MODUL PRAKTIKUM
MATAKULIAH : INDUSTRI PAKAN

STUDI KELAYAKAN INDUSTRI PAKAN

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KATA PENGANTAR

Puji syukur kehadirat ALLAH SWT atas limpahan karunia-Nya sehingga modul praktikum ini dapat tersusun

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Kritik dan saran kami harapkan demi perbaikan modul ini. Semoga modul praktikum ini memberikan manfaat bagi yang membutuhkan. Amin

Semarang, Desember 2008
Penyusun

DAFTAR ISI

Nomor Halaman

KOMPETENSI :

Setelah melaksanakan praktikum ini diharapkan mahasiswa mampu membuat studi kelayakan suatu industri pakan

PENDAHULUAN

Perusahaan dalam menjalankan usahanya mempunyai kegiatan rutin, yang setiap hari harus dijalankan. Kegiatan rutin tersebut misalnya membuat barang-barang bagi perusahaan yang berupa pabrik (*manufacture*), kegiatan jual beli barang-barang bagi perusahaan perdagangan atau kegiatan menciptakan dan menjual jasa bagi perusahaan jasa seperti bank, perusahaan pengangkutan dan perusahaan jasa lainnya. Kegiatan ini selalu dijalankan secara rutin, terus menerus dan setiap hari selama perusahaan masih berdiri dan masih menjalankan usahanya.

Kecuali kegiatan rutin, kadang-kadang perusahaan juga menjalankan kegiatan yang tidak rutin, yaitu kegiatan yang hanya suatu saat saja dijalankan, tidak setiap hari dan tidak tertentu waktunya. Kegiatan tidak rutin ini tujuannya antara lain untuk menunjang kegiatan rutin agar kegiatan yang rutin tersebut dapat berjalan dengan lancar. Kecuali itu, kegiatan ini dijalankan untuk mengimbangi kemajuan teknologi yang selalu berkembang dengan pesat, juga agar supaya perusahaan dapat selalu memenuhi kebutuhan konsumen dengan cepat dan tepat, yang pada akhirnya ikut menunjang tujuan perusahaan secara keseluruhan, terutama mencapai laba maksimal dan perkembangan perusahaan. Kegiatan yang tidak rutin ini misalnya pembelian mesin-mesin untuk produksi, pembelian kendaraan untuk keperluan perusahaan atau untuk usaha, pendirian gedung pabrik, pembelian peralatan dan sebagainya. Kegiatan-kegiatan yang tidak rutin inilah yang disebut dengan proyek, atau juga dinamakan penanaman modal, atau **investasi.**

Proyek dibuat dalam jangka waktu tertentu, mempunyai titik awal yaitu kegiatan pada saat dimulainya pembuatan proyek, dan mempunyai titik akhir dimana proyek tersebut sudah selesai dibuat, dan sudah siap untuk dipakai. Jangka waktu antara titik awal sampai dengan titik akhir inilah waktu kegiatan proyek yang aktivitasnya telah direncanakan dan diharapkan dapat dilaksanakan dalam satu kesatuan yang menggunakan sumberdaya terbatas untuk mendapatkan benefit (kemanfaatan) yang maksimal. Sumberdaya yang terbatas misalnya lahan, air, modal, tenaga kerja, teknologi, bahan-bahan dasar sebagai input faktor, sedangkan benefit dapat berbentuk tingkat pendapatan yang menguntungkan, tingkat konsumsi yang lebih besar, penambahan lapangan dan kesempatan kerja serta hal-hal lain yang dikategorikan sebagai output (hasil suatu proses kegiatan).

Proyek merupakan suatu kegiatan, oleh karena itu jelas memerlukan dana investasi yang besar kecilnya tergantung pada besar kecilnya proyek itu sendiri. Dana yang ditanamkan ini berupa pengeluaran modal yang dikeluarkan selama masa pembuatan proyek, pada saat proyek

sudah jadi, sudah siap dipakai atau pada saat sudah beroperasi. Kadang-kadang ada proyek yang pengeluaran modalnya hanya pada saat pembuatannya saja, tetapi ada juga proyek yang pengeluaran modalnya selain pada saat pembuatannya juga pada saat proyek tersebut sudah beroperasi. Disamping penanaman modal yang berupa dana, maka proyek juga membutuhkan tenaga kerja dan manajemen untuk penanganannya, sebab tanpa manajemen yang baik maka proyek tidak dapat selesai pada saat yang ditentukan dan juga tidak sesuai dengan hasil yang diharapkan.

Penilaian terhadap suatu proyek yang direncanakan, apakah proyek tersebut nantinya dapat dibuat atau tidak, dinamakan **evaluasi**. Dasar dari penilaian ini bermacam-macam, dari berbagai segi misalnya dari segi ekonomi, teknis, finansial, sosial dan lain-lain. Dalam praktikum manajemen industri pakan ini diupayakan agar mahasiswa dapat mengevaluasi suatu proyek di dalam industri peternakan khususnya industri pakan.

Maksud dan Tujuan Analisa Proyek

1. Untuk memperbaiki pemilihan investasi / sumber-sumber yang serba terbatas. Karena kesalahan dalam memilih dan mengevaluasi suatu investasi akan mengakibatkan suatu usaha menjadi sia-sia dan kurang bermanfaat.
2. Untuk memilih / menentukan suatu pilihan usaha dalam rangka menanamkan investasi yang terbatas dengan adanya banyak alternatif usaha-usaha peternakan.
3. Supaya dapat menentukan secara kualitatif maupun kuantitatif suatu usaha peternakan yang menguntungkan maupun kurang menguntungkan bagi investor.

Beberapa aspek yang umumnya harus dievaluasi dalam suatu perencanaan suatu proyek (***feasibility study***) adalah:

- Evaluasi Pasar
- Evaluasi Teknis Teknologis
- Evaluasi Management
- Evaluasi Yuridis
- Evaluasi Finansiil Ekonomis

Tetapi dalam praktikum ini hanya aspek Finansiil Ekonomis yang diambil sebagai latihan evaluasi usaha dalam rangka menentukan pilihan usaha.

Berbagai macam biaya dari suatu proyek

Secara umum biaya yang harus diperhitungkan ialah:

1. Sunk Cost.

   Sunk Cost ialah biaya yang sudah dikeluarkan di waktu proyek belum berjalan. Biaya ini termasuk biaya perencanaan dalm memilih alternatif berbagai usaha yang akan ditawarkan dan juga sebelum menentukan pilihan.
2. Penyusutan
3. Cicilan hutang berupa bunga bank.
4. Tingkat bunga pada perencanaan feasibility study.
5. Kepemilikan tanah (sewa, beli)
6. Modal kerja
7. Biaya konstruksi / pengadaan peralatan. Yang termasuk di dalamnya ialah biaya: penyediaan alat-alat / mesin-mesin, bahan-bahan baku produk, tenaga kerja.
8. Biaya operasional dan pemeliharaan.
9. Biaya pergantian (mesin, suku cadang)
10. Biaya tak terduga.

Pengertian Investasi

Jika seseorang hendak melakukan suatu usaha, maka agar usahanya memiliki sarana dan prasarana untuk membiayai keperluan tersebut diperlukan **modal** (dana). Misalkan alat-alat, kendaraan, tanah bangunan, perijinan dan dana lain yang digunakan untuk membiayai proses kegiatan usaha. Semua pengadaan sarana dan prasarana tersebut bersifat fisik dan non fisik. Jika modal tersebut akan dijadikan **asset** maka modal yang harus disediakan untuk keperluan tersebut dinamakan **modal investasi**.

Pada usaha industri pakan, umumnya investasi yang lengkap meliputi biaya-biaya untuk:

1. Tanah (mulai proses awal hingga siap untuk digunakan)
2. Bangunan (kantor, perumahan, gudang, laboratorium, silo, mixing and processing serta sarana dan prasarana lainnya).
3. Peralatan yang menunjang usaha (mesin-mesin utama, mesin-mesin Bantu)
4. Training tenaga kerja
5. Mengurus perijinan dan perencanaan.
6. Transportasi (ongkos angkut, pengadaan kendaraan)
7. Pengadaan alat-alat dan perabot kantor.
8. Biaya percobaan produksi (jika diselenggarakan).

9. Instalasi listrik dan pengadaan air.
10. Biaya-biaya lain selama periode investasi.

Pada dasarnya, semua biaya yang dikeluarkan selama usaha peternakan belum memulai produksi komersialnya dapat dimasukkan ke dalam golongan **modal investasi** asalkan pengeluaran tersebut tertanam di dalam pengadaan sarana dalam jangka waktu yang cukup lama. Kalau biaya dikeluarkan pada saat dan selama usaha sudah mulai berproduksi / beroperasi maka dimasukkan ke dalam golongan **biaya operasional** (modal kerja) yang dapat dibedakan sebagai **biaya tetap** (fixed cost) dan **biaya tidak tetap** (variable cost). Dinyatakan sebagai biaya tetap, jika ia tidak berubah sekalipun volume penjualan / pembuatannya berubah. Sebaliknya biaya tidak tetap akan berubah mengikuti perubahan volume penjualan / pembuatan produknya.

Sebenarnya batasan tetap dan tidak tetap dalam prakteknya sulit, sehingga perlu ditetapkan. Penetapannya haruslah berdasar argumentasi yang tepat, dalam kaitannya dengan hal ini maka fixed cost ditetapkan untuk pengeluaran-pengeluaran yang relative tetap (berubah sedikit saja) dengan perubahan volume barang yang dibuat. Sehingga oleh karenanya gaji dapat ditetapkan ke dalam biaya tetap. Biaya penyusutan, sewa kantor dan asuransi dapat ditetapkan sebagai fixed cost pula. Sedangkan pengadaan bahan baku ditetapkan sebagai biaya tidak tetap, karena ia akan berubah dengan adanya perubahan pada volume barang yang dibuat. **Penyusutan** adalah pengeluaran modal yang dibebankan sebagai biaya selama usia aktiva, jadi pengeluaran modal ini tidak dibebankan pada satu periode pada saat pembelian / pembuatan aktiva tetap tersebut, tetapi biaya ini akan dibagi pada periode-periode selama usia aktiva. Penyusutan termasuk biaya rutin, yaitu biaya yang dikeluarkan setiap periode / setiap tahun. Misalkan pada usaha industri pakan komersial, di dalam analisa biayanya dibutuhkan:

Biaya tetap (fixed cost):

1. Penyusutan bangunan pabrik
2. Penyusutan peralatan
3. Upah tenaga kerja tetap
4. Pemeliharaan mesin-mesin
5. Analisa laboratorium
6. Biaya pengembalian modal pinjaman
7. Pajak

Biaya tidak tetap (Variable cost)

1. Pengadaan bahan baku pakan
2. Pembelian bahan-bahan additive
3. Biaya transportasi untuk distribusi produk
4. Biaya promosi

Penerimaan dan keuntungan usaha

1. Hasil penjualan produk
2. Hasil penjualan limbah bahan baku pakan

Metode Evaluasi Finansial

Evaluasi proyek dari segi finansial adalah penilaian atas proyek yang akan didirikan ditinjau dari segi financial atau keuntungannya, apakah proyek tersebut nantinya menguntungkan atau tidak pada saat sudah beroperasi. Di dalam penilaian tersebut akan dibandingkan antara modal / investasi yang dikeluarkan untuk pembuatan atau pendirian proyek dengan penghasilan atau pendapatan yang diterima dari operasional proyek tersebut apabila sudah berjalan. Ada beberapa metode dalam evaluasi proyek dari segi finansial, tetapi di dalam diktat ini hanya akan diberikan 5 macam saja yang dianggap sering digunakan. Metode-metode itu adalah:

1. Return On Investment (ROI)
2. Payback Period (PBP)
3. Net Present Value (NPV)
4. Benefit Cost Ratio (BC Ratio)
5. Internal Rate of Return (IRR)

Return On Investment

Metode ini menghitung perbandingan antara keuntungan bersih yang diterima dengan investasi yang dikeluarkan atau berapa tingkat keuntungan apabila dibandingkan dengan investasinya. Return on investment ini dinyatakan dalam prosentase.

