a) 5<sup>th</sup> May      b) 5<sup>th</sup> June      c) 18<sup>th</sup> July      d) 16<sup>th</sup> August
13. Physical pollution of water is due to,  
a) Dissolved oxygen      b) Turbidity      c) PH      d) None of the above
14. Which pyramid is always upright?  
a) Energy      b) Bio mass      c) Numbers      d) Food chain
15. Disfigurement in the teeth is caused by excessive amount of,  
a) Mercury      b) Nitrate      c) Fluoride      d) Lead
16. The first international earth Summit was held in,  
a) Johannes burg      b) Kyoto      c) Riode Janeiro      d) Stock holm
17. In aquatic ecosystem, phytoplankton can be considered as a,  
a) Consumer      b) Producer      c) Decomposers      d) Macro consumer
18. Which state is having highest woman literacy rate in India?  
a) Karnataka      b) Punjab      c) Rajasthan      d) Kerala
19. \_\_\_\_\_ are referred to as earth's Lungs,  
a) Forest      b) Carbon cycle      c) Water sources      d) Mines
20. Biomass power generation uses,  
a) Crop      b) Animal dung      c) Wood      d) All of these
21. The international protocol to protect the ozone layer is,  
a) The Montreal protocol      b) Kyto protocol  
c) The Vienna protocol      d) Cartagena protocol



22. Which of the following is not a green house gas,  
 a) Hydrochloro fluorocarbons                      b) Methane  
 c) Carbon dioxide                                      d) Oxygen
23. Major compound responsible for the destruction of stratospheric ozone layer is,  
 a) Oxygen                      b) CFC                      c) Carbon dioxide                      d) Methane
24. Which of the following is not a method for water conservation?  
 a) Rain water harvesting                      b) Ground water extraction  
 c) Improving irrigation efficiency                      d) Avoiding water wastage.
25. What is the permissible range of pH for drinking water as per the Indian standards?  
 a) 6 – 9                      b) 6 – 8.5                      c) 6.5 – 7.5                      d) 6.5 to 8.5
26. Who is the author of the book “Silent Spring”?  
 a) Robin cook                      b) Arthur Hailey                      c) Rachel carson                      d) Darwin
27. Amount of oxygen present in atmospheric air is,  
 a) 0.03%                      b) 21%                      c) 36%                      d) 0.9%
28. Remote sensing is a,  
 a) Satellite system                      b) Ground system                      c) Sensor system                      d) None of the above
29. GIS can be expanded as,  
 a) Geological information system                      b) Geographic information system  
 c) Geographic internet system                      d) Geodynamic information system
30. Geothermal energy is a,  
 a) Heat energy                      b) Wind energy                      c) Current energy                      d) Solar energy
31. Charnobyl nuclear disaster occurred in the year,  
 a) 1984                      b) 1987                      c) 1986                      d) 1988
32. Demography is the study of,  
 a) Animals behaviour                      b) Population growth                      c) River                      d) None of these
33. Ozone layer is present in,  
 a) Troposphere                      b) Stratosphere                      c) Mesosphere                      d) Thermosphere
34. The Central Pollution Control Board (CPCB) was established in the year,  
 a) 1974                      b) 1982                      c) 1986                      d) 1976
35. Which of the following is NGO?  
 a) Narmada Bachao Andolan                      b) CPCB  
 c) KSPCB                      d) None of these

36. Smog is a,  
a) National phenomena  
b) Colourless  
c) Combination of smoke and Fog  
d) None of these
37. Which of the following is the source of Fly ash,  
a) Vehicle exhausts  
b) Sewage  
c) Thermal power plant  
d) All of these
38. Ozone layer thickness is measured in,  
a) PPM  
b) PPb  
c) Decibels  
d) Dobson unit
39. Energy is measured in,  
a) BIU  
b) Bhu  
c) Btu  
d) Ntu
40. Nuclear waste is active for,  
a) 5 year  
b) 10 years  
c) 50 years  
d) 100 years

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## CBCS SCHEME

USN

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Question Paper Version : D

**First/Second Semester B.E Degree Examination, June/July 2016**  
**Constitution of India, Professional Ethics & Human Rights**  
**(COMMON TO ALL BRANCHES)**

Time: 2 hrs.]

