Q.P. Code: 37608

Duration – 3 Hours **Total Marks : 80**

(1) N.B.:-Question no 1 is compulsory.

(2) **Attempt any THREE questions out of remaining FIVE questions.**

Q.1) a) Find Laplace Transform of the periodic function $|\sin t|$. (5)

b) Find the half range sine series of $f(x) = lx - x^2$, in $(0, l)$. (5)

c) Find the directional derivative of $x^3 + y^3 + z^3 - xyz$ at P(1,1,1) in the direction normal to the surface $x \log z + y^2 = 4$ at Q(1,-2,1). (5)

d) Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. (5)

Q.2 a) Show that the image of the rectangular hyperbola $x^2 - y^2 = 1$ under the transformation $w = \frac{1}{z}$ is the lemniscates $\rho^2 = \cos 2\phi$. (6)

b) Evaluate $\int_0^\infty e^{-t} \left(\int_0^t u^4 \sinh u \cosh u \, du \right) dt$. (6)

c) Obtain Fourier series of $f(x) = \begin{cases} 1 + (2x/\pi) & -\pi \le x \le 0 \\ 1 - (2x/\pi) & 0 \le x \le \pi \end{cases}$. Hence deduce that **(8)**

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$$

Q.3 a) Show that the set of functions $\left\{ Sin\left(\frac{\pi x}{2L}\right), Sin\left(\frac{3\pi x}{2L}\right), Sin\left(\frac{5\pi x}{2L}\right), \ldots\ldots \right\}$ forms an Orthogonal set over the interval $[0, L]$. Construct corresponding orthonormal set. (6)

b) Prove that $\nabla \times \left[\frac{\bar{a} \times \bar{r}}{r^3} \right] = \frac{-\bar{a}}{r^3} + \frac{3(\bar{a} \bullet \bar{r})\bar{r}}{r^5}$. (6)

c) Find the analytic function f(z) = u + iv ,if $u + v = \frac{2 \sin 2x}{e^{2y} + e^{-2y} - 2 \cos 2x}$. **(8)**

Q. 4 a) Verify Green's theorem for $\int_C (xy + y^2)dx + x^2 dy$ where C is the closed path formed by $y = x, y = x^2$. (6)

b) Prove that $\int J_5(x)dx = -J_4 - \frac{4}{x} J_3(x) - \frac{8}{x^2} J_2(x)$. (6)

c) Solve $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=3te^{-t}$, $y(0)=4$, $y'(0)=2$ using Laplace Transform. **(8)**

Q. 5 a) Find the Bilinear Transformation which maps z= 1, i, -1 onto the points w= i,0,-i. (6)

b) Find Inverse Laplace Transform of $\frac{(s+2)^2}{(s^2+4s+8)^2}$ using Convolution theorem. (6)

c) Evaluate $\iint_S \overline{F}\bullet\overline{n}dS$ where S is the surface of the cube bounded by $x=0, y=0, z=0, x=1, y=1, z=1$ and $\overline{F}=4xzi-y^2j+yzk$. **(8)**

Q. 6 a) Evaluate $\int_C (x+2y)dx+(x-z)dy+(y-z)dz$ where C is the boundary of the triangle with vertices $(2,0,0),(0,3,0),(0,0,6)$ oriented in the anti-clockwise direction. (6)

b) Find the Fourier integral representation for $f(x)=\begin{cases}1-x^2 \; for \; |x|\le 1\\ 0 \quad for \quad |x|>1\end{cases}$ (6)

c) Evaluate the inversr Laplace transformation of **(8)**

a) $\log\left(\frac{s^2+a^2}{(s+b)^2}\right)$ b) $\frac{e^{-2s}}{s^2+8s+25}$.

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[Time: 3 Hours] **[Marks: 80]**

Please check whether you have got the right question paper.

N.B:
1. Q**ue**stion No **1**. is **compulsory.**
2. Attempt **any three** from the rest.
3. Write neat and clean
4. Writing answer directly for numerical will not be considered for marks allotment
5. Assume any suitable data wherever required.