Cara menghitung ROI menggunakan rumus:

$$\frac{keuntungan\ rata - rata\ setelah\ pajak}{investasi}$$

Keuntungan rata-rata adalah jumlah keuntungan bersih selama usia aktiva yang bersangkutan, atau keuntungan rata-rata setiap tahun. Investasi adalah investasi total yang dikeluarkan selama usia aktiva.

Contoh Soal:

Investasi tahun ke 0 Rp. 2.000.000,00

Keuntungan bersih setelah pajak :	Tahun ke 1 Rp.	230.000,00
	Tahun ke 2 Rp.	230.000,00
	Tahun ke 3 Rp.	180.000,00
	Tahun ke 4 Rp.	180.000,00
	Tahun ke 5 Rp.	180.000,00
		Rp. 1.000.000,00

Keuntungan rata-rata = Rp. 1.000.000,00 : 5

= Rp. 200.000,00 / tahun

$$\text{ROI} = \frac{Rp.200.000,00}{Rp.2.000.000,00} x100\% = 10\%$$

Ketentuan menerima atau menolak

Untuk memutuskan apakah suatu proyek diterima atau ditolak apabila dilihat dari metode ROI, maka terlebih dahulu ditentukan minimum ROI, yang besarnya tergantung pada pemilik proyek atau tergantung pada keadaan, tetapi untuk bahan pertimbangan, minimum ROI ini dapat disesuaikan dengan:

- tingkat bunga yang berlaku umum, misalnya bunga deposito atau bisa juga tingkat bunga kredit
- ROI dari proyek yang sudah berjalan, atau proyek yang sudah pernah ada, baik proyek sejenis maupun tidak sejenis. Proyek sejenis misalnya proyek-proyek yang menghasilkan produk yang sama, sedangkan proyek yang tidak sejenis misalnya usaha lain yang sudah atau sedang dijalankan.

Proyek akan diterima jika ROI lebih besar dari minimum ROI yang ditentukan, jika ROI proyek lebih kecil dari minimum ROI yang ditentukan maka proyek ditolak. Jika ROI proyek sama dengan minimum ROI yang ditentukan maka proyek dianggap tidak rugi dan tidak menguntungkan (break even point).

Payback Period

Metode ini menghitung lamanya waktu yang diperlukan untuk mengembalikan pengeluaran melalui keuntungan yang diterima setiap tahun. Apabila keuntungan yang diterima setiap tahun jumlahnya sama, maka payback period dapat dihitung dengan menggunakan rumus:

$$\frac{jumlah\ \ pengeluara\ n}{keuntungan\ \ setiap\ \ tahun} x\ 1\ tahun$$

Tetapi jika keuntungan yang diterima tidak sama setiap tahun maka dihitung dengan cara sebagai berikut:

Pengeluaran tahun ke 0		Rp. 1.800.000,00
Keuntungan tahun ke 1		530.000,00 (selama 1 th)
	(-)	Rp. 1.270.000,00

Sisa pengeluaran tahun ke 1 menjadi		Rp. 1.270.000,00	
Keuntungan tahun ke 2		530.000,00	(selama 1 th)
	(-)	Rp. 740.000,00	
Sisa pengeluaran tahun ke 2 menjadi		Rp. 740.000,00	
Keuntungan tahun ke 3		580.000,00	
	(-)	Rp 160.000,00	(selama 1 th)
Sisa pengeluaran tahun ke 3 menjadi		Rp. 160.000,00	
Keuntungan tahun ke 4		580.000,00	

Pada tahun ke 4, sisa pengeluaran tinggal sebesar Rp. 160.000,00, sedangkan besarnya keuntungan pada tahun ke 4 adalah Rp. 580.000,00, dengan demikian karena keuntungan yang diterima lebih besar daripada pengeluaran pada tahun ke 4, sisa ini akan dapat dilunasi dalam waktu kurang dari 1 tahun dengan perhitungan sbb.

$$\frac{Rp\ 160.000,00}{Rp\ 580.000,00} x\ 12\ bulan\ (1\ th) = 3\ bulan\ 10\ hari$$

Jadi proyek tersebut akan kembali dalam waktu 3 tahun 3 bulan 10 hari. Titik payback period tampak pada gambar di bawah ini.

Tahun 0 ——— 1 ——— 2 ——— 3 * ——— 4

PBP

Ketentuan menerima atau menolak

Proyek diterima jika payback period lebih pendek daripada maksimum payback period yang ditentukan, dan akan ditolak jika payback periodnya lebih panjang dari maksimum payback period yang ditentukan. Jika sama besarnya maka proyek tidak untung dan tidak pula merugi (break even). Dalam contoh soal di atas, jika ditentukan maksimum payback period misalnya 4 tahun sesuai dengan jangka waktu kredit yang digunakan, maka proyek akan diterima untuk dibuat karena payback period proyek lebih pendek, yaitu 3 tahun 3 bulan 10 hari.

Net Present Value

Berbeda dengan metode-metode ROI dan PBP, metode net present value ini sudah memperhitungkan time value of money, sudah menghargai uang sesuai dengan perubahan waktu, yaitu dengan menghitung nilai sekarang / present value dari pengeluaran dan keuntungan pada tingkat bunga yang sudah ditentukan. Misalnya tingkat bunga kredit, deposito maupun tingkat bunga tertentu yang berlaku umum. Tergantung pada pemilik proyek, tingkat bunga mana yang akan dipakai. Metode present value ini membandingkan **present value outlay/pengeluaran**

(PVO) dengan **present value proceed/keuntungan (PVP)** dengan jalan mengurangkan PVO dari PVP. Cara menghitung:

- Pada saat terjadi pengeluaran / outlay (tahun tertentu) dipresentvaluekan, kemudian present value tersebut dijumlahkan (ini jika outlaynya lebih dari satu kali), sehingga diperoleh total present value outlay (PVO).
- Demikian juga untuk proceed, setiap ada penerimaan / proceed pada tahun-tahun tertentu juga dipresent valuekan, kemudian dijumlah sehingga didapatkan jumlah / total present value proceed (PVP).
- Total PVP dikurangi dengan total PVO, hasilnya bisa positif, negative atau sama dengan nol.

Contoh soal:

Ditentukan tingkat bunga yang dipakai untuk menghitung present value adalah 15 %.

* present value proceed

Tahun	Proceed	Discount factor 15 %	PVP
1	Rp. 530.000,00	x 0,8696	= Rp 460.888,00
2	Rp. 530.000,00	x 0,7561	= Rp 400.733,00
3	Rp. 580.000,00	x 0,6575	= Rp 381.350,00
4	Rp. 580.000,00	x 0,5718	= Rp 331.644,00
5	Rp. 580.000,00	x 0,4972	= Rp 288.376,00
	Jumlah		= Rp 1.862.991,00

* present value outlay

Tahun	Proceed	Discount factor 15 %	PVP
0	Rp 1.800.000,00	x 1,00000	= Rp 1.800.000,00

* net present value

= Rp. 1.862.967,00 - Rp. 1.800.000,00

= Rp. 62.967,00 (+)

Ketentuan menerima atau menolak

Proyek akan diterima jika hasil net present value positif, yang artinya present value penerimaan lebih besar daripada present value pengeluaran modal, dan akan ditolak jika NPVnya

negative, sedang jika NPV sama dengan nol maka dianggap break even. Artinya, pada suatu saat bisa diterima, tetapi pada saat yang lain bisa juga ditolak.

Benefit Cost Ratio

Seperti pada metode net present value, metode benefit cost ratio juga membandingkan antara PVP dengan PVO pada tingkat bunga yang sudah ditentukan lebih dahulu, yaitu sesuai dengan tingkat bunga yang berlaku, misalnya tingkat bunga kredit atau tingkat bunga deposito, dll. Metode benefit cost ratio ini dihitung dengan cara sama persis seperti pada net present value, dengan langkah-langkah sebagai berikut:

- menghitung total PVO dengan jalan menjumlahkan present value tia-tiap pengeluaran sesuai dengan tahun atau saat dikeluarkannya.
- menghitung total PVP dengan jalan menjumlahkan present value tiap-tiap penerimaan / proceed sesuai dengan tahun atau saat diterimanya proceed tersebut.
- Total PVP dibagi dengan total PVO, dengan demikian hasilnya bisa lebih besar dari 1, lebih kecil dari 1 atau akan sama dengan 1.

Untuk contoh soal ini dihitung PVO dan PVP dengan tingkat bunga 15 % seperti pada contoh net present value.

* total PVP Rp 1.862.967,00
* total PVO Rp 1.800.000,00

$$\text{Benefit Cost Ratio} = \frac{Rp\ 1.862.967,00}{Rp\ 1.800.000,00}$$

$$= 1,035$$

Ketentuan menerima atau menolak

Proyek akan diterima jika BCR lebih besar dari 1, yang berarti bahwa present value proceed / penerimaan lebih besar dari present value outlay / pengeluaran modal. Jika terjadi sebaliknya, yaitu BCR lebih kecil dari 1, maka proyek akan ditolak, dan jika BCR sama dengan 1 maka proyek dianggap break even. Pada contoh soal di atas maka dapat dikatakan bahwa proyek dapat diterima karena BCR > 1.

Internal rate of return

Metode ini juga sering disebut dengan yield, yaitu tingkat bunga proyek yang mempersamakan present value proceed dengan present value outlay. Atau dengan perkataan lain, berapa tingkat bunga proyek jika PVP sama dengan PVO. Pada kondisi ini, jika dilihat NPVnya akan sama dengan nol, atau jika dilihat BCRnya akan sama dengan 1. Apabila pada metode net present value dan benefit cost ratio tingkat bunganya ditentukan untuk menghitung present value, maka pada metode IRR ini justru tingkat bunganya yang dicari.

Untuk menghitung internal rate of return maka digunakan cara coba-coba (trial and error) yaitu dengan mencari net present value pada 2 tingkat bunga (secara sembarang). Kemudian kedua net present value tersebut diinterpolasikan, sehingga akan didapatkan tingkat bunga yang dicari (internal rate of return).