[Max. Marks: 40

**INSTRUCTIONS TO THE CANDIDATES**

1. Answer all the forty 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.

- 
1. Gram Panchayat is a completely \_\_\_\_\_ body  
a) Elected                      b) Nominated                      c) Selected                      d) None of these
  2. Gram Panchayat is the primary organ of the \_\_\_\_\_ tier system  
a) Two                      b) Four                      c) Three                      d) One
  3. Professional Ethics is  
a) Set of rules passed by professional bodies  
b) Set of rules relating to personal character of professionals  
c) Set of standards adopted by Professionals  
d) Traditional rules observed since a long time.
  4. Minimalist view means  
a) A narrow thinking                      b) A ministerial view  
c) A novel plan to minimize industrial loss                      d) A concept of responsibility.
  5. The formulae of a soft drink is an example of  
a) Trade secret                      b) Patent                      c) Copy right                      d) Trade mark
  6. According to Indian constitution the power of amending the constitution are rested with  
a) President of India                      b) Parliament of India  
c) People of India                      d) The Prime Minister of India
  7. Which of the following words was not added by the 42<sup>nd</sup> Amendment Act, to the Indian Constitution  
a) Secular                      b) Socialist                      c) Flexible                      d) Integrity
  8. Minority Groups are recognized on the basis of their  
a) Population                      b) Religion                      c) Race                      d) Caste



9. Jobs are reserved for SC & ST people
  - a) At the time of appointment
  - b) At the time of promotion
  - c) Both at the time of appointment and promotion
  - d) On the basis of their annual income
10. Under the provisions of which Article of the constitution the Government abolished the practice of untouchability
  - a) Article 18
  - b) Article 17
  - c) Article 16
  - d) Article 20
11. The President of India is
  - a) Elected
  - b) Selected
  - c) Appointed
  - d) Nominated
12. The term of office of the President is \_\_\_\_\_ years.
  - a) 5 years
  - b) 4 years
  - c) 6 years
  - d) 7 years
13. The present Speaker of the Lok Sabha is \_\_\_\_\_
  - a) Meira Kumar
  - b) Sumitra Mahajan
  - c) Somnath Chatterjee
  - d) Jaypal Reddy
14. Maximum strength of Rajya Sabha is
  - a) 200
  - b) 280
  - c) 250
  - d) 300
15. The Prime Minister is
  - a) Constitutional Head
  - b) Head of State
  - c) Head of State as well as Government
  - d) Head of Government
16. India has been described under Article 1 of the constitution as a
  - a) Confederation
  - b) Federation
  - c) Federation with strong unitary bias
  - d) Union of States
17. Preamble declares that the constitution of India was adopted on
  - a) 26<sup>th</sup> November 1949
  - b) 15<sup>th</sup> August 1947
  - c) 26<sup>th</sup> January 1950
  - d) 15<sup>th</sup> July 1946
18. The Constitution supports
  - a) Rule of Men
  - b) Rule of Individuals
  - c) Rule of Law
  - d) Rule of women
19. Part III<sup>rd</sup> from Articles 12 to 35 of the Indian constitution contains
  - a) Fundamental Rights
  - b) Directive principles of State policy
  - c) Emergency provisions
  - d) Citizenship.
20. Original constitution classified Fundamental Rights into seven categories but now there are
  - a) Five Rights
  - b) Six Rights
  - c) Four Rights
  - d) Eight Rights
21. It is not a kind of trademark
  - a) Symbols
  - b) Sounds
  - c) Goodwill
  - d) Designs
22. An author retains copy right for
  - a) 100 years
  - b) 50 years
  - c) 60 years
  - d) 20 years
23. The risk expert's approach is usually
  - a) Biased
  - b) Favorable to employer
  - c) Utilitarian
  - d) None of these
24. In which year did the cabinet mission come to India
  - a) 1942
  - b) 1946
  - c) 1947
  - d) 1949
25. Who of the following acted as the constitutional advisor to the Constituent Assembly
  - a) Sachidananda Sinha
  - b) B.R. Ambedkar
  - c) Rajendra Prasad
  - d) B.N. Rau.

26. While Proclamation of Emergency is in operation, the President cannot suspend certain Fundamental rights  
 a) Article 14 & 16      b) Article 32      c) Article 19 & 23      d) Article 20 & 21
27. When a State Emergency is declared all or any of the functions of the State Government are assumed by the  
 a) President      b) Governor      c) Chief Minister      d) Union cabinet
28. The National Human Rights commission of India constituted on  
 a) 14 October 1992      b) 20 October 1994      c) 12 October 1993      d) 02 October 1996
29. Human Rights are  
 a) Local      b) Universal      c) Regional      d) None of these
30. The Town and City municipality members enjoy a term of \_\_\_\_\_ years  
 a) 4 years      b) 6 years      c) 3 years      d) 5 years
31. Who appoints the Governor of the State  
 a) The President      b) Chief Justice of India  
 c) Chief Justice of State      d) Chief Minister
32. A High Court judge retires at the age of  
 a) 65 years      b) 62 years      c) 63 years      d) 60 years
33. How many houses are there in the Parliament  
 a) 3      b) 4      c) 2      d) 5
34. Election Commission of India is  
 a) Multimember commission      b) Two member commission  
 c) One member commission      d) None of these.
35. The power to superintend direct and control elections is rested in the \_\_\_\_\_  
 a) Finance commission      b) Planning commission  
 c) Cabinet commission      d) Election commission
36. Cultural and Educational Rights under Article 29 and 30 are also called as \_\_\_\_\_  
 a) Legal Rights      b) Moral Rights      c) Minority Rights      d) Majority Rights
37. The aim of the Directive principles of State policy is to establish  
 a) Socialist State in our Country      b) Capitalist State in our Country  
 c) Welfare State in our Country      d) None of these
38. The Framers of the Indian Constitution borrowed the concept of directive principles of State policy from the constitution of  
 a) USA      b) Ireland      c) Germany      d) British
39. Fundamental Duties are applicable to all  
 a) States      b) Citizens      c) Persons      d) Foreigners
40. Respecting our National Flag is a  
 a) Directive Principles of State policy      b) Fundamental Rights  
 c) Fundamental Duties      d) None of these