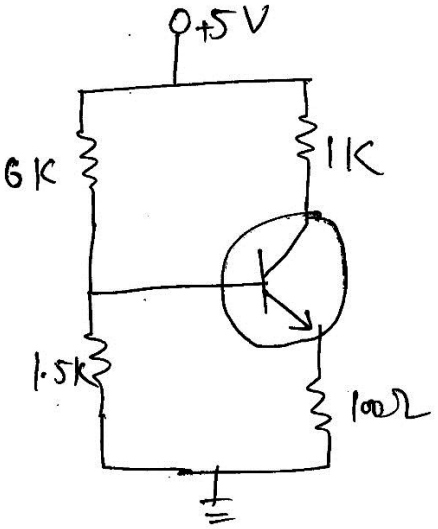
Q.1 Answer **any four** **(20)**

a) Explain input and output characteristic of FET.
b) Explain the ripple factor in case of center tapped full wave rectifier with C filter.
c) Explain the Nyquist criteria of oscillation.
d) Explain voltage shunt current feedback amplifier.
e) Explain enhancement type MOSFET.

Q.2 (a) Explain collpit oscillator with the help of suitable circuit diagram. Derive the expressing of frequency for oscillation and necessary condition for oscillation. **(10)**

(b) Explain double biased clipper with the help of suitable circuit and waveform. **(10)**

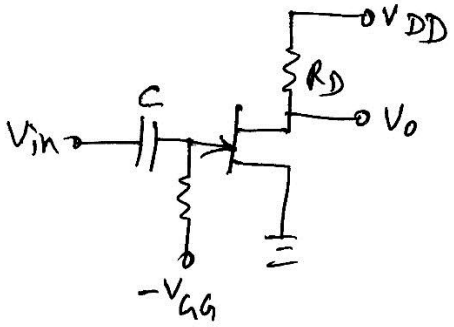
Q.3 (a) For the given circuit find steady state DC parameters I_{cq} and V_{ceq}. Given $\beta = 100$ and $V_{be} =$ 0.7v. Also state in which region the circuit in working. **(10)**



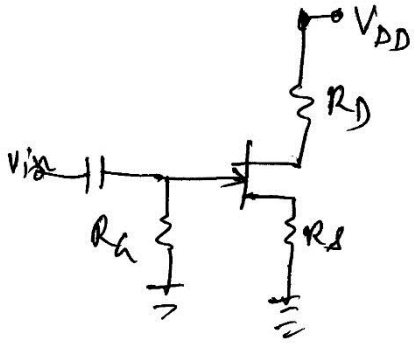
(b) Derive the expressing for stabilization factors for voltage divider biased circuit of BJT. **(10)**

Q.4 (a) Draw the circuit diagram of cascade and cascade amplifiers and differentiate it. **(10)**

(b) Given V_{GG} = 1.5V, V_{DD} = 15V, R_D = 1.5kΩ, R_G = 1.5kΩ, I_{DSS} = 15mA, V_P = -4V **(05)**
Determine V_{GS} and I_D and V_{DS}.



(c) In JEET circuit show with self bias V_{DD} = 25V, R_D = 3kW, R_S = 400W, ID = 2.mA **(05)**
Determine V_{DS} and V_{GS}



Q.5 (a) Draw and explain the h-parameter model of BJT and derive the expression for A_v, A_i, R_i. **(10)**
Consider CE configuration.

(b) Explain various configuration of feedback amplifier. Explain current series feedback in detail. **(10)**

Q.6 Write short note on **any two** **(20)**

(a) Thermal runaway in BJT and FET

(b) r_e model of BJT

(c) RC phase shift oscillator.

Q. P. Code:-23916

[Time: Three Hours] **[Marks:80]**

1) Question No.1 is compulsary.
2) Attempt any 3 questions from remaining four questions.
3) Figure to the right indicate full marks.
4) Make suitable assumptions wherever necessary.
5) Draw suitable diagram wherever necessary

Q 1 20

a) Compare the nuclear fission and fusion
b) State advantages and disadvantages of gas turbine power plant
c) Explain hydraulic cycle
d) Explain the working of PV cells with the neat diagram

Q 2 20

a. Explain typical layout of thermal power plant
b. Explain various factors and effect of fluctuating load on operation of power plant and also explain method to meet fluctuating load.

Q 3 20

a) Draw and explain the general layout of diesel power plant.
b) The maximum demand of power station is 96000kW. It has to supply the load as follow:

Time(hrs)	0-6	6-8	8-12	12-14	14-18	18-22	22-24
Load(MW)	48	60	72	60	84	96	48

i. Draw load curve and load duration curve
ii. Calculate load factor

Q 4 20

a. Explain horizontal axis and vertical axis wind turbine
b. Draw a neat layout of hydroelectric power plant and explain in brief.
   i. Reservoir
   ii. Dam
   iii. Penstock
   iv. Surge tank

Q 5 Write shot notes on any two: 20

a. Boiling water reactor(BWR)
b. Fuel Cell
c. power generation by using biomass
d.Solar Collector

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Time: (3 Hours) **Total Marks – 80**

Note: 1) Question No.1 is compulsory.
2) Attempt any three questions out of remaining five question.
3) Assume suitable data if required.