Contoh Soal:

Untuk contoh soal ini dihitung / dicari net present value pada tingkat bunga 20 % dan 15 %.

* pada tingkat bunga 20 %

Present value proceed:

Tahun	Proceed	Discount factor 20 %	PVP
1	Rp. 530.000,00	x 0,883	= Rp 441.490,00
2	Rp. 530.000,00	x 0,694	= Rp 367.820,00
3	Rp. 580.000,00	x 0,579	= Rp 335.820,00
4	Rp. 580.000,00	x 0,482	= Rp 279.560,00
5	Rp. 580.000,00	x 0,402	= Rp 233.160,00
	Jumlah		= Rp 1.657.850,00

Present value outlay:

Tahun	Proceed	Discount factor 20 %	PVP
0	Rp 1.800.000,00	x 1,000	= Rp 1.800.000,00

Net present value:

= Rp 1.657.850,00 - Rp 1.800.000,00

= Rp 142.150,00 (-)

* pada tingkat bunga 15 %

Present value proceed:

Tahun	Proceed	Discount factor 15 %	PVP
1	Rp. 530.000,00	x 0,8696	= Rp 460.888,00
2	Rp. 530.000,00	x 0,7561	= Rp 400.733,00
3	Rp. 580.000,00	x 0,6575	= Rp 381.350,00
4	Rp. 580.000,00	x 0,5718	= Rp 331.644,00
5	Rp. 580.000,00	x 0,4972	= Rp 288.376,00
	Jumlah		= Rp 1.862.991,00

Present value outlay:

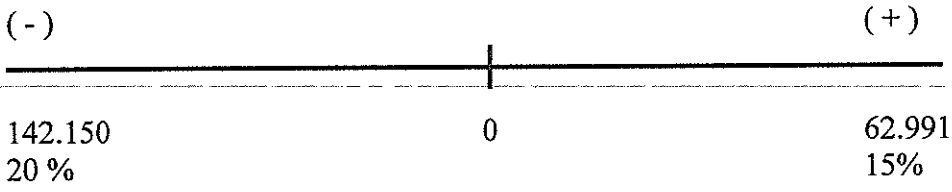
Tahun	Proceed	Discount factor 15 %	PVP
0	Rp 1.800.000,00	x 1,000	= Rp 1.800.000,00

Net present value:

= Rp 1.862.991,00 - Rp 1.800.000,00

= Rp 62.991,00 (+)

Apabila kedua net present value dari kedua tingkat bunga tersebut digambar dalam satu garis maka akan tampak seperti di bawah ini:



Internal rate of return adalah tingkat bunga dimana net present value sama dengan nol, jadi terletak di antara 20 % dan 15 %. Untuk mencari tingkat bunga internal rate of return tersebut maka kedua tingkat bunga masing-masing 20 % dan 15 % diinterpolasi.

* tingkat bunga 20 %	NPV (-) Rp	142.150
* tingkat bunga 15 %	NPV (+) Rp	62.991
* jarak	5 % Rp	205.141

$$IRR = 20\,\% - \left[\frac{Rp\,142.150}{Rp\,205.141} x\,5\%\right]$$

$$= 20\,\% - 3{,}465\,\% = 16{,}535\,\%$$

atau

$$IRR = 15\,\% + \left[\frac{Rp\,62.991}{Rp\,205.141} x\,5\%\right]$$

$$= 15\,\% + 1{,}535\,\% = 16{,}535\,\%$$

Internal rate of return sebesar 16,535 % memberi arti bahwa pada tingkat bunga tersebut, present value proceed sama dengan present value outlay, atau pada NPV sama dengan nol dan benefit cost ratio sama dengan 1.

Ketentuan menerima atau menolak

Seperti pada metode-metode yang terdahulu, untuk menerima atau menolak suatu proyek menurut metode IRR ada kriteria atau patokannya. Terlebih dahulu akan ditentukan berapa minimum IRR dimana besarnya tergantung pada pemilik proyek, dan sebagai pertimbangan dapat disesuaikan dengan tingkat bunga yang berlaku, atau dengan IRR dari proyek yang sudah pernah ada. Jika IRR proyek lebih besar dari minimum IRR yang ditentukan maka proyek akan diterima, jika sebaliknya maka proyek akan ditolak. Apabila IRR proyek sama dengan IRR minimum yang ditentukan maka proyek dianggap break even.

Metode evaluasi yang telah diuraikan masing-masing mempunyai ciri-ciri tersendiri, dimana antara metode yang satu dengan yang lain dapat dikatakan bisa saling melengkapi. Kelemahan yang ada dalam metode yang satu, dapat diatasi dengan kebaikan dari metode yang lain. Untuk menilai suatu proyek ada baiknya menggunakan beberapa metode, tidak hanya satu metode saja mengingat adanya kekurangan yang terdapat pada masing-masing metode evaluasi.

CONTOH-CONTOH STUDI KELAYAKAN PADA BEBERAPA PERUSAHAAN

Studi Evaluasi Finansiil Ekonomi pada Peternakan Sapi Perah Sindoro

* Evaluasi Rencana Operasional (evaluasi aspek umum)

Nama Usaha : Peternakan Sapi Perah Sindoro

Pengadaan Sapi : Berasal dari menyewa sapi perah dari daerah sekitarnya
Sapi perah yang disewa adalah sapi-sapi perah siap bunting
Lama pemeliharaan selama 8 tahun
Masa kering kandang selama 2 bulan / tahun / ekor

Sistem perkawinan : Perkawinan sapi perah melalui program Inseminasi Buatan (IB)

Kapasitas Perusahaan : Tujuh ekor sapi perah periode laktasi
Produksi susu: 1714 liter/ekor/1 x masa laktasi dalam satu tahun

Analisa Harga : Bekatul Rp 350,00 / kg
Ampas tahu Rp 20,00 / kg
Harga sewa sapi Rp 500.000 / ekor / tahun
Harga jual produk susu Rp 1.000,00 / liter
Biaya IB Rp 2.500,00 / satu kali IB / ekor
Kenaikan biaya produksi 2 %
Kenaikan hasil produksi 7 %

* Perencanaan Modal

Modal Investasi

Tanah, Bangunan

-	Pembelian tanah 300 m^2	Rp. 3.000.000,00
-	Pembuatan kandang 135 m^2	Rp. 2.700.000,00
-	Pembuatan gudang 20 m^2	Rp. 200.000,00
	Total	Rp. 5.900.000,00

Peralatan

-	Alat penampung susu 5 buah	Rp. 40.000,00
-	Gerobak	Rp. 50.000,00
-	Instalasi air	Rp. 500.000,00
	Total	Rp. 590.000,00

Pra Operasional

-	Perijinan	Rp. 500.000,00

Modal Kerja Tetap (per 1 tahun)

Tenaga Kerja

- Pelaksana teknis (2 orang)	Rp. 1.440.000,00
- Tenaga Kasar (1 orang)	Rp. 360.000,00
Total	Rp. 1.800.000,00

Perawatan (per 1 tahun)

- Listrik	Rp. 120.000,00
- Pajak Bumi dan Bangunan	Rp. 80.000,00
- Obat-obatan	Rp. 70.000,00
Total	Rp. 270.000,00

Modal Kerja Variabel (per 1 tahun)

Pembelian konsentrat

• Bekatul : 2 kg x 7 ekor x Rp 350,00 x 365 hari	Rp. 1.788.000,00
• Ampas tahu : 14 kg x 7 ekor x Rp. 20,00 x 365 hari	Rp. 715.400,00
Sewa sapi perah	Rp. 3.500.000,00
Total	Rp. 6.003.900,00

Total kebutuhan modal

- Modal Investasi	Rp 6.990.000,00
- Modal Kerja Tetap	Rp 2.070.000,00
- Modal Kerja Variabel	Rp 6.003.900,00
Total Modal	Rp 15.063.900,00
	Rp 15.500.000,00

Biaya produksi (per 1 tahun)

1. Pembelian konsentrat	Rp. 2.500.000,00
2. Gaji dan maintenance Rp. 1.800.000 + Rp. 270.000,00	Rp. 2.070.000,00
3. Penyusutan	
Bangunan 5 %	Rp. 145.000,00
Alat 10 %	Rp. 59.000,00
Pra Operasional 10 %	Rp. 50.000,00
4. Biaya Inseminasi Buatan 1 x 7 ekor x Rp. 2.500,00	Rp. 17.500,00
5. Sewa sapi perah Rp. 500.000,00 x 7 ekor	Rp. 3.500.000,00
Total	Rp. 8.345.400,00

Pendapatan Perusahaan

Produk Susu

Produk susu selama 1 masa laktasi = 40 l/ hari x 300 = 12.000 l/th
Dengan asumsi 1 masa laktasi dalam 1 tahun selama 300 hari dengan masa kering kandang 2 bulan.

Hasil Penjualan Susu

Harga 1 liter susu adalah Rp. 1.000,00 maka hasil penjualan susu dalam 1 tahun adalah:

1.000 liter x Rp. 1.000 = Rp. 12.000.000,00

Analisa Benefit Cost Ratio (BC Ratio)

Tahun Usaha	Investasi (juta)	Eksploitasi (juta)	Pengeluaran (juta)	Penerimaan (juta)	DF (12 %)	Nilai Pengeluaran (juta)	Nilai Penerimaan (juta)
1	6,9900	8,3454	15,3354	12,0000	0,8929	13,6930	10,7148
2	-	8,5123	8,5123	12,8400	0,7972	6,7860	10,2360
3	-	8,6825	8,6825	13,7388	0,7118	6,1802	9,7793
4	-	8,8562	8,8562	14,7005	0,6355	5,6281	9,3422
5	-	9,0333	9,0333	15,7295	0,5674	5,1255	8,9249
Total	6,9900	43,4297	50,4197	59,0088		37,4128	48,9972

$$\textbf{BC Ratio} = \frac{48,9972}{37,4128 + 6,9900} = 1,1035$$

NPV = 48,9972 - 37,4128 = 11,5844

Analisa Internal Rate of Return (IRR)

Tahun Usaha	Pengeluaran (juta)	Penerimaan (juta)	Neraca	DF (10%)	NPV (juta)	DF (14%)	NPV (juta)
1	15,3354	12,0000	-3,3354	0,9091	- 3,0322	0,8772	- 2,9258
2	8,5123	12,8400	4,3277	0,8264	3,5764	0,7695	3,3302
3	8,6825	13,7388	5,0563	0,7513	3,7988	0,6750	3,4130
4	8,8562	14,7005	5,8443	0,6830	3,9916	0,5921	3,4604
5	9,0333	15,7295	6,6962	0,6209	4,1577	0,5194	3,4780
Total					12,4923		10,7558

$$IRR = 10\% + \frac{12{,}4923}{12{,}4923 - 10{,}7558} x\ 4\%$$

$= 10\% + 28{,}78\%$

$= 38{,}78\%$

Analisa Payback of Credit

Investasi	= 6.990.000
Proceed tahun 1	= - 3.335.400
Sisa	= 10.325.400
Proceed tahun 2	= 4.327.700
Sisa	= 5.997.700
Proceed tahun 3	= 5.056.300
Sisa	= 941.400
Proceed tahun 4	= 5.844.300

Payback of Credit / Period $= 4 + \frac{941.400}{5.844.300}$

$= 4 + 0{,}16$

$= 4{,}16$ (4 tahun 2 bulan)

Kesimpulan

Berdasarkan studi kelayakan dapat disimpulkan bahwa dengan:

1. Benefit Cost Ratio : 1,1035
2. NPV dengan DF 12 % : Rp. 11.584.400,00
3. IRR dengan selang DF 10% - 14% : 38,78%
4. PPC dengan DF 12% : 4 tahun 2 bulan

maka perusahaan ini dapat dikatakan tidak merugi.