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## Second Semester B.E. Degree Examination, June/July 2016 Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 a. Solve :  $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ . (05 Marks)
- b. Solve  $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$ , using inverse differential operator method. (05 Marks)
- c. Solve :  $\frac{d^2y}{dx^2} - y = \frac{2}{1 + e^x}$  by the method of variation of parameters. (06 Marks)

**OR**

- 2 a. Solve :  $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$ , using inverse differential operator method. (05 Marks)
- b. Solve :  $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x \cos x$ , using inverse differential operator method. (05 Marks)
- c. Solve :  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = x^2 + e^x$  by the method of undetermined coefficients. (06 Marks)

### Module-2

- 3 a. Solve :  $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = (1 + x)^2$  (06 Marks)
- b. Solve :  $y \left( \frac{dy}{dx} \right)^2 + (x - y) \frac{dy}{dx} - x = 0$ . (05 Marks)
- c. Solve :  $y = 2px + p^2y$  by solving for x. (05 Marks)

**OR**

- 4 a. Solve :  $(3x + 2)^2 y'' + 3(3x + 2)y' - 36y = 8x^2 + 4x + 1$ . (06 Marks)
- b. Solve :  $y - 2px = \tan^{-1}(xp^2)$  (05 Marks)
- c. Solve the equation  $(px - y)(py + x) = 2p$  by reducing it into Clairaut's form by taking a substitution  $X = x^2$  and  $Y = y^2$ . (05 Marks)

### Module-3

- 5 a. Obtain the partial differential equation by eliminating the arbitrary functions, given that  $z = yf(x) + x\phi(y)$  (05 Marks)
- b. Solve  $\frac{\partial^2 u}{\partial x \partial y} = \frac{x}{y}$  subject to the conditions  $\frac{\partial z}{\partial x} = \log x$  when  $y = 1$  and  $z = 0$  when  $x = 1$ . (05 Marks)
- c. Derive the one dimensional wave equation in the form,  $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$  (06 Marks)



OR

- 6 a. Obtain the partial differential equation of the function,  $f\left(\frac{xy}{z}, z\right) = 0$ . (05 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial z}{\partial x} - 4z = 0$ , subject to the conditions  $z = 1$  and  $\frac{\partial z}{\partial x} = y$  when  $x = 0$ . (05 Marks)
- c. Derive the one dimensional heat equation in the form  $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ . (06 Marks)

**Module-4**

- 7 a. Evaluate  $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} xyz \, dz \, dy \, dx$ . (06 Marks)
- b. Evaluate  $\int_0^1 \int_x^{\sqrt{x}} xy \, dy \, dx$  by changing the order of integration. (05 Marks)
- c. Obtain the relation between beta and gamma function in the form,  

$$\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}.$$
 (05 Marks)

OR

- 8 a. Evaluate  $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$  by changing into polar co-ordinates. (06 Marks)
- b. Find the area enclosed by the curve  $r = a(1 + \cos \theta)$  above the initial line. (05 Marks)
- c. Prove that  $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin \theta}} \times \int_0^{\frac{\pi}{2}} \sqrt{\sin \theta} d\theta = \pi$  (05 Marks)

**Module-5**

- 9 a. Evaluate : (i)  $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$  (ii)  $L\{t^2 e^{-3t} \sin 2t\}$  (06 Marks)
- b. If  $f(t) = \begin{cases} t, & 0 \leq t \leq a \\ 2a - t, & a \leq t \leq 2a \end{cases}$ ,  $f(t + 2a) = f(t)$  then show that  $L[f(t)] = \frac{1}{s^2} \tanh\left(\frac{as}{2}\right)$ . (05 Marks)
- c. Solve by using Laplace transforms,  

$$\frac{d^2 y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}, y(0) = 0, y'(0) = 0$$
 (05 Marks)

OR

- 10 a. Evaluate  $L^{-1}\left\{\frac{4s+5}{(s+1)^2(s+2)}\right\}$ . (06 Marks)
- b. Find  $L^{-1}\left\{\frac{1}{s(s^2+a^2)}\right\}$  by using convolution theorem. (05 Marks)
- c. Express  $f(t) = \begin{cases} 1, & 0 < t \leq 1 \\ t, & 1 < t \leq 2 \\ t^2, & t > 2 \end{cases}$  in terms of unit step function and hence find its Laplace transform. (05 Marks)

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