Q.1 (a) Differentiate between indicating and integrating instrument. (4)

(b)Explain resolution and sensitivity of digital meter. (4)

(c)Discuss the broad classification of Transducer. (4)

(d)Explain a De Sauty's bridge to measure the capacitance of capacitor. (4)

(E)Explain resistance temperature detector (RTD)and piezoelectric transducer. (4)

Q.2 (A) Explain working principle construction of moving iron instrument and hence derive the torque equation. (10)

(b)Describe construction,working principle and theory of dynamometer type wattmeter. (10)

Q.3 (a) Explain with block diagram Ramp type digital voltmeter. (10)

(b)Explain working principal of Schering bridge and hence derive the equation for unknown quantity. (10)

Q.4 (a) Explain Maxwell's Inductance bridge to measure self inductance and hence derive the equation for self inductance using above bridge, draw phasor diagram. (10)

(b)Explain the construction and working of D.C. Crompton type potentiometer. (10)

Q.5 (a) A moving coil instrument gives a full scale deflection of 10mA when the potential difference across its terminals is 100 mV. Calculate

(i)The shunt resistance for a full scale deflection corresponding to 100A
(ii) The series resistance for full scale reading with 1000V
Calculate the power dissipation in each case. (10)

(b) Explain the construction and working of LVDT. (10)

Q.6Write a short note on **(any two)** (20)

a) PMMC instrument
b) Megger
c) Digital frequency meter
d) Ballistic galvanometer

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58393

Q. P. Code : 21838

(3 Hours) **(Total Marks : 80)**

Please check whether you have the right question paper.

N.B.: **1)** **Questions No.1** is **compulsory**.
2) Attempt **any three** from the remaining **Questions No.2** to **No.6**.
3) **Illustrate answer** with **diagrams** wherever **necessary**.

1. Attempt **any four** : **(20)**

a) Explain the use commutator and brushes in DC machine.
b) Explain in brief the principle of Electromechanical Energy conversion.
c) Draw and explain Torque-stepping rate characteristics of stepper motor.
d) How back emf makes DC motor as a self-regulating machine?
e) What is the necessity of starter in DC motor?

2. **a)** A ring has diameter of 21 cm and cross sectional area of 10 cm^2. The ring is made up of semicircular sessions of cast iron and cast steel, with each joint having reluctance equal to an air gap of 0.2 mm. Find the ampere turns required to produce a flux of 8×10^{-4} Wb. The relative permeability of cast steel and cast iron are 800 and 166 respectively. Neglect fringing and leakage effect. **(10)**

b) Derive the expression for torque developed in doubly excited magnetic field. **(10)**

3. **a)** Explain the armature reaction in DC generator and hence explain how to minimize armature reaction. **(10)**

b) A 220 V, 970 RPM, 100 A DC separately excited motor has an armature resistance of 0.05 Ω. It is braked by plugging from an .initial speed of 1000 RPM. **(10)**
Calculate : i) Resistance to be placed in armature circuit to limit braking current to twice the full load value, ii) Braking torque, iii) Torque when speed has fallen to zero.

4. **a)** Explain the process of commutation and hence mention the methods to improve commutation. **(10)**

b) Two identical DC shunt machines when tested by Hopkinson's test gave the following results : **(10)**

Field currents are 2.5A and 2 A.
Line voltage is 220V
Line current (including both the field currents) is 10 A
Motor armature current is 73A
The armature resistance of each machine is 0.05 ohms

Calculate the efficiency of both the machines.

5. **a)** Explain the Variable Reluctance Stepper Motor (VRSM). **(10)**

b) A 200 V, 10.5 A, 2000 rpm DC shunt motor has the armature and field resistances of 0.5 Ω and 400 Ω respectively. It drives a load whose torque is constant at rated motor torque. Calculate the motor speed if the source voltage drops to 175 V. **(10)**

6. **a)** Explain retardation test for determination of moment of inertia of DC motor. **(10)**

b) Derive the torque speed relation and explain speed-torque characteristic for DC series and shunt motor. **(10)**