Studi kelayakan pada pabrik pakan 'Tirto Nilo'

Perhitungan analisa ekonomi meliputi investasi, biaya penyusutan, biaya pengeluaran, penerimaan (hasil penjualan pakan) dan analisa keuntungan. Adapun perhitungannya adalah sebagai berikut:

Investasi

No	Jenis Investasi	Biaya (rupiah)
1	Sewa Tanah (1 tahun)	10.500.000
2	Bangunan dan perlengkapannya	120.000.000
3	Inventaris kantor	1.500.000
4	Mesin produksi	19.000.000
5	Peralatan produksi	1.250.000
6	(Instalasi listrik)	
7	(Gudang)	
8	(Angkutan/mobil)	
9	Lain-lain	5.000.000
	Total	157.250.000

Biaya Penyusutan (Rp)

No.	Macam Investasi	Taksiran (tahun)	Nilai Awal	Nilai Akhir	Penyusutan
1	Bangunan	5	120.000.000	75.000.000	45.000.000
2	Investasi kantor	3	1.500.000	1.000.000	500.000
3	Mesin produksi	10	19.000.000	10.000.000	9.000.000
4	Peralatan produksi	3	1.500.000	750.000	750.000
	Total				55.250.000

Biaya Pengeluaran

No	Macam Biaya	Tahun I	Tahun II	Tahun III
	Investasi	55.250.000		
1	Biaya tetap:			
	- gaji/honor 16 karyawan	69.600.000	76.560.000	84.296.000
	- penyusutan	55.250.000	55.250.000	55.250.000
	- pajak	696.000	765.600	842.160
2	Biaya tidak tetap:			
	- bahan baku pakan	1.225.950.000	1.263.100.000	1.300.250.000
	- pengemasan	69.000.000	10.910.666	72.886.573
	- lain-lain	10.000.000	12.500.000	15.000.000
	Total	1.430.496.000	1.479.092.310	1.528.444.833

Penerimaan (Hasil Penjualan Pakan)

Tahun	Jumlah/Ton	Harga/Ton	Jumlah
I	3.330	500.000	1.650.000.000
II	3.400	600.000	2.010.000.000
III	3.500	750.000	2.645.000.000

Analisa Keuntungan

Tahun	Biaya Pengeluaran (C)	Penerimaan (B)	Keuntungan
I	1.430.496.000	1.650.000.000	219.504.000
II	1.449.092.310	2.010.000.000	560.907.690
III	1.528.444.033	2.645.000.000	1.116.555.967
	4.438.032.343	6.315.000.000	1.876.967.657

Net Present Value (NPV)

NPV = B - (C + I/n)

= 6.315.000.000 - (4.438.032.343 + 157.250.000)

= 6.315.000.000 - (4.595.282.343) = 1.719.917.657

Jadi keuntungan pabrik pakan "Tirto Nilo" selama umur teknis dari investasi 3 tahun

= Rp. 1.719.917.657,- maka keuntungan bersih per tahun adalah

= Rp. 1.719.971.657 / 3 = Rp. 573.239.219

B/C Ratio = B / (C + I/n)

= 6.315.000.000 / (4.595.282.343)

= 1,374 ⟶ lebih dari 1

Berarti perluasan usaha / kegiatan perusahaan dapat terus dilaksanakan !

Perhitungan biaya investasi (x 1.000)

No	Jenis Investasi	Satuan	Harga/Satuan (Rp)	Jumlah (Rp)
1.	Pembelian tanah	4000 m²	150	600.000
2.	Bangunan			
	- Kantor & Gudang	3000 m²	10	30.000
3.	Peralatan			
	- Generator	1	1.000	1.000
	- Mixer	3	6.000	18.000
	- Mesin giling	1	6.000	6.000
	- Angkutan			
	Besar	2	75.000	150.000
	Kecil	1	45.000	45.000
	- Peralatan Kantor			5.000
4.	Ijin dan Perencanaan			3.000
5.	Lain-lain			5.000
	Jumlah Investasi			863.000

Perhitungan biaya penyusutan (x 1.000)

No.	Jenis Penyusutan	Taksiran pakai (th)	Beli (Rp)	Jual (Rp)	Penyusutan (Rp)
1.	Pabrik	20	30.000	12.500	875
2	Kantor	20	10.000	6.000	200
3	Generator	5	1.000	750	50
4	Mixer	10	6.000	4.000	200
5	Mesin Giling	10	6.000	4.000	200
6	Angkutan	10	60.000	45.000	1.500
7	Peralatan Kantor	10	5.000	1.000	400
8	Perijinan	5	3.000	-	300
9	Lain-lain	10	5.000	-	500
	Jumlah Penyusutan				4.225

Perhitungan biaya operasional (x 1.000)

Jenis Biaya	Tahun				
	1991	1992	1993	1994	1995
			Rp		
Biaya Tetap					
- Gaji Karyawan	58.000	58.000	58.000	58.000	58.000
- Pajak Tanah & Bangunan	1.250	1.250	1.250	1.250	1.250
- Pajak Angkutan	1.080	1.080	1.080	1.080	1.080
- Pengembalian Kredit	2.250	2.250	2.250	2.250	2.250
- Penyusutan	4.225	4.225	4.225	4.225	4.225
Biaya Tak Tetap					
- Bahan baku	200.000	200.000	200.000	200.000	200.000
- Transportasi	13.800	13.800	14.000	14.000	14.000
- Listrik	12.000	12.000	12.000	12.500	12.500
- Lain-lain	500	500	500	600	600
Jumlah Biaya	293.105	293.105	293.805	293.905	293.905

Perhitungan Pemasukan (x 1.000)

Jenis Pemasukan	Tahun				
	1991	1992	1993	1994	1995
			Rp		
Penjualan pakan jadi	607.200	607.200	607.200	607.200	607.200
Jumlah pemasukan	607.200	607.200	607.200	607.200	607.200

Perhitungan NPV dan BC Ratio

Tahun	Biaya		Pengeluaran	Penerimaan	DF 18 %	Nilai Sekarang	
	Investasi	Eksploitasi				Pengeluaran	Pemasukan
	863.000						
1991		293.105	1.156.105	607.200	0,8475	979.798,9875	514.602
1992		293.105	293.105	607.200	0,7182	210.508,011	514.602
1993		293.805	293.805	607.200	0,6086	178.809,723	514.602
1994		293.905	293.905	607.200	0,5188	151.596,199	514.602
1995		293.905	293.905	607.200	0,4371	128.465,87	514.602
Jumlah						1.649.178,791	2.573.010

NPV = 2.573.010.000 - 1.649.178.791

= 923.831.309

$$\text{BC Ratio} = \frac{2.573.010.000}{1.649.178.791}$$

= 1,5602

Perhitungan IRR

Tahun	Pendapatan	DF 24 %	NPV	DF 30 %	NPV
1991	- 642.503	0,8065	- 517.372,1695	0,7692	- 493.444,1076
1992	221.497	0,6504	144.061,6488	0,5917	131.059,7749
1993	220.797	0,5245	115.808,0265	0,4552	100.506,7944
1994	220.697	0,4230	93.354,831	0,3501	77.266,0197
1995	220.697	0,3411	75.279,7467	0,2693	59.433,7021
Jumlah			- 88.867,9165		- 215.177,8165

$$\text{IRR} = 24 + \left[(30-24)x\frac{-88.867{,}9165}{-88.867{,}9165+215.177{,}8165}\right]$$

= 19,78 %

Perhitungan Payback Period (x 1.000)

Investasi : 863.000

Proceeds tahun I : - 641.503 -

Sisa : 1.504.503

Proceeds tahun II : 221.497 -

Sisa : 1.283.006

Proceeds tahun III : 220.797 -

Sisa : 1.062.209

Proceeds tahun IV : 220.697 -

Sisa : 841.512

Proceeds tahun V : 220.697 -

Sisa : 620.815

Payback Period belum dapat diketahui karena data hanya diperoleh dari tahun 1991 s/d 1995, sedangkan sisa investasi masih sejumlah Rp. 620.815.000,-

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Kamal, M dan Rahardja. 1985. Evaluasi Proyek Keputusan Investasi. Cetakan pertama. Badan Penerbit UNDIP Semarang.

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MATERI DAN METODE PRAKTIKUM

Materi : Industri pakan Ternak

Bahan : Materi quisioner

Prosedur :

1. Tentukan paling sedikit 3 obyek praktikum (industri pakan) dengan usaha yang sama yang ingin anda buat studi kelayakannya
2. Lakukan pengamatan tentang :
    - kelayakan pasar
    - kelayakan teknis teknologis
    - kelayakan manajemen
    - kelayakan yuridis
    - kelayakan finansiil
3. Buat studi kelayakan industri pakan tersebut !

LAMPIRAN KEGIATAN
ACADEMIC CURRICULUM DEVELOPMENT
TAHUN ANGGARAN 2007

GBPP VERSI BAHASA INGGRIS

Jurusan Teknik Elektro
Fakultas Teknik
Universitas Diponegoro
Semarang
2007

LEARNING SPECIFICATION

Subject Name : **Electrical Machines I** ; **Code: TKE 403** ; **T: 2 Credit; P: Credit**

Prerequisite(s) : -

Subject Description : This lecture contain about some type of electric Machines that is DC Generator, DC Motor and Transformer which in it contain about principle work, construction, characteristic and also related/relevant calculation.

Learning Outcomes : Student will be able to understand to comprehend and explain the working principal, construction and also characteristic from some the electric machines type.

No	Learning Objectives	Topic	Sub-topic	Time (minutes)	Reference(s)
1	2	3	4	5	6
1	Having completed this fundamental discussion, major student of electrical engineering of semester V will be able to explain the division of electric machines of pursuant to voltage type used and also pursuant to its function and also can exemplify its application	1. Introduction	1.1. Energy conversion principal in general. 1.2 Classification of electric machine of pursuant to its function and voltage type 1.3 Convention going into effect	3 × 50	[1] [2] [3]
2	Having completed this fundamental discussion, major student of electrical engineering of semester V will be able to explain the principle work of the construction, division of classification, and also electrical analyse from DC generator and also can do the problem which is related to percentage of truth miniumal 90%	2. DC Generator	2.1 Equivalent circuit of electric machines according to way of excitation along with voltage equation and its energy. 2.2 Self excitation 2.3 Separated excitation - Series DC Generators - Shunt DC Generators	10 × 50	[1] [2] [3]

			- Compound DC Generators 2.4 Principle of voltage generation. 2.5.Working Principal and voltage equation from DC Generator along with energy conversion equation 2.6 DC generator Constructions 2.7 Armature reaction and commutation. 2.8 Generator Characteristics : 2.8.1 Internal Characteristics 2.8.2 Eksternal Characteristics 2.8.3 No Load Characteristics 2.9 DC Generator lossess : 2.9.1 Copper losses 2.9.2 Iron losses 2.9.3 Mechanical lossess 2.10 Generator Efficiencies DC: 2.10.1 Electrical efficiencies 2.10.2 Mechanical efficiencies 2.10.3 Commercial efficiencies 2.10.4 All day efficiencies		
3	Having completed this fundamental discussion, major student of electrical engineering of semester V will be able to explain the working principle, construction, classification and electricity analysis from DC.motor	3. DC Motor	3.1 DC.motor working principles 3.2 DC.motor back EMF concepts along with its equations 3.3 DC.motors (Series, Shunt, Compound) along with its voltage equation 3.4 The relation of torque, back EMF and speed at DC motor 3.5 DC.motor constructions 3.6 DC motor characteristics 3.7 Lossess and efficiency of DC motor 3.8 Various methods of starting. 3.9 Speed control of DC.motor with various methods	10 × 50	[1] [2] [3]

			3.10 Way of brakings		
4	Having completed this fundamental discussion, major student of electrical engineering of semester V will be able to explain the working principle, construction,classification and electricial analysis from Transformer and can do calculations related to percentage of success of 90%	4. Transformer	4.1 Understandings and working principles 4.2.Single phaseTransformer 4.2.1 Construction and the types 4.2.2 Circuits equivalen and voltage equation 4.3 Transformer phasor diagrams 4.4 Loading and calculation of power. 4.5 Efficiency calculations. 4.6 Division of load at parallel operation of single phase transformer 4.7 Three phase transformers 4.7.1 Constructions 4.7.2 Classifications 4.7.3 Cooling systems 4.8 All kinds of connection of three phase transformer 4.9 Clock numbers 4.10 Division of load at three phase transformer parallel operation 4.11 Special transformers	10 × 50	[1] [2] [3]

Textbooks

[1] BL Theraja, 1984, *Electrical Engineering HandBook*, McGrawHill, Bombay, India
[2] Fitzgerald,A.E, 1996, Mesin-mesin Listrik,Erlangga, Jakarta,
[3] Nagrath,I.J, 1986, *Modern Power Syatem Analisis*,Tata McGraw-Hill, New Dehli, India

LEARNING SPECIFICATION

Subject Name : **Electrical Traction and Transportation System**; **Code: TKE 420** ; **T: 2 Credit**; **P: Credit**

Prerequisite(s) : -

Subject Description : This lecture contains about some electrical traction system types and transportation that is electrical traction system and transportation of electrical direct current and traction system and transportation of alternating current in by it to contain about working principle, construction, characteristic and related calculations.

Learning Outcomes : Student will be able to understand to comprehend and explains working principles, construction and characteristic from some electrical traction system types and transportation.

No	Learning Objectives	Topic	Sub-topic	Time (minutes)	Reference(s)
1	2	3	4	5	6
1	Having completed this fundamental discussion, major student of electrical engineering of semester VII will be able to explain division of electrical traction system and transportation based on actuator type applied and based on function of and can exemplify the application of his.	1. Introduction	1.1. Assorted of locomotion at electrical traction system and transportation. 1.2 Classification of electrical Traction system and transportation based on locomotion and electric motor applied 1.3 Power feeder system at electrical traction and transportation	3 × 50	[1] [2]
2	Having completed this fundamental discussion, major student of electrical engineering of semester VII will be able to finalizes calculation traction mechanics	2. Traction mechanics and electrical	2.1 Traction mechanics. 2.1.1 Unit systems 2.1.2 Speed-time curves	10 × 50	[1] [2]

	and explains working principle, konstruction , classification, and electrical analysis from electrical traction system and transportation of direct current and can do problem related to percentage of truth of minimum 90%	power feeder and related equipments r	2.1.3 Various forces at traction system 2.2 Arrangement of Electricity feeder 2.2.1. Substation 2.2.2. Transformer, CB, DS, and other equipments. 2.3 Protection System at Traction system. 2.4 Rectifier systems of traction DC 2.5. Equipment at overhead lines. 2.6 Current collecting system : 2.6.1 Cable types 2.6.2 P*ole types* 2.6.3 B*ow types*. 2.6.4. P*antograph types* 2.7 Rectifiying equipment: 2.7.1 Mercury rectifier 2.7.2 Silicon rectifier 2.8 Traction Motor : 2.8.1 DC Motor 2.8.2 Series Motor 2.8.3 Repultion Motor 2.8.4.Induction Motor		
3	Having completed this fundamental discussion, major student of electrical engineering of semester VII will be able to explain way of speed control at traction system and performs calculation at related circuits.	3. Speed control and breaking	3.1 Traction motor speed control : 3.1.1 Series-paralel control 3.2.2 *Buck and boost* 3.2.3 *Metadyne* 3.2.4 *Thyristor* 3.3.5 *Master control* 3.4 Breaking technics: 3.4.2 Mechanical breaking 3.4.3 *Plugging* 3.4.4 *Rheostatic* 3.4.5 *Regeneratif*	10 × 50	[1] [2]

4	Having completed this fundamental discussion, major student of electrical engineering of semester VII will be able to mentions and explains about circuits track,sistem lighting, water system conditioning at electrical traction system and transportation along with calculations related to percentage of success of 90%	4. T*rack circuits,* lighting and *air conditionin*	4.1 Many types of T*rack* circuits: 4.1.1 *DC Track* 4.1.2 *AC Track* 4.1.3 *Frequency Track* 4.1.4 Many types of Signal 4.2. Lighting system that is usualy is utilized 4.3 Refrigeration system installation 4.3.1 Compresor 4.3.2 Condenser 4.3.3 Dehidrator 4.3.4 Filter	10 × 50	[1] [2]

Textbooks

[1] H Partab, 1980, *Modern Electric Traction*, Dhanpat Rai &Sons, Delhi, India
[2] Dover , AT, 1963, *Electric Traction*,Pitman &Sons Ltd., London,

LEARNING UNIT

Subject Name : **Electrical Machines I**
Code : **TKE 403**
Credits : **2**
Study Time : **2 × 50 minutes**
Study week : **VI**

A. Learning Objectives

1. **General**
   This unit provides students with a direct current motor basis principle, analyses performance at steady state and application in field.
2. **Specific**
   Students should be able to explain and calculates voltages, power and torque from direct current motor with minimum of 90% correctness.

B. Topic: Direct Current Motor

C. Sub-topic:

1. Comparison of generator and motor, back e.m.f calculation and voltage equation.
2. Electrical and mechanical characteristic depiction and power and torque calculation.

D. Learning Activities

Staging	Teacher Activities	Student Activities	Media and Teaching aid
Introduction	1. Explains the materials inclusion at this meeting. 2. Explains the relevance of this materials with electric machine 1 lecture 3. Explains Specific Learning Objectives from this materials.	Gives attention to	Transparent+OHP Power Point+LCD
Explanation	1 Explains comparison between generators and motor	Gives attention to	Transparent+OHP Power Point+LCD Whiteboard
	2 Gives formulation of voltage, current and power 3 Depicts various mechanic and electrical characteristics from current motor	Does training Discuss	
End of session	1. Invites comment or question from student 2 Gives assessment to comment and answers question of student 3 Gives image of public about lecturing materials which will come	Gives comment and question about lecturing materials.	Transparent+OHP Power Point+LCD Whiteboard

E. Evaluation

Student is given by task calculation about voltage, current, power and torque and analyses operation characteristic from direct current motor

F. References

1. B.L Theraja, A.K Theraja, *A Textbook of Electrical Technology*, 23rd Edition, S. Chand & Company LTD, 2004

2 A.E. Fitzgerald, Charles Kingsly Jr., Stephen D. Umans, *Electric Machinery*, Sixth Edition, Mc Graw Hill, 2003

LEARNING UNIT

Subject Name : **Electrical Machines I**
Code : **TKE 403**
Credits : **2**
Study Time : **2 × 50 minutes**
Study week : **X**

A. Learning Objectives

1. General

This unit provides students with a transformer basis principle, analyses performance at steady state and application in field.

2. Specific

Students should be able to explain and calculates voltages, power and torque from transformer with minimum of 90% correctness.

B. Topic: Transformer

C. Sub-topic:

1. Calculation of voltage, current and power
2. Formation of equivalent circuit and depiction of diagram phasor

D. Learning Activities

Staging	Teacher Activities	Student Activities	Media and Teaching aid
Introduction	1. Explains the materials inclusion at this meeting. 2. Explains the relevance of this materials with electric machine 1 lecture 3. Explains Specific Learning Objectives from this materials.	Gives attention to	Transparent+OHP Power Point+LCD
Explanation	1. Explains formulation of voltage, current and power 2. Compilation of transformer equivalent circuit 3. Depicts diagram phasor for various load condition	Gives attention to Does training Discuss	Transparent+OHP Power Point+LCD Whiteboard
End of session	1. Invites comment or question from student 2 Gives assessment to comment and answers question of student 3 Gives image of public about lecturing materials which will come	Gives comment and question about lecturing materials.	Transparent+OHP Power Point+LCD Whiteboard

E. Evaluation

Student is given by homework in the form of calculation about voltage, current,power and compilation of equivalent circuit along with its approximation. Also depiction of phasor diagram for various load condition.

F. References

1. B.L Theraja, A.K Theraja, *A Textbook of Electrical Technology*, 23rd Edition, S. Chand & Company LTD, 2004

2 A.E. Fitzgerald, Charles Kingsly Jr., Stephen D. Umans, *Electric Machinery*, Sixth Edition, Mc Graw Hill, 2003

LEARNING SPESIFICATIONS

Subject Name: Power Electronics; Code: TKE408; **T:** 2 **sks**; P :0 sks.
Subject Description: This subject contain about of power semiconductors and components of the main circuit such as capacitors and inductors in both sinusoidal and non-sinusoidal conditions. Furthermore, different types of converters (rectifiers, dc/dc converters, inverters, cycloconverter and resonant converters), their operating principles and analytical techniques, practical applications and design of converters. Both self-commutated as well as line-commutated converters are treated. The course also describes different power electronic circuits when ideal conditions are assumed as well as including the actual semiconductor characteristics.
Learning Outcomes: Students will be familiar and aware of how the operating principles of static power converters commonly used in practical industrial systems and power electronic circuits fit in to the practical world. It addresses the underlying concepts and methods behind various applications ranging from low-medium power utility interfaces to high power transmission systems.

No	Learnig Objectives	Topic	Sub-topic	Time (minutes)	References
1	2	3	4	5	6
1	Overview of solid state components and their high power counterparts, power semiconductor devices and their use as switches	1. Introduction	1.1 Development history and basic fungtions of static converter 1.2 System components and semiconductor switches 1.3 Power semiconductor devices	2 X 2 X 50	[1], [2], [3]
2	Having completed this topic discussion, student will be able to design and analysis: single-phase, three-phase rectifier circuits and linear power supplies.	2. **Rectifiers**	2.1 Phase-Controlled Thyristor Converters 2.2 Single phase rectifier circuits 2.3 Three-phase rectifier circuits	2 X 2 X 50	[1], [2]
3	Having completed this topic discussion, student will be able to design and analysis DC-to-DC power electronic converters circuit with voltage control by pulse-width-modulation	3. **DC Choppers**	3.1 Class A 3.2 Class B 3.3 Class C 3.4 Class D 3.5 Class E 3.6 DC Chopper application	3 X 2 X 50	[1], [2]
4	Having completed this topic discussion, student able to design and analysis inverter circuit and PWM modulation.	4. **DC to AC Converter (Inverters)**	4.1 Definition and Properties 4.2 Single phase inverter 4.3 Three-phase inverter 4.4 PWM modulation	3 X 2 X 50	[1], [2]

			4.6 Inverter application		
5	Having completed this topic discussion, student able to analysis Cycloconverter single and three phase, with resistif or inductif load.	5.**Cycloconverter**	5.1 Single phase Cycloconverter 5.2 Three-phase Cycloconverter 5.3 Cycloconverte with resistif or inductif load	2 X 2 X 50	[1], [2]
6.	Having completed this topic discussion, student able to analysis a resonant converter as a power conditioning system which utilizes a resonant L-C circuit as a part of the power conversion process.	6. Resonant Converter	6.1 Introduction to Resonant Power Conversion 6.2 The Series Resonant Converter 6.3 The Parallel Resonant Converter	2 X 2 X 50	[1], [2]

[1] Mohan N., Undeland T.M. and Robbins W.P., Power Electronics, Converters, Applications and Design, John Wiley and Sons.
[2] Rashid M.H., Power electronics, Circuits, Devices and Applications, Prentice-Hall.
[3] Heumann K., Basic Principles of Power Electronics, Springer-Verlag Heidelberg New-York London Paris Tokyo.

LEARNING SPESIFICATIONS

Subject Name: Digital Processing of Speech Signal (Pengolahan Suara Digital) ; **Code:** TKE118; T: 3 sks; P :0 sks.
Subject Description: This subject contain about digital modelling of speech signal, speech coding, time-frequency analysis, homomorphic analysis, pitch detection, formant analysis, and applications.
Learning Outcomes: Student able to apply the processing principles speech digitally and make the speech processing algorithm for the application.

No	Learnig Objectives	Topic	Sub-topic	Time (minutes)	References
1	2	3	4	5	6
1	Having completed this topic discussion, student will be able to mention to minimize 2 example of processing applying speech digitally and explain the way of its work	1. Introduction	1.1 Speech Production 1.2 Application of digital speech processing	3 X 50	[1], [2]
2	Having completed this topic discussion, student will be able to make one of model of voice tract, with radiation or excitation	2. Speech Modelling	2.1 Acoustic Theory of Speech Production 2.2 Lossless Tube Model 2.3 Digital Models for Speech Signal	6 X 50	[1], [2]
3	Having completed this topic discussion, student able to calculate the estimation of period of speech signal pitch with the autocorrelation function	3. Time Domain Model for Speech Signal	3.1 Short-time Analysis 3.2 Pitch Period Estimation 3.3 Autocorrelation Function 3.4 Median Smoothing	6 X 50	[1], [2]
4	Having completed this topic discussion, student able to make the program to present the spectogram of speech signal truly.	4. Short-Time Fourier Analysis	4.1 Definition and Properties 4.2 Design of Digital Filter Bank 4.3 Spectographic Displays 4.4 Analysis-by Synthesis	6 X 50	[1], [2]
5	Having completed this topic discussion, student able to make the simulation program of determination of pitch speech signal with the homomorphic method.	5. Homomorphic Speech Processing	5.1 Homomorphic System for Convolution 5.2 Cepstrum 5.3 Pitch Detection 5.4 Formant Estimation	3 x 50	[1], [2]

	calculate the coefficient of LPC for speech signal truly.	Predictive Coding of Speech	Predictive Analysis 6.2 Solution of LPC Equations 6.3 Comparasion Between the Methods of Solution of the LPC Analysis Equations 6.4 Application of LPC Parameter		
7	Having completed this topic discussion, student able to make the simulation program to one of the application of digital processing of speech signal	7. Application of Digital Speech Processing	7.1 Speech Response System 7.2 Speech Recognition 7.3 Speech Identification 7.4 Speech Compression	12 x 50	[1],[2],[3]

[1] Lawrence R. Rabiner dan Ronald W. Schafer, 1978, *Digital Processing of Speech Signal*, Prentice Hall, New Jersey.

[2] Ben Gold dan Nelson Morgan, 2000, *Speech and Audio Signal Processing: Processing and Perception of Speech and Music*, John Wiley & Sons, Inc., New York.

[3] L.R. Rabiner dan B.H. Juang, 1982, *Fundamentals of Speech Recognition*, Prentice Hall, New Jersey.

LEARNING UNIT

Subject : **Digital Processing of Speech Signal (Pengolahan Suara Digital)**

Code : **TKE118**

Study Time : **3 × 50 menit**

Study Week : **1**

A. Learning Objectives

1. General

Having completed this subject (by the end of semester), student able to apply the processing principles of speech digitally and make the speech processing algorithm for the certain application.

2. Spesific

Having completed this topic discussion, student will be able to mention to minimize 2 example of application of digital speech processing and explain the way of its work

B. Topic: Introduction

C. Sub-Topic:

1.1 Speech Production

1.2 Application of digital speech processing

D. Learning Activities

Stage	Teacher Activites	Student Activities	Media and Teaching Aid
Introduction	1. Explain items coverage in this first meeting. 2. Explain the relevance of this subject with the prerequisities 3. Explain the spesific objectives of this sub-topic	Having attention and discussion	Slide Power Point + LCD Projector
Explanation	4. Explain the human speech production 5. Explain the digitalization of speech signal and the relevant aspect 6. Give the state-of-the-art of digital speech processing	Having attention Having attention and discussion	Whiteboard Slide Power Point + LCD Projector Demo Program
End Session	7. Close the session a. Discussing some example of digital speech processing applications and invite the student to think the other example which not yet been referred as previously b. Giving related and briefly description about next lecturing items	Having attention and give their ideas	Whiteboard Whiteboard

E. Evaluation

Used instrument: student undertake to formulate a digital voice processing applying according to their ideas and explain the target and also the way of its work

F. Reference

[1] Lawrence R. Rabiner dan Ronald W. Schafer, 1978, *Digital Processing of Speech Signal*, Prentice Hall, New Jersey.

[2] Ben Gold dan Nelson Morgan, 2000, *Speech and Audio Signal Processing: Processing and Perception of Speech and Music*, John Wiley & Sons, Inc., New York.

LEARNING SPESIFICATIONS

Subject Name: Digital Processing of Speech Signal (Pengolahan Suara Digital) ; **Code:** TKE118; **T**: 3 **sks**; P :0 sks.
Subject Description: This subject contain about digital modelling of speech signal, speech coding, time-frequency analysis, homomorphic analysis, pitch detection, formant analysis, and applications.
Learning Outcomes: Student able to apply the processing principles speech digitally and make the speech processing algorithm for the application.

No	Learnig Objectives	Topic	Sub-topic	Time (minutes)	References
1	2	3	4	5	6
1	Having completed this topic discussion, student will be able to mention to minimize 2 example of processing applying speech digitally and explain the way of its work	1. Introduction	1.1 Speech Production 1.2 Application of digital speech processing	3 X 50	[1], [2]
2	Having completed this topic discussion, student will be able to make one of model of voice tract, with radiation or excitation	2. Speech Modelling	2.1 Acoustic Theory of Speech Production 2.2 Lossless Tube Model 2.3 Digital Models for Speech Signal	6 X 50	[1], [2]
3	Having completed this topic discussion, student able to calculate the estimation of period of speech signal pitch with the autocorrelation function	3. Time Domain Model for Speech Signal	3.1 Short-time Analysis 3.2 Pitch Period Estimation 3.3 Autocorrelation Function 3.4 Median Smoothing	6 X 50	[1], [2]
4	Having completed this topic discussion, student able to make the program to present the spectogram of speech signal truly.	4. Short-Time Fourier Analysis	4.1 Definition and Properties 4.2 Design of Digital Filter Bank 4.3 Spectographic Displays 4.4 Analysis-by Synthesis	6 X 50	[1], [2]
5	Having completed this topic discussion, student able to make the simulation program of determination of pitch speech signal with the homomorphic method.	5. Homomorphic Speech Processing	5.1 Homomorphic System for Convolution 5.2 Cepstrum 5.3 Pitch Detection 5.4 Formant Estimation	3 x 50	[1], [2]

6.	Having completed this topic discussion, student able to calculate the coefficient of LPC for speech signal truly.	6. Linear Predictive Coding of Speech	6.1 Basic Principles of Linear Predictive Analysis 6.2 Solution of LPC Equations 6.3 Comparasion Between the Methods of Solution of the LPC Analysis Equations 6.4 Application of LPC Parameter	6 x 50	[1], [2]
7	Having completed this topic discussion, student able to make the simulation program to one of the application of digital processing of speech signal	7. Application of Digital Speech Processing	7.1 Speech Response System 7.2 Speech Recognition 7.3 Speech Identification 7.4 Speech Compression	12 x 50	[1],[2],[3]

[1] Lawrence R. Rabiner dan Ronald W. Schafer, 1978, *Digital Processing of Speech Signal*, Prentice Hall, New Jersey.

[2] Ben Gold dan Nelson Morgan, 2000, *Speech and Audio Signal Processing: Processing and Perception of Speech and Music*, John Wiley & Sons, Inc., New York.

[3] L.R. Rabiner dan B.H. Juang, 1982, *Fundamentals of Speech Recognition*, Prentice Hall, New Jersey.

LEARNING UNIT

Subject	**: Digital Processing of Speech Signal (Pengolahan Suara Digital)**
Code	**: TKE118**
Study Time	**: 3 × 50 menit**
Study Week	**: 1**

A. Learning Objectives

1. General

Having completed this subject (by the end of semester), student able to apply the processing principles of speech digitally and make the speech processing algorithm for the certain application.

2. Spesific

Having completed this topic discussion, student will be able to mention to minimize 2 example of application of digital speech processing and explain the way of its work

B. Topic: Introduction

C. Sub-Topic:

1.1 Speech Production

1.2 Application of digital speech processing

D. Learning Activities

Stage	Teacher Activites	Student Activities	Media and Teaching Aid
Introduction	1. Explain items coverage in this first meeting. 2. Explain the relevance of this subject with the prerequisities 3. Explain the spesific objectives of this sub-topic	Having attention and discussion	Slide Power Point + LCD Projector
Explanation	4. Explain the human speech production 5. Explain the digitalization of speech signal and the relevant aspect 6. Give the state-of-the-art of digital speech processing	Having attention Having attention and discussion	Whiteboard Slide Power Point + LCD Projector Demo Program
End Session	7. Close the session a. Discussing some example of digital speech processing applications and invite the student to think the other example which not yet been referred as previously b. Giving related and briefly description about next lecturing items	Having attention and give their ideas	Whiteboard Whiteboard

E. Evaluation

Used instrument: student undertake to formulate a digital voice processing applying according to their ideas and explain the target and also the way of its work

F. Reference

[1] Lawrence R. Rabiner dan Ronald W. Schafer, 1978, *Digital Processing of Speech Signal*, Prentice Hall, New Jersey.

[2] Ben Gold dan Nelson Morgan, 2000, *Speech and Audio Signal Processing: Processing and Perception of Speech and Music*, John Wiley & Sons, Inc., New York.

1.1.1 LEARNING SPESIFICATIONS

Subject Name : Microprocessor
Code/SKS : TKE 103; **T**(class): 3 **sks**; **P**(Lab): 1 **sks**

Subject Discription This subject contain basic concept of Microprocessor and Microcontroller, hardware and software, interface tehnique, memory map, concept of address decoding, analysis and syntesis circuit of system microprocessor and microcontroller.

Learning Outcomes: Student having ability to understand concept of microprocessor and microcontroller and capable to synthesis and analysis a simple project using system microprocessor and microcontroller, both software and hardware.

No	Learning Objectives	Topic	Sub Topic	Time in minutes	References
1	2	3	4	5	6
1	Having completed this topic discussion, student will be able to explain basic concept microprocessor concept.	1. Introduction	1.1 History of uP 1.2 Technology of uP 1.3 Architecture of uP 1.4 Some kind of uP uP 1.5 uP Development System	3 X 50 (1st week)	[1] [2] [3]
2	Having completed this topic discussion, student will be able to explain ideal model of uP and basic principal of uP (microprocessor) and uC (Microcontroller).	2. Basic of uP and uC	2.1 uP ideal. 2.2 address bus and data bus 2.3 System Control 2.4 Memory Map 2.5 Mapping Memory 2.6 Basic Configuration	6 X 50 (2nd and 3th week)	[1] [2] [3]

3	Having completed this topic discussion, student will be able to explain basic supporting system hardware.	3Supporting System	3.1 Power Supply 3.2 Clock 3.3 Logic Gates 3.4 Latches& Buffers	3 X 50 (4th week)	[1] [2] [3]
4	Having completed this topic discussion, student will be able to read and design of memory map.	4. Address Decoding	4.1 Address Decoding 4.2 Hardware diagram 4.3 Space Memory and Mapping Memory	6 X 50 (5th ,6th week)	[1] [2] [3]
5	Having completed this topic discussion, student will be able to explain type of memory, able to place memory into memory map, making memory work in system microprocessor..	5. Memory	5.1 Type of Memory 5.2 Expanding Memory 5.3 Read & Write Timing 5.4 Memory Interface	6 X 50 (7th ,8th week)	[1] [2] [3] [4] [5]
6	Having completed this topic discussion, student will be able to explain type of Input/Output, placing into memory map and interfacing into microprocessor system.	6. Input Output	6.1 Type of I/O 6.2 Expanding I/O 6.3 Read & Write Timing 6.4 I/O Interface	6 X 50 (9th ,10th week)	[1] [2] [3] [4] [5] [8]
7	Having completed this topic discussion, student will be able to explain Data transfer and signaling in microprocessor system.	7. Data Transfer and Signaling	7.1 Paralel Data 7.2 Serial Data 7.3 Interupt & Polling 7.4 *Direct Memory Access*	6 X 50 (11th ,12th week)	[1] [3] [4] [8]
8	Having completed this topic discussion, student will be able to explain Features, Architecture and performance MCS51 microcontroller.	8. uC MCS51	8.1 Features 8.2 Architecture 8.3 Memory organization 8.4 Bus Control & I/O	3 X 50 (13th ,14th week)	[4]-[13]
9	Having completed this topic discussion, student will be able to build simple application program using assembly languange of microcontroller MCS51.	9. Assembly Language of MCS51	9.1 Compiler 9.2 Basic Programming 9.3 Programming Technique	6 X 50 (15th ,16th week)	[4]-[13]

References

[1] John Uffenbeck, 1985, *Microcomputers and Microprocessors,* Prentice Hall International.
[2] Garland, *Microprocessor System Design,* Prentice Hall.
[3] Roger L Tokheim, *Microprocessor Fundamentals*, Schaum's Outline Series.
[4] Richard H Barnett, PE, PHD, *The 8051 Family of Microcontrollers,* Prentice Hall
[5] Scott Mackenzie, *The 8051 Microcontrollers,* Prentice Hall.
[6] Sencer Yeraland and Ashutosh Ahluwalia, *Programming and Interfacing the 8051,*Addison Wesley Publishing.
[7] Intel Corporation, *MCS51 - Family of the Single Chip Microcomputers User Manual,* Intel 1981
[8] Jan Axelson, *The Microcontroller Idea Book,* Lakeview Research
[9] Intel Corporation, *8 Bit Embedded Controller Handbook,* Intel 1989
[10] www.atmel.com
[11] www.intel.com
[12] www.8052.com
[13] www.epanorama.net

LEARNING SPESIFICATIONS

Subject Name: Power Electronic; **Code:** TKE4088; **T**: 2 **sks**; P :0 sks.
Subject Description: This subject contain about of power semiconductors and components of the main circuit such as capacitors and inductors in both sinusoidal and non-sinusoidal conditions. Furthermore, different types of converters (rectifiers, dc/dc converters, inverters, cycloconverter and resonant converters), their operating principles and analytical techniques, practical applications and design of converters. Both self-commutated as well as line-commutated converters are treated. The course also describes different power electronic circuits when ideal conditions are assumed as well as including the actual semiconductor characteristics.
Learning Outcomes: Students will be familiar and aware of how the operating principles of static power converters commonly used in practical industrial systems and power electronic circuits fit in to the practical world. It addresses the underlying concepts and methods behind various applications ranging from low-medium power utility interfaces to high power transmission systems.

No	Learnig Objectives	Topic	Sub-topic	Time (minutes)	References
1	Overview of solid state components and their high power counterparts, power semiconductor devices and their use as switches	1. Introduction	1.1 Development history and basic fungtions of static converter 1.2 System components and semiconductor switches 1.3 Power semiconductor devices	2 X 2 X 50	[1], [2], [3]
2	Having completed this topic discussion, student will be able to design and analysis: single-phase, three-phase rectifier circuits and linear power supplies.	2. **Rectifiers**	2.1 Phase-Controlled Thyristor Converters 2.2 Single phase rectifier circuits 2.3 Three-phase rectifier circuits	2 X 2 X 50	[1], [2]
3	Having completed this topic discussion, student will be able to design and analysis DC-to-DC power electronic converters circuit with voltage control by pulse-width-modulation	3. **DC Choppers**	3.1 Class A 3.2 Class B 3.3 Class C 3.4 Class D 3.5 Class E 3.6 DC Chopper application	3 X 2 X 50	[1], [2]
4	Having completed this topic discussion, student able to design and analysis: inverter circuit and PWM modulation.	4. **DC to AC Converter (Inverters)**	4.1 Definition and Properties 4.2 Single phase inverter 4.3 Three-phase inverter 4.4 PWM modulation	3 X 2 X 50	[1], [2]

			4.5 Multilevel inverter 4.6 Inverter application		
5	Having completed this topic discussion, student able to analysis Cycloconverter single and three phase, with resistif or inductif load.	5.**Cycloconverter**	5.1 Single phase Cycloconverter 5.2 Three-phase Cycloconverter 5.3 Cycloconverte with resistif or inductif load	2 X 2 X 50	[1], [2]
6.	Having completed this topic discussion, student able to analysis a resonant converter as a power conditioning system which utilizes a resonant L-C circuit as a part of the power conversion process.	6. Resonant Converter	6.1 Introduction to Resonant Power Conversion 6.2 The Series Resonant Converter 6.3 The Parallel Resonant Converter	2 X 2 X 50	[1], [2]

[1] Mohan N., Undeland T.M. and Robbins W.P., Power Electronics, Converters, Applications and Design, John Wiley and Sons.
[2] Rashid M.H., Power electronics, Circuits, Devices and Applications, Prentice-Hall.
[3] Heumann K., Basic Principles of Power Electronics, Springer-Verlag Heidelberg New-York London Paris Tokyo.

LEARNING SPECIFICATION

Subject Name :Optimal Control; **Code: T**: 3 **sks**
Prerequisite(s) :
Subject Description :
This subject contain basic optimal programming concept to certain criteria, potryagin maximum principle, methode of lyapunov 2, linear quadratic methode, regulator problem, tracking systems, sub optimal, discreet system LQR and estimator.

Learning Outcomes :
The student can analysis and design control methode optimaly to choosed linear quadratic performance function

No	Learning Objectives	Topic	Sub-topic	Time (minutes)	Reference(s)
1	Having completed this fundamental subject, the student can explain optimal control basic concept at least 80% precise	1.basic optimal control concept	1.1 Overview of optimal control 1.2 comparison of quadratic optimal control and non optimal 1.3 LQR Problem	6 X 50	[1]: 1-7 [3]
2	Having completed this fundamental subject, the student can complete problem in optimal control, stabilizing theorem, and Potryagin maximum principle at least 80% precise	2. Pontryagin maximum principle and Lyapunov stability theorem	2.1 Pontryagin maximum principle 2.2 Lyapunov stabilition 2.3 Hamilton- Jakoby equality	9 X 50	[1]: 8-34

3	Having completed this fundamental subject, the student can solve regulator problem at least 80% precise	3. regulator standard Problem	3.1 Infinite-TimeStandard Regulator Problem 3.2 Regulator stability	9 X 50	[1]: 35-67
4	Having completed this fundamental subject, the student can solve Tracking Systems at least 80% precise	4. Tracking Systems	4.1 Trajektory problems 4.2 Finite Time Result 4.3 Infinite Time Result	9 X 50	[1]: 68-100
5	Having completed this fundamental subject, the student can solve nature of Regulator dan Weight Selection at least 80% precise .	5. nature of Regulator and quadratic weight selection	5.1 Return Difference equality 5.2 Gain Margin and Phase Margin 5.3 inverse Optimal control 5.4 selection of Q and R weight	6 X 50	[1]: 101-140
6	Having completed this fundamental subject, the student can solve Estimator problem at least 80% precise	6. Estimator	6.1 nature of estimation State 6.2 design of deterministic estimator	6 X 50	[1]: 164-206

Reference :

1. Anderson,B.D.M. : "Optimal Control, Linear Quadratic Methods", Prentice-Hall, New Jersey 1989.
2. Lewis,F.L. : " Applied Optimal Control and Estimation ", Prentice-Hall, New Jersey, 1992.
3. Lewis,F.L. : " Optimal Control ", Prentice-Hall, New Jersey, 1995.

LEARNING SPECIFICATION

Subject Name: Antenna; and of Propagation ; Code: TKE110; T: 3 sks; P : 0 sks.
Prerequisite(s) :
Subject Description :
The Subject contain definition and parameters of antenna;, intensity of radiation, point of source, linear antenna;, pattern antenna;, antenna; with reflector and measurement of antenna;.
Learning Outcomes :
The student will be know elementary principles of antenna; and can design it

No	Learning Objectives	Topic	Sub-topic	Time (minutes)	Reference(s)
1	Having completed this fundamental discussion, The student can explain elementary concept [of] electromagnetic wave radiation from an conductor correctly.	1.Definition and Parameter antenna	1.1 Definition of antenna 1.2 Radiation Pattern 1.3 Directional and Amplification 1.4 Antenna Field Zone	3 X 50	[1]
2	Having completed this fundamental discussion, the student can mention minimally 2 antenna family and its use.	2. Family Antenna	2.1 Loop, Pattern and Slot 2.2 coacial Antenna 2.3 Antenna of Double strand 2.4 Antenna of Waveguide 2.5 Antenna; with Reflector	3 X 50	[1]
3	Having completed this fundamental discussion, The student can calculate field intensity yielded by point source series	3. Concept Point Source.	3.1 Definition Point Source 3.2 Pattern Field 3.3 series of Point Source	6 X 50	[1]
4	Having completed this fundamental discussion, student can calculate pattern and resistance of pattern radiation of 1 / 2 wave dipole antenna	4 Dipole Antenna	4.1 Short Pattern 4.2 Short Field Pattern 4.3 Short dipole radiation resistance 4.4 Pattern 1 / 2 Wave	6 X 50	[1]
5	Having completed this fundamental discussion, The student could design helices antenna or Yagi	5. Helices Antenna	5.1 Geometry of Helices 5.2 Scheme of Antenna; of Helices 5.3 Pattern with parasite 5.4 Antenna; Yagi	6 x 50	

6	Having completed this fundamental discussion, student could Calculate reinforcement yielded by reflector of parabola	6. Antenna; with Reflector.	6.1 Reflector level off 6.2 Reflector of Angle Corner 6.3 Parabola	3 x 50	[1]
7	Having completed this fundamental discussion, student can depict measurement of antenna; parameter and used equipments.	7. Measurement of Antenna	7.1 Elementary Concept 7.2 Type Mistake of Measurement 7.3 Range Measurement 7.4 Measurement of Parameter Antenna;	6 x 50	[1],[2]
8	Having completed this fundamental discussion, student can mention antenna; characteristic and type used to a real target correctly.	8. Antenna; for Special Application.	8.1 Antenna of Gound-Plane 8.2 Antenna; of Turnstile 8.3 High Omni Gain 8.4 Antenna; for the Communications of Satellite 8.5 Antenna; of ILS 8.6 Antenna; for the Communications of Terrestrial	9 x 50	[1]

Reference

[1] John D. Kraus and Ronald J. Marhefka., 2002, *Antennas: for All Applications*, Mc Graw Hill, New York.

[2] John D. Kraus, 1992, *Antennas*, Prentice Hall, New Jersey.

Subject Name : Electrical Drawing ; Code: TKE175 ; T: 1 sks; P: 0 sks
Prerequisite(s) :
Subject Description :
This Subject contain letter and line type; Drawing symbol standard; lighting installation drawing, power installation, lightning installation, installation of sound system, installation of hydrant, installation of telephone and of Nurse Call

Learning Outcomes :
student could be familiar with drawing symbols, reading installation drawing, and draw .

No	Target of Special Instruksional.	Fundamental Discussion.	Sub-Pokok Discussion.	Estimation Time (minute)	Source/ Bibliography
1	Having completed this fundamental discussion, The student could be recognize concept, order and way of presenting drawing.	1. Elementary Concept draw technique.	1.1 Function and nature of Picture 1.2 Kinds of line and letter 1.3 Kinds of appliance draw and its function 1.4 geometric Construction 1.5 Picture three dimension 1.6 Projection picture 1.7 Order picture 1.8 Handling and moderation of picture	4 X 50	[1]:
2	Having completed this fundamental discussion, The student could be recognize and draw kinds of drawing Symbols	2. drawing symbols	2.1 symbols standard 2.2 electronics drawing symbols 2.3 Electrical and mechanical daring symbols 2.4. Sound system drawing symbols	5 X 50	[2]: [3]: [4]

			2.5 hydrant drawing symbols 2.6 installation of telephone and of nurse call drawing symbols		
3	Having completed this discussion the student could be read and draw installation.	3. Picture Installation.	2.1 Regulation of Installation 2.2 Picture electronics 2.3 Picture lighting installation 2.4 Picture energy installation 2.5 Picture Installation and thunder of grounding 2.6. Installation picture of sound system 2.7 Drawing installation of hydrant 2.8 Drawing installation of telephone and of nurse call	7 X 50	[2]: [3]: [4]:

REFERENCE

[1] G Takeshi Sato, N Sugiarto H., 1994: Menggambar Mesin menurut Standar ISO,Pradnya Paramita , Jakarta

[2] ....., PUIL 2000

[3]....., PUIL 1997

[4] P Van Harten, Ir E Setiawan, 1985, Instalasi Listrik Arus Kuat. 1,2,3 Binacipta ,Bandung

LEARNING SPECIFICATION

Subject Name : Digital Image Processing; **Code:** TKE115; **T**: 3 **sks**; P :0 sks.
Prerequisite(s) :
Subject Description : This Subject contain image concept, 2 dimension basic mathematic and digital image algorithm development
Learning Outcomes : Student will be recognize digital image processing concept, algorithm and implementation

No	Learning Objectives	Topic	Sub-topic	Time (minutes)	Reference(s)
1	Having completed this fundamental discussion, The student can minimally mention digital image processing implementation and its general picture	1. Introduction	1.1 Image Concept 1.2 Man vision System 1.3 Vision Phenomenon 1.4 Image Processing Concept	6 X 50	[1],[2]
2	Having completed this fundamental subject, the student can explain digital filter design series for digital image processing	2. Two dimension signals Processing	2.1 Two dimension Basic Math 2.2 FIR and IIR digital filter design 2.3 Spectrum Estimation	6 X 50	[1],[2]
3	Having completed this fundamental subject, the student can find fast fourier transform coefficient accurately	3. Discreet Fourier transformation	3.1 Discreet fourier Series 3.2 Discreet fourier transformation 3.3 discreet cosinus transformation 3.4 Fast fourier transform	6 X 50	[1],[2]
4	Having completed this fundamental subject, the student can develop image enhancement algorithm correctly	4. Image enhancement	4.Point operation 4.2 Histogram modeling 4.3 space operation 4.4 transformation operation	9 X 50	[2]
5	Having completed this fundamental subject, the student can encode image correctly	5. Image encoding	5.1 quantisation 5.2 Wave form encoding 5.3 Transformation encoding 5.4 Image model encoding	6 x 50	[2]

6.	Having completed this fundamental subject, the student can develop simulation program for one of image processing correctly	6. Image processing algorithm	6.1 Space ekstraction 6.2 edge detection 6.3 Noise reduction 6.4 image compression	12 x 50	[1]

Reference

[1] Anil K. Jain, 1989, *Fundamentals of Image Processing*, Prentice Hall, New Jersey.

[2] Jae S. Lim, 1990, *Two-Dimensional Signal and Image Processing*, Prentice Hall, New Jersey

LEARNING SPECIFICATION

Subject Name :Algorithm and Data Structure; Code: TKE 300; T: 3 sks
Prerequisite(s) :
Subject Description : This Subject contain algorithm Concept and Data structure of Programming
Learning Outcomes : Student will be able to recognize and can use algorithm to solve problems using computer program

No	Learning Objectives	Topic	Sub-topic	Time (minutes)	References
1	Having completed this fundamental discussion, The Student will be able to conduct step by step of simple algorithm and calculating its performance at least 80% precise	1. Accessing Algorithm	1.1. Definition of Algorithm 1.2. Modification of Algorithm 1.3. Measurement of performance	2 x 50	[1] 1 – 12 [2] 1-29
2	Having completed this fundamental discussion, the student will be able to define Linked List, Stack and Queue in a trouble-shooting algorithm at least 80% precise	2. Structure of basic data.	2.1. Linked List 2.2. Stack 2.3. Queue	2 x 2 x 50	[1] 13-50 [2] 37-64
3.	Having completed this fundamental discussion, The student will be able to define concept of hash and 3 type of hash in a trouble-shooting algorithm at least 80% precise	3. Hash	3.1. Concept of Hash 3.2. Function of Hash 3.3. Linear of Has 3.4. Non Linear of Hash 3.5 is. External [of] Chaining	2 x 2 x 50	[1] 63 – 93 [2] 122 - 135
4.	Having completed this fundamental discussion, The student will be able to define concept of searching and 4 type of search in trouble-shooting algorithm at least 80% precise	4. Search	4.1. Characteristic of Search 4.2. Brute Force Search 4.3. Boyer Moore Search 4.4. Search Multiple 4.5. Comparison	2 x 2 x 50	[1] 95 – 171

5	Having completed this fundamental discussion, The student will be able to define concept of sorting and 10 type of sorting in trouble-shooting algorithm at least 80% precise	5. Sorting	5.1. characteristic of Search 5.2. Model of Sort : Bubble, Insert, Shell, Quick, Heap 5.3. combination with list linked 5.4. Sorting with key multiple	2 x 2 x 50	[1] 173 – 243 [2] 253 - 286
6	Having completed this discussion fundamental, The student will be able to define concept of tree and 4 type of tree in trouble-shooting algorithm at least 80% precise	6. Tree	6.1. Binary tree 6.2. Red Black tree 6.3. Tree Splay 6.4. Tree B 6.5. Implementation	2 x 2 x 50	[1] 245 – 361
7.	Having completed this fundamental discussion, The Student will be able to define concept of directed and of undirected graph in trouble-shooting algorithm at least 80% precise	7. Graph	7.1. Definition of Graph 7.2. Representation of Directed Graph 7.3. Representation of Undirected Graph	2 x 2 x 50	[2]198-246
8	Having completed this discussion fundamental, The student will be able to define concept of data compression and its implementation at least 80% precise	8. Data Compresion	8.1. Run Length Encoding 8.2. Huffman Compression 8.3. LZW 8.4. Other compression	2 x 50	[1] 535 -570

Reference.

[1] Andrew Binstock, John Rex, " Practical Algorithms for Programmers", Addison Welley Publishing, 1995
[2] Alfred V Aho, John E Hopcroft, Jeffrey D Ullman, "Data Structur and Algorithms" Addison Welley Publishing,